SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.

1.2 SUBMITTALS

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

B. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

C. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

D. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

1.3 QUALITY ASSURANCE

A. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located.

B. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than ½ in. diameter; and free of weeds, roots, and toxic and other non-soil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes except for wetland creation areas. Avoid and do not obtain topsoil where extensive weeds or bamboo have grown in the past.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

D. Orange Safety Fence: Open web polypropylene fence with a 4'-0" height. Support with 8'-0" long #6 rebar driven at 6'-0" on center; 4'-0" into ground. Secure fence to rebar with cable ties.

E. Organic Mulch: Wood and bark chips, free from deleterious materials.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Mulch areas inside tree protection zones and within drip line of trees to remain and other areas indicated.

1. Apply average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

D. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.

E. Notify Owners Representative and Engineer when tree protection measures are in place and prior to commencement of construction activities. Engineer shall review and approve tree protection measures prior to the start of construction.

3.2 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.

B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

C. Moderate Fill: Where existing grade is more than 6 inches but less than 12 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:

1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches below elevation of grade.
2. Place filter fabric with edges overlapping 6 inches minimum.
3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune trees to remain that are affected by temporary and permanent construction.

B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.

C. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

1. Type of Pruning: Cleaning and Thinning.
2. Specialty Pruning: Vista.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Chip removed tree branches and stockpile in areas approved by Engineer/Owner's Representative.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

3.6 DISPOSAL OF WASTE MATERIALS

A. Disposal: Remove excess excavated material and displaced trees from Owner's property.

END OF SECTION

SECTION 01 70 00.01

SITE PERMIT REQUIREMENTS

PART 1 - GENERAL

A. Construction of this project must meet the terms and conditions of a City of Portland Site Plan Permit. The Owner has applied for this permit. This permit is provided to the contractor in Attachment A. The aforementioned permit shall be the extent of Owner supplied permits. Any other permits required to conduct the work shall be obtained by the Contractor.

B. Some of the permits may require inspection or the work by the Owner or Engineer. The contractor shall review these requirements and provide the Owner a minimum of 48 hours prior to the need for a specified inspection. The Owner will respond and arrange for a time for the inspections to occur. It is the responsibility of the Contractor to have these inspections performed during the course of the work.

C. Copies of the Permit Applications and correspondence during review of the permits may be inspected during normal working hours at the office of:

Stantec Consulting Services Inc.
482 Payne Road, Scarborough Court
Scarborough, Maine
celina.daniell@stantec.com

D. Any Contractor who desires to view the Permit Applications and Associated Correspondence must contact Stantec 48 hours prior to inspecting the information.

E. Certain conditions of the permits will be the responsibility of the Contractor. The Contractor is responsible for familiarizing himself with all specific and standard conditions of the permits issued for the project, and for undertaking all work in strict conformance with these.

F. A copy of the permit and the approved plans shall be available at the Project Site at all times.

G. A copy of all erosion inspection logs, reports and meeting minutes shall be available at the Project Site at all times.

PART 2 - PERMITS

A. The City of Portland Site Plan Permit.

END OF SECTION

ATTACHMENT A

CITY OF PORTLAND SITE PLAN PERMIT

ELECTRONIC DOCUMENT TRANSFER AGREEMENT

Project:	Date:
Client:	Project No.
Location:	Page 1 of 1

Company Requesting Files:

Person Requesting Files:

Description of Files:

Reason for Requesting Files:

1. The requested electronic file(s) (the "Files") remain the property of Stantec.
2. No warranties or guarantees are made that the Files represent or reflect the complete scope of work and/or as-built condition.
3. Stantec assumes no responsibility for data files supplied in electronic format. Such data is being provided as a courtesy only.
4. Company receiving the Files and users thereof accept full responsibility for verifying the accuracy and completeness of the Files and shall indemnify and hold Stantec, its officers, employees, consultants and agents harmless from any claims or damages arising from the use of the Files.
5. The use of Files to alter or revise the scope of work is not permitted unless authorized by change orders.
6. In the event that drawing Files transferred electronically contain electronic copies of permits or professional seals, the Files shall be immediately returned to Stantec and all copies thereof destroyed.
7. No use shall be made of the Files for any purpose other than that for which they were originally intended without the express written consent of Stantec.
8. No retransmission of the Files in any form to any third party is permitted unless authorized in writing by Stantec.

Having read and understood the above, and in consideration of Stantec providing e-copies, the undersigned agrees to be bound by the terms hereof.

Print Name and Title

Signature of Company's Authorized Representative — Date

Signature of Stantec Project Manager Authorizing Release — Date

The above requested files will only be released upon receipt by Stantec of an original of this agreement signed by a duly authorized representative of the company requesting the files. Stantec reserves the right to deny any request for copies of electronic files.

Revised: 2013.09.04

REQUEST FOR INFORMATION FROM THE ENGINEER

RFI NO. _____

DATE: _____ PROJECT: _____
(City, State)

TO: _____

FROM: _____ DRAWING NO. _____
(General Contractor)

_____ DETAIL NO. _____
(Project Superintendent)

_____ SPECS SECTION NO. _____
(Job Site Fax Number)

RFI Type:

( ) Demolition
( ) Site Preparation
( ) Earthwork
( ) Rock
( ) Erosion Control
( ) Storm Sewer
( ) Utilities
( ) Paving
( ) Landscape/ Irrigation
( ) Site Lighting
( ) Slope Stabilization Retaining Walls
( ) Traffic Related
( ) Other

Information Requested: _____

Requested By: _____

Reply: _____

_____ _____
Response By: Date:

File Distribution:

SECTION 01 70 00.02

CIVIL ENGINEERING REQUESTS FOR INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for handling and processing "Requests for Information" (RFI).

2. "Request for Information" form is attached at the end of this Section.

3. Request/limit of use for AutoCAD files.

4. "Electronic Document Transfer Agreement" form is attached at the end of this Section.

1.2 DEFINITION

A. Requests for Information: A formal process used during the construction phase to facilitate communication between the contractor, the Owner's representative, the Architect's Clerk of the Works, and the Civil Engineer with regard to requests for additional information and clarification of the intent of the Contract Documents (Drawings and Specifications).

B. Do not use "Request for Information" form during bidding. Direct questions during bidding phase as indicated in the bid documents.

1.3 PROCEDURE

A. Conditions Requiring Clarification and the Contract Documents:

1. Contractor shall submit a "Request for Information" to the Owner and request review by the Civil Engineer.

2. Submit "Request for Information" from the Contractor's office or field office only. "Requests for Information" submitted directly from subcontractors or suppliers will not be accepted.

3. Generate "Requests for Information" by one source per project and number accordingly.

4. Submit one "Request for Information" per form.

B. Engineer will review RFI from the Contractor with reasonable promptness and the Contractor will be notified in writing of decisions made.

1. The Engineering Consultant's written response to the RFI shall not be considered as a Change Order or Change Directive, nor does it authorize changes in the Contract Sum or Contract Time.

C. Contractor shall maintain a log of "Requests for Information" sent to, and responses from Engineer "Requests for Information" log shall be sent, by Fax, every Friday to the Engineer.

D. All "Requests for Information" regarding scheduling, costing, and Owner provided equipment coordination shall be directed to the Architect.

1.4 REQUEST FOR INFORMATION FORM

A. Submit "Requests for Information" on the attached "Request for Information" form, or format accordingly on letterhead. Engineer will not respond to requests for information unless this form or format is utilized.

B. Where submittal form or format does not provide space needed for complete information, additional sheets may be attached.

1.5 REQUEST FOR ELECTRONIC MEDIA

A. Contractors may request AutoCAD disks for use in determining earthwork quantities. Contractors may obtain these disks by submitting the enclosed “Electronic Document Transfer Agreement” form to the Architect. This form restricts the use of this data.

B. The computer aided design file represents the work product of Stantec Consulting Services Inc. Certain files and information are considered proprietary and are not to be released to any third party.

C. Contractors acknowledge that CAD files may include embedded information, have varying degrees of layer management, and are subject to limitations in the software systems.

END OF SECTION

SECTION 01 71 23.13

LAYOUT OF WORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The City of Portland has established a project benchmark and elevation as shown and identified on the project plans. For the purposes of this specification, this shall be the limit of Owner provided survey control to the contractor. The datum is NGVD 1929.

B. The Contractor shall employ a licensed land surveyor in the State of Maine to lay out the work from the established reference points, benchmarks, and the coordinate system indicated on the drawings, and shall be responsible for all measurements in connection with the layout. AutoCAD 2014 files will be furnished to the Contractor upon written request upon signing a limit of use form. The licensed land surveyor shall certify in writing that the layout was performed under his/her direct supervision and is correct and meets the requirements of the contract documents. A copy of the certificate shall be furnished to the Engineer.

The Contractor is responsible for confirming elevation by cross checking the two benchmarks.

The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Owner. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Owner until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Owner may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

C. The layout shall establish the locations of silt fence and areas of clearing shall be delineated for review and approval of the Owner prior to clearing.

D. Establish and plainly mark centerlines for the site work and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each athletic field, access drive, utilities, and parking lots, are in accordance with lines and elevations shown on contract drawings.

E. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work.

1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the Owner before any work is placed.

2. A detailed check of all coordinates, resultant pipe lengths, backslopes, and appurtenant locations shall be made by the registered land surveyor or civil engineer and provided to the Owner prior to starting utility lines.

F. During progress of work, the Contractor shall have line grades and plumbness of all major work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the Owner before any major items are placed. In addition, Contractor shall furnish to the Owner certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.

1. Elevations of all parking, driveway, and walkways.

2. Lines and elevations of sewers, storm drains, utility systems.

3. Lines of elevations of all swales and drainage areas.

4. Lines of elevations of parking area.

5. Horizontal alignment of all access drives.

6. Record conditions of the stormwater management system.

G. Record Data:

1. The Contractor shall record the following information for buried utilities:

   - The location of all appurtenances and controls including control or shutoff valves, angle points or bends, manholes, handholes, and inlets.

2. All information shall be identified on a CAD reproducible drawing by a number or letter with a schedule of locations by coordinates tied to the Maine State Coordinate Grid. The final record drawings shall be delivered to the Owner. Two copies are required.

H. The location of catch basins and manholes shall be accurately located by a registered land surveyor. Catch basins and manholes shall be located from the layout data and established on the contract drawings.

I. Whenever approved changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to the Engineer.

J. Changes in location, additions and appurtenant items such as, but not limited to, manholes, inlets, pipe lines and conduits shall be shown in same manner as on contract drawings (by coordinates or dimensions from buildings); however, if no such locations are shown on contract drawings, changes in locations of items shall be shown by a sufficient number of right-angled dimensions from the nearest building.

K. Contractor is responsible for all costs associated with layout of work, and any costs associated with correcting non-conforming work or with restoring the landscape to its original condition.

L. The survey data obtained for this section shall be incorporated into the project record drawings and profiles.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, site improvements, and for disposition of hazardous waste.
2. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
3. Section 026000 “Excavated Material Management” for special requirements attendant with potential contaminated soils and groundwater at the site.
4. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.
5. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for Notice to Proceed.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. LEED Submittal (N.I.C.): LEED letter template for Credit MR 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

H. Qualification Data: For waste management coordinator.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications (N.I.C.): LEED-Accredited Professional, certified by USGBC. A waste management coordinator may also serve as LEED coordinator.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for sale and donation are not permitted on Project site.

C. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area onsite designated by Owner.
5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving (N.I.C.): Grind asphalt in accordance with Section 024221 Reclaimed Stabilized Base.

B. Concrete (N.I.C.): Remove reinforcement and other metals from concrete and sort with other metals in accordance with Section 024200 Aggregate Material from Recycling.

1. Pulverize concrete to maximum Section 024200 Aggregate Material from Recycling.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum Section 024200 Aggregate Material from Recycling.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

J. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them in accordance with the Environmental Work Plan prepared by Ransom Consulting (Refer to Section 026000 Excavated Material Management).

3.7 SAMPLE FORMS

A. Owner will review and provide sample templates at the preconstruction conference.

END OF SECTION

SECTION 02 32 00

GEOTECHNICAL INVESTIGATIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions apply to work of this Section.

1.2 DESCRIPTION OF WORK

A. Contractor shall review the Geotechnical Report prepared for the project by Summit Geoengineering Services appended to this section of Project Specifications. During the Bidding Process, the Contractor may conduct his own subsurface investigations after requesting and receiving prior approval from the Owner. The request for approval shall be accompanied by a plan indicating the location and type of investigations to be undertaken by the Contractor. The Contractor is encouraged to verify Owner's subsurface investigations and shall notify the Owner in writing prior to the bid date of any discrepancies.

PART 2 - PRODUCTS

2.1 REPORT

A. Subsurface conditions have been investigated by test pits and borings. Locations of the test pits and borings are shown on the contract drawings. Logs of the explorations are also appended to these specifications.

B. Said subsurface investigations are not warranted to show the actual subsurface conditions except at the location of said test pits or investigations, and at these points are subject to inaccuracies inherent in methods used and to variations in the classification and interpretation of soil layers.

C. Subsurface information is included only as an aid to the Bidder and it is the obligation of the Bidder to draw his own conclusions of subsurface conditions from his own investigations prior to submitting his proposal. The Contractor agrees, in signing his Contract, that he will make no claims against the Owner or Engineer, if in carrying out the work, he finds that the actual conditions encountered in performing the work do not conform to conditions presented, discussed, or anticipated prior to the commencement of work, the Contractor shall notify the Owner immediately of such differences in the conditions.

PART 3 - EXECUTION

3.1 REPORT REVIEW

A. A copy of the geotechnical engineering services report is appended to the project manual and shall be considered part of the Contract Documents.

END OF SECTION

GEOTECHNICAL REPORT
PREPARED BY
SUMMIT GEOENGINEERING SERVICES

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.
4. Removal of selected site improvements (ex. Garage).

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and re-installed.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Predemolition Photographs or Video: Submit before Work begins.

1.5 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 FIELD CONDITIONS

A. Owner will not occupy portions of building immediately adjacent to selective demolition area.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations (existing building does not have a sprinkler system).

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove irrigation systems, drainage piping, electrical systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain. Provide secure fencing to prevent unauthorized access to construction areas.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.

2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill and in accordance with Maine Department of Environmental Protection regulations.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 26 00 20

SITE ELECTRICAL & COMMUNICATIONS WORK

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. All work of this section shall be completed by an electrical subcontractor to the site contractor except where the site contractor elects to perform the work. The site contractor is responsible for assuring that the bid price includes all work of this section.

B. Description: Provide all necessary site electrical work in connection with the following:

1. Provision of a new 3-phase primary underground electrical line from the new terminal utility pole to a new concrete pad for a service transformer.
    a. Wiring by Central Maine Power (CMP).
    b. Conduit, hand holes, and manholes by the Electrical Sub-Contractor of Site Work Contractor.

4. Provision of a new concrete transformer pad for an electrical service.
    a. Concrete transformer pad by the Site Contractor.
    b. Service transformer by Central Maine Power.

5. Provision of empty electrical conduit from the service transformer to the concrete splice box.

6. Provision of a post-mounted, utility service meter located adjacent to the service transformer.
    a. Meter by Central Maine Power.
    b. Meter post, conduit, and meter back box by the Electrical Sub-Contractor.

7. Provision of service grounding at the concrete transformer vault for the CMP service transformer.

8. Provision of relocated light poles.
    a. Secondary underground electric to connect light poles.

9. Provision of an empty telephone conduit from the terminal utility pole to a point one foot inside the proposed building.
    a. Conduit by the Electrical Sub-Contractor for Site Work Contractor.
    b. Telephone service cable by Fairpoint Communications (to be provided under separate contract for the proposed building), conduit by Site Work Contractor.

11. Provision of an empty telecommunications conduit from the terminal utility pole to a point one foot inside of the proposed building.
    a. Conduit by the Electrical Sub-Contractor of Site Work Contractor.
    b. Cable TV service cable by telecommunications provider (to be provided under separate contract for the proposed building), conduit by Site Work Contractor.
12. Provision of site lighting poles with luminaries, lamps, and anchor bolts.
    a. Concrete foundation bases by the Site Contractor using anchor bolts provided by the pole supplier.
    b. Poles, luminaries, lamps, anchor bolts to be reused.
    c. Underground conduit and wiring by electrical subcontractor.
13. Provision of empty underground conduit with pull string from site lighting junction box to be extended through the foundation wall of the proposed building perimeter.
    a. Conduit by the Electrical Sub-Contractor for Site Work Contractor.
    b. Wiring to be provided under separate contract for the proposed building.

C. The Contractor for this work is referred to in Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work that is a part of this Contract as contained in Division 1. The following General Provisions amplify and supplement these sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 1 supersede and must be satisfied by the Contractor.

1.2 REFERENCES

A NEMA TC-2 – Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

B. NEMA TC-3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

C. ANSI/NFPA 70 – National Electrical Code.

D. ANSI C80.1 – Rigid Galvanized Steel Conduit.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide for each product specified herein. Indicate overall equipment dimensions and electrical characteristics including voltage, frame and trip ratings and short circuit withstand ratings where applicable.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Record the installed location of all electrical equipment and underground services.

1.5 REGULATORY REQUIREMENTS

A. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances, included but not limited to latest approved editions of the following:

1. National Electrical Safety Code (ANSI C2).
2. National Electrical Code (NFPA 70).
3. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
4. All applicable State and Local Codes.

B. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes, and ordinances, and they are thereby included in these specifications.

C. Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim will be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.

D. Furnish products listed and classified by Underwriters Laboratories, Inc.

E. Obtain permits and request inspections from all authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. It is recognized that minor adjustments to locations may be required to coordinate with existing site conditions and underground utilities. Where equipment and/or conduit cannot be installed at the location shown on the plans, notify the Engineer to receive direction. Prior to installation of any site light pole or foundation, verify the minimum clearance requirements will be met with other overhead utilities, as required by utility company or other regulatory codes.

PART 2 – PRODUCTS

2.1 CONDUIT AND FITTINGS

A. PVC Schedule 40 Plastic Conduit: NEMA TC 2.

B. Plastic Conduit Fittings: NEMA TC-3.

C. Rigid Galvanized Steel Conduit: ANSI C80.1.

2.2 UNDERGROUND WARNING TAPE

A. Underground Warning Tape: 6” wide plastic tape, colored red with suitable legend describing buried electrical lines: Model UT27737-6 as manufactured by Emedco, or equal.

2.3 SITE LIGHTING

A. Provide site lighting poles/luminaries as described on the site lighting plans contained in the contract documents.

B. Provide all necessary pole hardware including anchor bolts as required.

C. Foundations, poles and anchor bolts shall be rated for the given EPA to withstand 90 mph wind with a 1.3 gust factor.

D. Site lighting poles shall be provided with all necessary internal wiring conductors.

E. Provide all site lighting poles with internal ground lugs.

PART 3 – EXECUTION

3.1 EXISTING UNDERGROUND UTILITIES IDENTIFICATION

A. The Contractor shall utilize the services of Dig-Safe to identify locations of existing underground utilities within the vicinity of all new excavation work.

3.2 CONDUIT INSTALLATION

A. Cut conduit square using a saw or pipe cutter; de-burr cut ends.

B. Bring conduit to the shoulder of fittings and couplings and fasten securely.

C. Install no more than the equivalent of three 90-degree bends between poles.

D. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

E. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

F. Install electrical warning tape for all underground conduits 6 inches below the finished grade.

G. Cap empty conduits for future use by others. Mark locations where ends of conduits are buried.

3.3 CONDUIT INSTALLATION SCHEDULE

A. Underground Locations - PVC, Schedule 40.

B. Above ground Locations - Rigid galvanized steel conduit.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing site utilities.
7. Temporary erosion and sedimentation control measures.

1.2 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner’s premises. Coordinate storage locations with Owner.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing. Note that a private utility detection service will be required to identify utilities on the school property. The Contractor shall be responsible for the cost of private utility detection.

D. Do not commence site clearing operations until temporary erosion and sedimentation control and plant protection measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. See Soil Management Plan for specific requirements related to imported soils on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 “Earth Moving”.

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation control Drawings and requirements for the project.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Section 01 56 39 “Temporary Tree and Plant Protection”.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner’s Rep and Engineer.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner’s Rep and Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner’s Rep and Engineer’s written permission.

C. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 02 41 19 “Selective Demolition”.

3.5 CLEARING AND GRUBBING

A. Clearing and grubbing shall include the removal of all trees, shrubs, vegetation, roots, and organic measures to permit installation of new construction. The Contractor may elect to remove some of the roots during loam stripping operations. Any area that will be regraded must be cleared and grubbed.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil. All removals/excavation shall be completed in accordance with the Soil Management Plan.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.7 SITE IMPROVEMENTS

A. Remove existing above and below grade improvements as indicated and necessary to facilitate new construction.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, stumps and cleared material, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

2. All topsoil shall be screened. Excess topsoil, if any, shall remain the property of the Owner. The location for stockpile material shall be agreed upon with the Owner.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, play surfaces, and all other subgrade surfaces required for this project.
2. Excavating and backfilling for site improvements and structures.
3. Moisture condition and/or chemically treat excavated soils as necessary to provide workable fill material that will meet the compaction specifications and maximize reuse of existing soils.
4. Subbase course for walks and pavements.
5. Subbase and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

B. Related Requirements

1. See Section 02 32 00 Geotechnical Investigation
2. See Section 31 10 00 Site Clearing
3. See Section 32 13 16.26 Rock Removal
4. See Soil Management Plan

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from on or off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade in areas where underslab drainage is required that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, curbs, electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or material placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

L. Zone of Influence (ZOI): The area below footings and below imaginary lines that extend 2 ft laterally beyond the footing outer bottom edges and down on a 1H:1V slope to suitable bearing material.

M. Pipe Zone: The pipe zone is considered to be the area from the invert of the pipe to 6 inches above the crown of the pipe.

N. Pipe Bedding: Pipe bedding is the material placed between the bottom of the trench and the invert of the pipe.

1.3 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated. A private utility detection service will be required to identify utilities within the school property.

1.4 SUBMITTALS

A. General

1. Unless otherwise noted, Contractor shall forward submittals to the Engineer a minimum of two weeks prior to any planned work related to the Contractor’s submittals.
2. The time period(s) for submittals are the minimum required by the Engineer to review, comment and respond to the Contractor. The Engineer may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.

3. The Contractor's submittals shall be reviewed and accepted by the Engineer prior to conducting any work.

4. Acceptance of the Contractor's submittals by the Engineer does not relieve the Contractor of responsibility for the adequacy, safety and performance of the work.

B. Excavation and Backfilling

1. A narrative describing the schedule and means and methods for placement/compaction of fill soils based on the material requirements provided in Part 2 of this Section.

2. Proposed type(s) and source(s) of chemicals to treat borrow soils to be reused beneath building or pavement areas if site work activities are to be performed outside of summer months.

3. A plan showing delineated site "haul roads" for heavy construction equipment such as articulated trucks and scrapers.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. In general, the Owner's intent is to encourage the use of onsite excavated materials for subgrade fills subject to the material requirements provided herein.

B. Satisfactory Soils: The existing soils will not meet the gradation specifications for Structural Fill, Base Course or Subbase Material. The native soils are acceptable for common subgrade fill if moisture conditioned and placed to meet the density and other requirements of the Contract Documents. The native soil may require segregation by type, blending with offsite borrow, filling with choke stone, must be free of organics, and moisture conditioned during winter construction or wet weather or extreme dry conditions. In no case should frozen soils be used beneath the building footprint, parking areas, or driveways.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, OL, CH, MH, OH, and PT or a combination of these groups and satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Course: Maine DOT 703.06 Type D. (Maximum Particle Size of 4 inches)

E. Base Course: Maine DOT 703.06 Type A. (Maximum Particle size of 2 inches)

F. Granular Borrow: Maine DOT 703.19 with a maximum particle size of 6 inches. Note that existing subgrade soils may meet the definition of Granular Borrow and may be used in place of imported materials if the Contractor can provide third party testing confirming conformance with this specification.

G. Crushed Stone: Maine DOT 703.22 Backfill for Underdrain Type C.

H. Pipe Bedding: Maine DOT 703.22 Backfill for Underdrain Type C.

I. Foundation Backfill: Foundations shall be backfilled with foundation backfill. The portion of foundation backfill passing the 3" sieve size should meet the following gradation requirements:

FOUNDATION BACKFILL	
Sieve Size	**Percent Passing By Weight**
3-inch	100
¼-inch	25 to 100
No. 40	0 to 50
No. 200	0 to 7

*The maximum particle size should be limited to 3-inches.

J. Structural Fill: Structural fill shall be used as fill below ground floor slabs. Structural fill shall be a well graded sand and gravel mixture free of roots, topsoil, loam, organic material, and any other deleterious materials, as well as clods of silt or clay, and meet the following gradation requirements:

STRUCTURAL FILL	
Sieve Size	**Percent Passing By Weight**
3-inch	100
½-inch	38 to 80
¼-inch	25 to 65
No. 40	0 to 30
No. 200	0 to 7

*The maximum particle size should be limited to 3-inches.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility with a separate metallic "tracer". This is required for all non-metallic utility lines except "straight runs" of sewer lines and storm drains between manholes.

PART 3 - EXECUTION

3.1 PREPARATION

A. The earthwork shall be conducted in accordance with the more stringent of the Maine DOT Specifications, and these specifications. All cost for moisture conditioning and complying with the Contract Documents is part of the base bid.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

C. Designated haul roads shall be established by the Contractor at the beginning of earthwork operations to minimize damage to soil subgrades resulting from construction vehicle traffic. The use of geotextile fabric and/or geogrid to stabilize haul road subgrades shall be included by the Contractor as part of the base bid.

D. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

E. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing." during earthwork operations.

F. Due to the previously developed nature of the site, the Project Contractor and their Subcontractors should be sensitive to the potential of encountering obstructions such as remnants from prior structures and buildings, associated foundations, and underground utilities (note: both active and abandoned) during site and earthwork activities. It is anticipated that obstructions may include, but not limited to, conduits, electrical and communications lines, and irrigation piping. Where such items are encountered beneath the proposed construction limits, they should be excavated to their full extent, removed, and replaced with compacted structural fill. The ends of underground pipes and utility conduits that will be abandoned in-place should be filled with concrete and capped to prevent erosion of material into the conduit or pipe.

3.2 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

B. Remove all organic soils within the ZOI of footings or slabs to expose naturally deposited soils or bedrock.

C. Excavation of bearing surfaces in soil or fill should be performed by earthwork equipment fitted with smooth-edged buckets. Final subgrade preparation should include compaction of fill or naturally deposited soil subgrades with vibratory compaction equipment. Following compaction and prior to placement of imported materials, care should be taken to limit disturbance of the bearing surfaces. Any loose, softened, or disturbed material due to construction traffic should be removed prior to placement of imported materials, and backfilled with compacted structural fill.

D. The integrity of natural soils and fill must be maintained during cold weather conditions. Footing and slab subgrades should not be allowed to freeze. The naturally deposited soils are considered moderately. Freezing of subgrade soils beneath improvements might result in heaving and post-construction settlement. The Contractor should make every effort to prevent freezing of subgrade soils. In the event frost penetration occurs, all frozen and previously frozen soils should be removed and replaced with compacted structural fill. At no time should frozen material be placed as fill.

E. Excavation measurement and pay dimensions shall extend 12” beyond the footing or slab.

3.3 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

B. Remove all man placed fill, topsoil, organic matter, and debris encountered within the footprint of site improvements and structures.

C. Proof-rolling should be performed using a fully loaded, tandem axle dump truck weighing not less than 25 tons or 2 passes in each of two perpendicular directions with a 5 ton min. vibratory roller. Proof-rolling should not be performed over culverts, pipes, conduits, or other underground construction that might be damaged by the proof-roller. Soft areas or areas that yield excessively during proof-rolling should be over excavated and replaced with ¾" crushed stone or structural fill. Soft areas or areas that yield excessively are characterized by weaving or rutting more than one inch deep.

3.4 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following trench width. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

C. A minimum and pay width of 2'-6" for conduits up to 6" diameter.

D. A minimum of 3'-0" or 4/3 the pipe inside diameter plus 1'-6" for conduits over 18".

E. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

F. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

3.5 SUBGRADE INSPECTION

A. Proof-roll subgrade consisting of granular soils (engineered fill or glacial till) below slabs and under pavement as outlined in paragraph 3.3.C above. Any soft pockets, areas of excess yielding, or areas disturbed during excavation and construction shall be over excavated and replaced with structural fill. Do not proof-roll wet or saturated subgrades or subgrades consisting of silt/clay soils (marine deposits).

B. The exposed subgrade will be examined in the field by the Engineer to observe the strength and bearing capacity of the soils. Disturbed or soft soils, as judged by the Engineer, shall be excavated and replaced with suitable material without additional compensation.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, or accumulated water, as directed by Engineer, without additional compensation.

D. Overexcavate subgrades disturbed/damaged by construction vehicle traffic to the depth and plan limits directed by the Engineer. Replace disturbed soil with suitable material without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.

B. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion.

B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

C. Stockpiles must be contained within permissible work and staging areas in accordance with the detail shown on the Drawings.

3.8 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches with Engineered Fill, Gravel Borrow, or granular backfill, or crushed stone.

D. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact pipe zone backfill to a height of 6 inches over the utility pipe or conduit.

F. Carefully compact pipe zone backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Place and compact trench granular backfill of satisfactory soil to final subgrade elevation.

H. Install warning tape directly above utilities as noted in Section 2.2, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.9 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

1. Place and compact fill material in layers to required elevations as follows:
2. Under grass and planted areas, use satisfactory soil material.
3. Under walks and pavements, use Granular Fill below base and subbase gravels.

B. In open areas, structural fill should be placed in level, uniform lifts not exceeding 12 inches in uncompacted thickness and be compacted with self-propelled compaction equipment. In confined areas and within 4 feet of foundation walls, structural fill should be placed in lifts not exceeding 6 inches in uncompacted thickness and be compacted with hand-operated compaction equipment. All fill placed for footing and slab support should be structural fill compacted to at least 95 percent of the maximum dry density as determined by *ASTM Standard D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).*

3.10 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, aerate or chemically treat otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Granular Borrow and Common Fill: Place in layers not more than 6 to 12 inches in loose depth for material compacted by heavy compaction equipment and not more than 6 inches for material compacted with hand-guided equipment.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

Location	**Minimum Compaction Requirements**	**Testing Frequency 1 Lift per:**
Structures and Walkways	95 Percent	5,000 square feet
Trenches	95 Percent Bedding and 92 Percent Trench Zone	100 linear feet
Pavement Base and Subbase Areas	95 Percent	5,000 square feet
Pavement Areas (Below Base & Subbase)	92 Percent	5,000 square feet
Landscaped Areas	90 Percent Nominal Compaction	5,000 square feet

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus ¼" with no "bird baths".
3. Pavements: Plus or minus ¼" with no "bird baths".

3.13 SUBBASE AND BASE COURSES

A. Place subbase and base course on stable, firm subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Shape subbase and base course to required crown elevations and cross-slope grades.

C. Compact subbase and base course in maximum 8 inch lifts in uncompacted thickness at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.14 DRAINAGE COURSE

A. Place drainage course on stable, firm subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade or filter fabric as shown on the Drawings, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

C. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades consisting of engineered fill materials, tests will be performed to verify that the compaction requirements are achieved. Bearing capacities will be verified visually in natural soils (glacial till), weathered rock or bedrock.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions without additional compensation.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

E. The in-situ sandy soils and gradation makes them susceptible to “loosening” if allowed to dry out. The contractor shall keep the soils moist and cover with a 12” layer of sand/soil mix approved to the geotechnical engineer of record.

F. All areas where soil is placed shall not have standing water. The contractor shall keep water out of the work areas until backfill is complete or adequate provisions to protect the work have been taken by the Contractor.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil except loam and materials otherwise shown on the contract drawings, waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 31 23 16.26

ROCK REMOVAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rock removal shall only be conducted by qualified contractors who have at least 15 years' experience in rock removal by blasting and have five recent projects and references for rock removal within 100 feet of existing buildings. The qualifications of the contractor who will conduct the rock removal shall be provided for review at the preconstruction conference.

B. The Site Contractor and the contractor who will conduct the rock removal shall attend a public informational meeting to address questions and explain the techniques and methods which will be used for rock removal. This meeting shall occur at least 14 days prior to any rock removal in order that the Owner can obtain samples of well water of any interested abutter.

C. The work to be done includes furnishing all labor, equipment, materials and services and performing operations required to fragment intact bedrock utilizing controlled blasting techniques to enable the excavation of blasted material using conventional excavation equipment. The work shall be completed such that damage is prevented to adjacent pipes, structures, property, utilities, and operations.

D. Pre-blast Surveys, Public Meetings, and Quality Control.

E. Removal of identified and discovered rock during excavation.

F. Use of Explosives to assist rock removal.

G. Incorporating removed rock into fills and embankments.

H. Conducting blast monitoring of every blast round during construction and utilizing the blast monitoring procedures and equipment specified herein.

I. Coordinate work with other trades affecting or affected by the work and cooperate with such trades to assure the steady progress of work.

J. Obtaining all required permits and licenses to perform the blasting for this project. The Contractor shall be responsible for obtaining all applicable permits including, but not limited to, a City of Portland Blasting Permit.

1.2 RELATED SECTIONS

A. Section 31 20 00 – Earth Moving.

B. Geotechnical Report for test pit locations and findings of subsurface materials and conditions.

C. Construction Drawings.

1.3 REFERENCE STANDARDS

A. NFPA 495 – Code for Explosive Materials

1.4 ENVIRONMENTAL REQUIREMENTS

A. Determine all environmental effects associated with proposed work and safeguard those concerns as regulated by law and all others by reasonable and practiced methods.

B. Perchlorates shall not be used as a blasting agent.

C. Coordinate blasting, monitoring, seismographs, and Owner radon testing.

D. Test nearby potable wells prior to blasting.

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. The Contractor shall submit the following information to the Owner and Engineer within seven (7) days prior to commencing drilling and blasting operations. Technical Submittals and blast designs shall be completed by experienced, competent Engineers familiar with controlled blasting.

1. Sequence and schedule of blasting rounds, including the general method developing the excavation, lift heights, etc.

2. Specifics of a typical blast round to be implemented in each of the following areas:

   (a) test blast areas,

   (b) the closest blasting area to adjacent structures,

   (c) where perimeter control blasting is required and

   (d) at the deepest rock cut areas.

3. In each area specified, include the following blast round details:

   (a) Diameter, spacing, burden, depth and orientation of each blast hole for each round design.

   (b) Nomenclature and amount (in terms of weight and number of cartridges) of explosive and distribution of charge to be used within each hole, on each delay and the total for the blast.

(c) Nomenclature and type of detonators, delay pattern wiring diagram for the round, type and capacity of firing source, size, type and location of safety switches and lightening gap.

(d) Type and location of stemming to be used in the holes.

(e) Calculations of anticipated vibration levels at nearest adjacent structure.

(f) Methods of matting or covering of the blast area in open excavations to prevent fly rock and excessive air-blast over-pressure.

(g) Written evidence of the licensing, experience and qualifications of the blasters who will be directly responsible for the loading and firing of each shot.

(h) Name and qualifications of the person(s) responsible for the design and directing the blasting.

(i) Name and qualifications of the independent professional responsible for conducting the pre-blast condition surveys.

(j) Name and qualifications of the independent professional or seismologist responsible for monitoring and reporting blast vibrations.

(k) Recent calibration certificates (within previous 6 months) for the proposed blast monitoring instrumentation.

(l) Listing of instrumentation that the contractor proposed to use to monitor vibrations and air-blast over-pressure levels complete with performance specifications and user's manual supplied by the manufacturer.

(m) Submit a Certificate of Insurance documenting that liability insurance coverage in an amount no less than $2,000,000, or as otherwise required by the Owner, will be in force during the duration of the project.

(n) Pre-blast condition surveys for neighboring residential and commercial property. A written report of the pre-condition survey shall be provided to the property owners. Notification shall be given to the neighbors prior to the commencement of any blasting.

(o) The Contractor shall perform a pre-blast survey of nearby structures as specified in this specification. The survey will include, as a minimum, video with audio description of areas of exterior and interior building surfaces. One copy will be maintained by the Contractor and one copy shall be supplied to the Owner.

C. In the event that the ground vibrations and/or air blast over-pressures exceed the blasting limit criteria in this Section, the Contractor shall immediately revise the design appropriately and submit the revised design to the Engineer for review.

D. Review by the Engineer or Owner of the blast design and techniques shall not relieve the Contractor of responsibility for the accuracy, adequacy and safety of the blasting as well as the protection of existing structures and overall safety. Loose, over-hanging or unstable rock along permanent rock cuts shall be removed as necessary or as directed by the Engineer. Controlled blasting procedures shall be utilized in areas of permanent rock cuts to minimize over-breakage and fracturing.

E. The material that will be used including MSDS Data Sheets.

F. Perchlorates are not permitted as a blasting agent.

G. Blasting agents used below the water table shall be canister type.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Persons responsible for blasting shall be licensed blasters in the State of Maine and shall have had experience in similar excavations in rock and controlled blasting techniques.

2. The contractor shall engage the services of a qualified, independent professional consultant, acceptable to the Engineer, to conduct a pre-blast condition survey of adjacent buildings, utilities and other concerned structures within 500 ft. of the blast or as required by Code.

3. Blast monitoring shall be conducted by a qualified professional engineer or seismologist trained in the use of seismographs. The name and experience of the seismologist shall be submitted to the Owner for review and approval. The seismologist shall also attend the public informational meeting. The blast records shall be maintained, analyzed and reported by persons familiar with the frequency content of a seismograph record.

B. Codes, Permits and Regulations

1. The contractor shall comply with all applicable laws, rules, ordinances and regulations of the Federal Government, the State of Maine, City of Portland, and the Owner, governing the transportation, storage, handling and use of explosives. All labor, material, equipment and services necessary to make a blasting operation comply with such requirements shall be provided without additional cost to the Owner.

2. The contractor shall obtain and pay for all permits and licenses required to complete the work of this Section.

3. In the case of a conflict between regulations or between regulations and Specifications, the Contractor shall comply with the strictest applicable codes, regulation or specification.

C. Blast Vibration Limits for Curing Concrete

1. Mass concrete on-grade which would not be subject to bending such as footings:

Age of Concrete	Allowable (PPV)
Less than 72 hours	1.0 inch/second
At least 72 hours	4.0 inch/second

2. Concrete which could potentially undergo bending such as walls, structural slabs, columns, and elevated slabs:

Age of Concrete	Allowable (PPV)
Less than 72 hours	0.5 inch/second

At least 72 hours	2.0 inch/second

3. Blasting shall not be permitted within 50 ft. of new concrete unless a blast plan for the specified blast is forwarded by the Contractor and approved by the Engineer.

4. The contractor shall comply with the Blasting Limit Criteria during all blasting. Adjustments to the drilling and blasting program and procedures to comply with the Blasting Limit Criteria shall be made by the Contractor during the execution of the work at no additional expense to the Owner.

D. Blast Monitoring

1. The Contractor shall monitor PPV and air-blast over-pressures resulting from each blast. Additional locations for blast monitoring may be necessary due to concerned structures within and around the blast.

E. Blast Monitoring Reports

1. Following each blast, a Blast Monitoring Report shall be submitted to the Owner and Engineer within 24 hours.

2. Any vibrations or air over-blast pressures close to or exceeding the specified limits shall be immediately reported to the Owner and Engineer.

F. Blast Monitoring Instrumentation

1. All instrumentation proposed for use on the project shall have been calibrated within the previous six (6) months to a Standard which is traceable to the National Bureau of Standards. Characteristics of the required instrumentation are listed below.

2. Measure the three (3) mutually perpendicular components of particle velocity in directions vertical, radial and perpendicular to the vibration source.

3. Measure and display the maximum PPV component, the associated frequency, and the peak air-blast over-pressure. The readings must be displayed and be able to read in the field immediately after each blast.

4. Furnish a permanent time history record on a strip chart (or from computer disk), of PPV components and air-blast over-pressure.

5. The Contractor shall cooperate with the Engineer in permitting observation of the Contractor's drilling and loading procedures, as well as providing detailed information on blasting operations.

G. The Contractor shall be completely responsible for all damages resulting from the blasting operations and shall, at a minimum, take whatever measures necessary to maintain PPV and peak air-blast over-pressure within specified or required limits. Modifications to the blasting

and excavation methods required to meet these requirements shall be undertaken at no additional cost to the owner.

H. Airborne Dust and Noise Limits: The Contractor shall take precautions, such as the use of water, vacuums, and mufflers to minimize noise and dust from the air track operations, and shall keep noise and airborne dust levels below regulatory limits.

1.7 PROJECT CONDITIONS

A. <u>The Contractor shall be fully responsible for conducting any investigations necessary to determine the extent and quality of rock on the site prior to submitting his bid. Rock locations may vary from that inferred by the geotechnical report based upon the inherent limitations of this work.</u>

PART 2 - PRODUCTS

2.1 MATERIALS

A. Explosives, delay device and blast mat materials shall be the type recommended by the explosive firm that will comply with the requirements of this section.

PART 3 - EXECUTION

3.1 SAFETY PRECAUTIONS

A. Clearing the Danger Area Before Blasting: No blasting shall be permitted until all personnel in the danger area have been removed to a place of safety. A loud, audible warning system shall be sounded before each blast. The Contractor shall familiarize all personnel on the project, Engineer, Owner and the general public with the implemented system. The danger area shall be patrolled before each blast to make certain that it has been completely cleared prior to a blast.

B. Explosives shall be stored, handled and employed in accordance with federal, state and local regulations.

C. No explosives, caps, detonators or fuses shall be stored on the site during non-working hours.

D. The Contractor shall be responsible for determining any other safety requirements unique to blasting operations so as not to endanger life, property, utility services, any existing or new construction, or any property adjacent to the site.

E. Blasting mats or other cover shall be used for each blast to secure all fly rock.

3.2 GENERAL BLASTING PROCEDURES

A. Blasting shall be limited to between the hours of 8:00 am and 4:00 pm, Monday through Friday, or as otherwise restricted by the Portland Fire Department and City Officials. No blasting shall

be completed on weekends, holidays or other weekday times until written permission is received by the Owner.

B. The Contractor shall notify the Owner and Engineer at least 48 hours before blasting operations are to commence.

C. The Contractor shall conduct all blasting operations such that damage or disruption is prevented to adjacent structures, utilities, property and operations, and such that PPV and air-blast over-pressure levels do not exceed the maximum specified limits.

D. The Contractor shall control dust so as to prevent dust from leaving the site boundaries.

E. Designed blast rounds shall be utilized with adjacent relief to allow the rock to move out towards a free face.

F. All overburden soils and loose rock shall be removed from areas where blasting is planned. The exposed bedrock surface shall be surveyed by a licensed land surveyor to determine the limits for payment unless the Contractor has agreed to a lump sum price for the work with no measurement for additional rock.

G. In areas where blasting is required in the building footprint, a structural fill is required 8-inches below and laterally beyond the footing limits. Loose, heaved and/or highly fractured bedrock below this depth shall be completely removed to expose intact bedrock or a tight fragmented over-blast suitable to the Engineer. In order to ensure good bearing material for the footings, the Contractor shall conduct blasting such that over-break and fracturing of the rock is minimized below the required subgrade level. Sub-drilling (depth of blast hole below required subgrade) shall be kept to the minimum necessary to adequately fragment and remove the rock to the limits of excavation. The sub-drilling shall not exceed 2 ft. unless the Contractor has submitted in advance a written request indicating why additional sub-drilling is necessary for the project.

H. Highly fractured, heaved and/or disturbed over-blast ledge beyond the payment limits shall be removed by the Contractor and replaced with compacted Structural Fill or ¾ inch crushed stone at no additional cost to the Owner except in the foundation overblast area. Tight over blast ledge may remain in-place provided it is reviewed and acceptable to the Engineer.

I. Permanent rock slope cuts no steeper than 1H:2V may be required for the project as shown on the Drawings. The Contractor shall use controlled blasting procedures by pre-splitting the rock prior to primary blasting. The permanent rock face shall be stable with no over-hanging or highly fractured rock. Particular attention, design, precautions and blasting operations shall be focused on these areas of the site.

J. Retain this article only if it supplements Division 01 requirements and includes provisions that apply specifically to individual Sections for cleaning, repairing, protecting, or otherwise preparing substrates for installation.

3.3 PREPARATION

A. Verify site conditions and note subsurface conditions affecting work of this section. Coordinate Owner radon monitoring.

B. Identify required lines, levels, and elevations that will determine the extent of the proposed removals.

C. Conduct a pre-blast survey in accordance with the following requirements:

1. The Contractor shall conduct a Pre-Blast Survey of all structures within the Blast Area and provide the Owner and the City of Portland, a written report of the Pre-Blast Survey and Blasting Plan. The Pre-Blast Survey shall be filed, reviewed, and approved by the City of Portland. This survey should include:

   - All structures within a minimum distance of 500 feet from any blasting activity. The area extending beyond the 500 feet minimum shall be determined by the Contractor. This distance shall be confirmed after consultation of the General Contractor, Site Contractor, Blasting Contractor and Insurance Companies.

   - A Blasting Plan which addresses:

     - Airblast limits
     - Ground vibrations
     - Maximum peak particle velocity

   - The Blasting Plan shall meet criteria established in Chapter 3 (Control of Adverse Effects) in the Blasting Guidance Manual of the United States Dept. of the Interior Office of Surface Mining Reclamation and Enforcement.

   - Provisions and measures to monitor and assure compliance with the blasting plan.

2. The Contractor shall provide the Engineer with a Blasting Log for the work. The Blasting Log shall contain the following information:

   - Location
   - Time and Date
   - Number of Holes
   - Amount and type of explosive used per hole
   - The names of persons, companies, corporations, or public utilities contacted, owning, leasing, or occupying property or structures in proximity to the site of the work of the Contractor's intention to use explosives.

3. Drilling equipment will be equipped with suitable dust control apparatus which must be kept in repair and used during all drilling operations.

4. A copy of the applicable permit approvals of the pre-blast survey and blasting plan obtained by the Contractor shall be submitted to the Owner prior to blasting.

5. Blasting shall not commence until the Owner has secured baseline radon tests.

3.4 ROCK EXCAVATION

A. Rock Excavation - definition - Igneous, metamorphic or sedimentary rock that cannot be removed by rippers or other mechanical methods and, therefore, requires drilling and blasting. Cut rock to form level bearing at bottom of trench. In the utility trenches, excavate to 6" below the invert elevation of pipe.

1. Reuse excavated materials on-site in accordance with contract documents, if applicable.

B. Comply with all laws, rules, and regulations of Federal, State and local authorities and insurer which govern storage, use, manufacture, sale, handling, transportation, licensing, or other disposition of explosives. Take special precautions for proper use of explosives to prevent harm to human life and damage to surface structures, all utility lines, or other subsurface structures.

1. Do not conduct blasting operations until persons in vicinity have had ample notice and have reached positions of safety.
2. All blasting shall be performed in accordance with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., of the "Construction Safety Rules and Regulations," as adopted by the State Board of Construction Safety, Auburn, Maine, and Maine Department of Transportation "Standard Specifications" Section 107.12, Use of Explosives. Blasting through the over burden will not be allowed.

C. Contractor shall save harmless Owner, Engineer, and Owner's representative from any claim growing out of use of such explosives. Removal of materials of any nature by blasting shall be done in such manner and such time as to avoid damage affecting integrity of design and to avoid damage to any new or existing structure included in or adjacent to work. It shall be the contractor’s responsibility to determine method of operation to ensure desired results and integrity of completed work.

D. Perform rock excavation in a manner that will produce material of such size as to permit it being placed in embankments in accordance with Section 31 20 00. Remove rock to limits as indicated. Remove loose or shattered rock, overhanging ledges and boulders which might dislodge.

E. Provisions for Blasting

Blasting shall be performed only after approval has been given by the Owner for such operations and must comply with the following provisions:

1. The Contractor or any subcontractor shall use sufficient stemming, matting or natural protective cover to prevent flyrock from leaving property owned or under control of the owner or operator or from entering protected natural resources or natural buffer strips.

Crushed rock or other suitable material must be used for stemming when available; native gravel, drill cuttings or other material may be used for stemming only if no other suitable material is available.

2. *The maximum allowable airblast at any inhabited building not owned or controlled by the developer may not exceed 129 decibels peak when measured by an instrument having a flat response (+ or – 3 decibels) over the range of 5 to 200 hertz.*

3. *The maximum allowable airblast at an uninhabited building not owned or controlled by the developer may not exceed 140 decibels peak when measured by an instrument having a flat response (+ or – 3 decibels) over the range of 5 to 200 hertz.*

4. *Monitoring of airblast levels is required in all cases for which a preblast survey is required by paragraph F. The Contractor may file a MeDEP Permit Modification requesting the MeDEP waive the monitoring requirement if the Contractor or subcontractor secures the permission of affected property owners to increase allowable airblast levels on their property and the department determines that no protected natural resource will be adversely affected by the increased airblast levels. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.*

5. *If a blast is to be initiated by detonating cord, the detonating cord must be covered by crushed rock or other suitable cover to reduce noise and concussion effects.*

6. *A preblast survey is required and must extend a minimum radius of 500' feet from the blast site. The preblast survey must document any preexisting damage to structures and buildings and any other physical features within the survey radius that could reasonably be affected by blasting. Assessment of features such as pipes, cables, transmission lines and wells and other water supply systems must be limited to surface conditions and other readily available data, such as well yield and water quality. The preblast survey must be conducted prior to the initiation of blasting at the operation. The Contractor or subcontractor shall retain a copy of all preblast surveys for at least one year from the date of the last blast on the development site.*

   (a) *The Contractor or the subcontractor is not required to conduct a preblast survey on properties for which the owner or operator documents the rejection of an offer by registered letter, return receipt requested, to conduct a preblast survey. Any person owning a building within a preblast survey radius may voluntarily waive the right to a survey.*

7. *Blasting may not occur in the period between sundown and sunrise the following day or in the period 7:00 p.m. and 7:00 a.m., whichever is greater. Routine production blasting is not allowed in the daytime on Sunday. Detonation of misfires may occur outside of these times but must be reported to the department within 5 business days of the misfire*

detonation. Blasting may not occur more frequently than 4 times per day. Underground production blasting may be exempted from these requirements provided that a waiver is granted by the department.

8. *Sound from blasting may not exceed the following limits at any protected location:*

Number of Blasts Per Day	*Sound Level Limit*
1	*129 dbl*
2	*126 dbl*
3	*124 dbl*
4	*123 dbl*

9. *The maximum peak particle velocity at inhabitable structures not owned or controlled by the developer may not exceed the levels established in Table 1 in paragraph E and the graph published by the United States Department of the Interior in "Bureau of Mines Report of Investigations 8507," Appendix B, Figure B-1. The Contractor or subcontractor may apply for a MeDEP Project Modification to request a variance to allow ground vibration levels greater than 2 inches per second on undeveloped property not owned or controlled by the applicant if the department determines that no protected natural resource, unusual natural area or historic site will be adversely affected by the increased ground vibration levels. If inhabitable structures are constructed on the property after approval of the MeDEP and prior to completion of blasting, the Contractor immediately must notify the department and modify blasting procedures to remain in compliance with the standards of this subsection. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.*

10. *Table 1 of this paragraph or the graph published by the United States Department of the Interior in "Bureau of Mines Report of Investigations 8507", Appendix B. Figure B-1 must be used to evaluate ground vibration effects for those blasts for which a preblast survey is required.*

    (a) *Either Table 1 of this paragraph or graph published by the United States Department of the Interior in "Bureau of Mines report of Investigations 8507", Appendix B, Figure B-1 may be used to evaluate ground vibration when blasting is to be monitored by seismic instrumentation.*

    (b) *Blasting measured in accordance with Table 1 of this paragraph must be conducted so that the peak particle velocity of any one of the 3 mutually perpendicular components of motion does not exceed the ground vibration limits at the distances specified in Table 1 of this paragraph.*

    (c) *Seismic instruments that monitor blasting in accordance with Table 1 of this paragraph must have the instrument's transducer firmly coupled to the ground.*

(d) An owner or operator using Table 1 of this paragraph must use the scaled-distance equation, W=(D/Ds)2, to determine the allowable charge weight of explosives to be detonated in any 8 millisecond or greater delay period without seismic monitoring, where W is equal to the maximum weight of explosives, in pounds, and D and Ds are defined as in Table 1 of this paragraph. The Contractor may apply for a Permit Modification to MeDEP to authorize the use of a modified scaled-distance factor for production blasting if the contractor can demonstrate to a 95% confidence level, based upon records of seismographic monitoring at the specific site of the mining activity covered by the permit, that use of the modified scaled-distance factor will not cause the ground vibration to exceed the maximum allowable peak particle velocities of Table 1 of this paragraph. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.

(e) Blasting monitored in accordance with the graph published by the United States Department of the Interior in "Bureau of Mines Report of Investigations 8507", Appendix B, Figure B-1 must be conducted so that the continuously variable particle velocity criteria are not exceeded.

The Contractor may apply for a Permit Modification to MeDEP for a variance of the ground vibration monitoring requirement prior to conducting blasting at the development site if the Contractor agrees to design all blasts so that the weight of explosives per 8 millisecond or greater delay does not exceed that determined by the equation $W=(D/D_s)^2$, where W is the maximum allowable weight of explosives per delay of 8 milliseconds or greater, D is the shortest distance between any area to be blasted and any inhabitable structure not owned or controlled by the developer, and Ds equals 70 ft./lb.$^{1/2}$. As a condition of the variance, the department may require submission of records certified as accurate by the blaster and may require the owner or operator to document compliance with the conditions of this paragraph. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.

The following is Table 1.

Distance Versus Peak Particle Velocity Method		
Distance (D) from the blast area	***Maximum allowable peak particle velocity (Vmax) for ground vibration (in./sec.)***	***Scaled-distance factor (Ds) to be applied without seismic monitoring***
0 to 300	*1.25*	*50*
301-5000	*1.00*	*55*
Greater than 5000	*0.75*	*65*

11. *A record of each blast, including seismographic data, must be kept for at least one year from the date of the last blast, must be available for inspection at the development or at the offices of the owner or operator if the development has been closed, completed or abandoned before the one-year limit has passed and must contain at a minimum the following data:*

    (a) Name of blasting company or blasting contractor;

    (b) Location, date and time of blast;

    (c) Name, signature and social security number of blaster;

    (d) Type of material blasted;

    (e) Number and spacing of holes and depth of burden or stemming;

    (f) Diameter and depth of holes;

    (g) Type of explosives used;

    (h) Total amount of explosives used;

    (i) Maximum amount of explosives used per delay period of 8 milliseconds or greater;

    (j) Maximum number of holes per delay period of 8 milliseconds or greater;

    (k) Method of firing and type of circuit;

    (l) Direction and distance in feet to the nearest dwelling, public building, school, church or commercial or institutional building neither owned nor controller by the developer;

    (m) Weather conditions, including such factors as wind direction and cloud cover;

    (n) Height or length of stemming;

    (o) Amount of mats or other protection used;

    (p) Type of detonators used and delay periods used;

    (q) The exact location of each seismograph and the distance of each seismograph from the blast;

    (r) Seismographic readings;

    (s) Name and signature of the person operating each seismograph; and

    (t) Names of the person and the firm analyzing the seismographic data.

12. *All field seismographs must record the full analog wave form of each of the 3 mutually perpendicular components of motion in terms of particle velocity. All seismographs must be capable of sensor check and must be calibrated according to the manufacturer's recommendations.*

3.5 SPECIAL PERIMETER CONTROL BLASTING PROCEDURES

A. When blasting at the perimeter of the excavation area, care shall be taken at the excavation limits to minimize over-breakage and fracturing of remaining rock. Pre-splitting or cushion blasting or line drilling shall be utilized at such locations and/or as indicated on the Drawings as described as follows.

B. If, in the judgment of the Engineer, the Contractor's perimeter control blasting procedures are causing rock fracturing at a distance beyond the limits of work, the geometry (diameter, spacing), stemming and loading of perimeter holes and adjacent production holes shall be adjusted until results acceptable to the Engineer are obtained or the perimeter control blasting technique shall be changed. The following descriptions of pre-splitting, cushion blasting and line drilling should be considered general guidelines. The Contractor shall use appropriate methods to conduct the work based on his experience, the project requirement and site conditions.

C. The perimeter controlled blasting procedures shall be employed in areas where a permanent rock slope is to be constructed for site grading and other critical areas. Perimeter rock slopes steeper than 1H:4V and taller than 5 ft. in overall vertical height as shown on the Drawings shall require special controlled blasting procedures.

D. The purpose of the perimeter controlled blasting is to pre-split the rock along the designated cut face to produce a uniform plane of rupture so that the resulting face (permanent face) will not be affected by subsequent fragmentation blasting and excavation operations. The Contractor shall adjust the blasting operations according to the characteristic and structure of the rock formation to obtain the required slope without fracturing the rock beyond the pre-split face.

E. Pre-Splitting

1. Pre-splitting rock shall, at a minimum, conform to the *Maine Highway Department-Standard Specifications for Highways and Bridges. Section 203.04 – Pre-splitting Rock* shall be used for this project on 1:6 slopes.

2. Pre-split blast holes shall be loaded and fired separately before the main round to create a fracture plane along the perimeter of the excavation.

3. Pre-split holes shall be string-loaded or space-loaded with light, distributed charges and shall be thoroughly stemmed for the full length of hole with sand. The top of the hole, for a minimum 18 inches, shall be unloaded and stemmed with tamped sand and gravel.

4. Spacing, burden, hole diameter and loading shall be maintained within the Guidelines listed in Table I unless deviated from the Guidelines is approved by the Engineer based on field performance.

TABLE I

PRE-SPLITTING GUIDELINES

HOLE DIAMETER (in)	HOLE SPACING (ft)	COLUMN LOAD CHARGE CONCENTRATION (lb/ft)
1.5 to 2.5	1.0 to 1.5	0.06 to 0.15
3.0 to 4.0	1.5 to 2.0	0.10 to 0.20

5. The bottom charge concentration within the bottom 1 to 3 ft. of hole shall be approximately three (3) times the column charge concentration.

6. Pre-split holes shall be fired simultaneously if particle velocity and air blast considerations will permit. Otherwise, groups of pre-split holes in segments along the pre-split line shall be systematically fired with millisecond (ms) delays.

7. Pre-split holes shall not deviate more than 6 inches out of alignment over the full maximum vertical lift height.

8. Loading of the first-row-in of production holes shall be approximately 50 to 75% of normal production hole loading.

F. Cushion Blasting

1. If used, cushion blast holes shall be loaded and fired separately after the main round to ensure a free face and equal burden.

2. Cushion blast holes shall be string-loaded or space-loaded with light charges, and shall be thoroughly stemmed with a maximum of 18 inches of tamped sand, peastone or other material capable of maintaining explosive gas pressures. Spacing, burden, blast hole diameter and loading shall be maintained within the Guidelines outlined in Table II.

TABLE II

CUSHION BLASTING GUIDELINES

HOLE DIAMETER (in)	SPACING (ft)	BURDEN (ft)	COLUMN LOAD CHARGE CONCENTRATION (ob/ft)
1.5 to 2.0	1.0 to 1.5	2.5 to 3.0	0.06 to 0.15
2.5 to 4.0	1.5 to 2.0	3.0 to 3.5	0.15 to 0.25

NOTE: Small diameter, unloaded guide holes shall be used if required for satisfactory results, located midway between each cushion blast hole.

3. The first row of drill holes in from the perimeter row shall be loaded with not more than four (4) times the charge weight indicated in the Table. Spacing and burden of the first-row-in holes shall be decreased sufficiently from those of other production holes to ensure that the perimeter holes have a free face and equal burden for the full depth of the round.

G. Line Drilling

1. Line drilling shall consist of a minimum of 3-inch diameter holes evenly spaced at 2 per lineal foot. Drill holes shall not be deviated by more than 3-inches from their required plane over the entire length of the hole. The line-drilled holes are to be left unloaded. As the perimeter is approached with the primary blasting, the distance should be about 50% of the normal hole spacing. The spacing of holes in the row adjacent to the perimeter holes shall also be about 50-75% of the normal hole spacing. The loading of the holes in the adjacent row should be about 50% of the loading used in the primary holes.

H. Condition of the Permanent Rock Face

1. The permanent rock face shall not deviate by more than 5% batter and 2 ft. in plan location as shown on the Drawings. Loose, fractured or over-hanging rock as determined by the Engineer to be unstable shall be removed as directed. Care shall be taken during the excavation to minimize over-breakage and fracturing.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

B. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control groundwater flow into excavations, to permit construction to proceed on stable subgrades and to restrict the flow of surface water into the excavation.

1.3 SUBMITTALS

A. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water, piles, slurry walls, or other formal dewatering systems.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

B. Discharge all pumped water through a Dirtbag® or equal.

C. Comply with all OSHA and other safety regulations.

PART 2 - PRODUCTS (VACANT)

PART 3 – EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.

2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, sumps, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavating below groundwater level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, Dirtbag® and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION

SECTION 31 25 13

EROSION CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary and permanent erosion control systems.

B. Slope Protection Systems.

1.2 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing

B. Section 31 20 00 – Earth Moving

C. Construction Requirements

D. Soil Management Plan

1.3 ENVIRONMENTAL REQUIREMENTS

A. The Site Contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the construction contract in accordance with the Erosion and Sediment Control plan, details and notes prepared for this project and in accordance with the requirements of the City of Portland's Permit and conditions of approval. The Erosion and Sediment Control plan, notes and details and Site Permits have specific restrictions on work which must be completed prior to the start of other construction, seasonal work limits, the amount of area which can be exposed at a given time, the general sequence of construction, and Site Contractor monitoring responsibilities for documenting compliance with the erosion control plan for this project. These affect the scheduling of the work.

Protected resources as referred to in this document include wetlands, streams or water bodies, and trees or vegetation outside of the work limit.

Prior to grubbing, orange safety fence shall be installed between the limit of grading and any protected resource. When the protected resource is a tree, the safety fence shall be installed at the drip line of the tree. If disturbance of the root system occurs, the Site Contractor shall have an Arborist or Nurseryman inspect the root system and provide recommendations to preserve the tree. This information shall be included in the logs for the Erosion Control Plan maintained by the Site Contractor.

B. The Site Contractor will be required to designate, by name, a suitably qualified individual, responsible for implementation of all erosion control measures as required by current local, State and federal regulations and this specification.

Specific responsibilities will include:

1. Assuring and certifying the Site Contractor's construction sequence is in conformance with the specified schedule. In addition, a weekly certification stating compliance, any deviations, and corrective measures shall be filed with the owner by this person. A copy of the certification form is contained the Erosion and Sedimentation Control plan, details and notes.

2. Inspection of the project work site on a weekly basis, with the installation of added erosion control measures in areas which appear vulnerable to erosion. The erosion and sediment measures shown on the contract documents are minimum provisions. Any additional measures required to comply with the permit or intent of the Erosion and Sedimentation Control plan shall be incidental to the contract.

3. Inspection of all erosion control measures and drainage inlets after any significant rainfall. Accumulated silt/sediment should be removed when the depth of sediment reaches 50 percent of the barrier height. Accumulated silt/sediment should be removed from behind silt fencing when the depth of the sediment reaches 6 inches. A significant rainfall shall be defined as over ½ inch of precipitation in any consecutive 24-hour period.

4. Inspect areas for catch of grass. A minimum catch of 90 percent is required prior to removal of erosion control measures.

5. Maintaining precipitation records and monitoring forecast activity.

C. It shall be the responsibility of the Site Contractor to implement, maintain, monitor and document compliance with the erosion and sediment control plan for the project and to avoid turbid discharges from the site, to avoid fugitive dust emissions, to avoid sediment from leaving the site, or affecting areas outside of the project work limits.

The work includes the submission of logs and photographic evidence of compliance with the plan at the time each pay requisition is submitted. These records shall be certified as complying with the Erosion Control Plan and this specification. Deficiencies in the logs or photographic records identified by the Owner or Engineer shall be corrected before the pay requisition is processed.

The photographic documentation must include:

1. A minimum of 10 digital photos per week showing the appropriate erosion control measures in place.

2. Evidence of stabilization of areas that are not being actively worked.

3. Documentation of any observed releases of turbid runoff or failure of any erosion control measure.

D. The erosion control measures specified are required to be installed in accordance with the details provided with the construction plans and manufacturer's recommendations. The method and details of the installation of these erosion control methods are of vital importance to insure the effectiveness of the erosion control measures. While precipitation amounts cannot be predicted, the Erosion Control Plan is designed to minimize erosion by restricting the amount of the site that can be open at a given time, limiting the period that an area can be open without stabilization, and requiring weather forecasts to be monitored. It is a requirement of the contract documents that these methods be incorporated on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quick growing grasses for temporary seeding (see seed mixes contained in Erosion and Sedimentation Notes).

B. Hay or straw bales.

C. Fencing for siltation control as specified on the plans. Mirafi prefabricated silt fence, straw wattles or approved equal.

D. Curlex blankets by American Excelsior Company or approved equal. Curlex single net except Curlex double net in winter months.

E. Bale stakes shall be a minimum of 4 feet in length and 1" in width.

F. Temporary mulches such as loose hay, straw, netting, wood cellulose or agricultural siltage.

G. Fence stakes shall be metal stakes a minimum of 8 feet in length.

H. Stone Sediment Barriers or SiltSacks™, or approved equal for inlet protection.

J. A stabilized construction entrance to be constructed of the materials identified on the contract drawings.

K. Calcium chloride and water for dust control.

L. DIRTBAG® as outlined on the contract drawings and specified in Section 31.

M. Catch basin inserts. SiltSacks™ or approved equal.

N. Sorbent booms. Ecotech "Hula" Bug or equal. (N.I.C.)

O. DirtGlue™ Polymar Emulsion Mixes. DirtGlue™ emulsion formulation must be approved by Owner prior to installation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Review site erosion control plan attached to this section of the specifications.

B. Deficiencies or changes in the erosion control plan as it is applied to current conditions will be brought to the attention of the Engineer and Owner and a remedial action prepared and implemented by the Contractor.

3.2 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Provide catalog cuts and information concerning the erosion control products which will be used for construction for review by the Owner.

B. Provide information concerning the installation of the erosion sedimentation control including anchorage trench provisions anchorage devices, and spacing for review by the Owner.

C. Place erosion control systems in accordance with the erosion control plan and in accordance with approved installation procedures.

D. This contract limits the surface area of erodible earth material exposed any time by clearing and grubbing, excavation, borrow and embankment operations. The Owner has the authority to direct the Site Contractor to provide immediate permanent or temporary pollution control measures. The Site Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and necessary to comply with the erosion control plan.

E. The temporary erosion control systems installed by the Site Contractor shall be maintained to control siltation at all times during the life of the Contract. The Site Contractor must respond to any maintenance or additional work to comply with this specification within a 48-hour period.

F. DIRTBAGS® are required for the discharge of <u>any</u> construction dewatering or pumping, and the DIRTBAG® shall be operational before any trenching.

G. Certain erosion control measures require staged restoration. For example, reinforced cuts must be completed in 5-foot vertical increments.

H. Fugitive dust shall be controlled through construction.

I. Sorbent booms must be installed in the catch basin before paving. These shall be replaced prior to requesting substantial completion. (N.I.C.)

J. DirtGlue™ may be substituted to the Engineer for approval when DirtGlue™ is to be substituted for mulch, dust control, and other erosion controls of the emulsion mix, application rate, and weather condition that exist at the time of proposed installation must be approved by the Engineer.

3.3 CONSTRUCTION OF TEMPORARY EROSION CONTROL MEASURES

A. Perimeter Dike/Swale Construction

1. All perimeter dike/swale shall have uninterrupted positive grade to an outlet.

2. Diverted runoff from a disturbed area shall be conveyed to a sediment trapping device.
3. Diverted runoff from an undisturbed area shall outlet into an undisturbed stabilized area at non-erosion velocity.
4. The swale shall be excavated or shaped to line grade and cross section as required to meet the criteria specified in the standard.
5. Stabilization of the area disturbed by the dike and swale shall be done in accordance with the standard and specifications for temporary seeding and mulching, and shall be done within 10 days.
6. Periodic inspection and required maintenance must be provided after each rain event.

   Max. Drainage Area Limit: 2 Acres.

B. Silt Fence Construction

1. Woven wire fence to be fastened securely to fence posts with wire ties or staples. Posts shall be steel either 'T' or 'U' type or hardwood.
2. Filter cloth to be fastened securely to woven wire fence with ties spaced every 24" at top and mid section. Fence shall be woven wire, 12 ½ gauge, 6" maximum mesh opening.
3. When two sections of filter cloth adjoin each other, they shall be overlapped by six inches and folded. Filter cloth shall be either Filter X, Mirafi 100X, Stabilinka T140N, or approved equivalent.
4. Prefabricated units shall be Geofab, EnviroFence, or approved equivalent.
5. Maintenance shall be performed as needed and material removed when 'bulges' develop in the silt fence.

C. Stabilized Construction Entrance

1. Stone Size – Use 2" stone, or reclaimed or recycled concrete equivalent.
2. Length – Not less than 50 feet (except on a single residence lot where a 30 foot minimum length would apply).
3. Thickness – Not less than six (6) inches.
4. Width – Twelve (12) foot minimum, but not less than the full width at points where ingress or egress occurs. Twenty-four (24) foot if single entrance to site.
5. Filter Cloth – Will be placed over the entire area prior to placing of stone.
6. Surface Water – All surface water flowing or diverted toward construction entrances shall be piped across the entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.
7. Maintenance – The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way, all sediment spilled, dropped, washed or tracted onto public rights-of-way must be removed immediately.
8. When washing is required, it shall be done on an area stabilized with stone and which drains into an approved sediment trapping device.

9. Periodic inspection and needed maintenance shall be provided after each rain.

D. Sump Pit Construction

1. Pit dimensions are optional.
2. The standpipe should be constructed by perforating a 12-24" diameter corrugated or PVC pipe.
3. A base of 2" aggregate should be placed in the pit to a depth of 12" after installing the standpipe, the pit surrounding the standpipe should be backfilled with 2" aggregate.
4. The standpipe should extend 12-18" above the lip of the pit.
5. If discharge will be pumped directly to a storm drainage system, the standpipe should be wrapped with filter cloth before installation. If desired, ¼" – ½" hardware cloth may be placed around the standpipe, prior to attaching the filter cloth.

1.4 MULCH ANCHORING REQUIREMENTS

Anchoring Method or Material	Kind of Mulch to be Anchored	How to Apply
Peg and Twine	Hay or straw	After mulching, divide areas into blocks approximately 1 sq. yd. in size. Drive 4-6 pegs per block to within 2" to 3" of soil surface. Secure mulch to surface by stretching twine between pegs in crisscross pattern on each block. Secure twine around each peg with 2 or more tight turns. Drive pegs flush with soil. Driving stakes into ground tightens the twine.
Mulch Netting	Hall or straw	Staple the light-weight paper, jute, wood fiber, or plastic nettings to soil surface according to manufacturer's recommendations. Should be biodegradable. Most products are not suitable for foot traffic.
Wood Cellulose Fiber	Hay or Straw	Apply with hydro seeder immediately after mulching. Use 500 lbs. Wood fiber per acre. Some products contain an adhesive material, possible advantageous.
Mulch Anchoring Tool	Hay or Straw	Apply mulch and pull a mulch anchoring tool (blunt, straight discs) over mulch as near to the contour as possible. Mulch material should be "tucked" into soil surface about 3".
Chemical	Hay or Straw	Apply Terra Tack AR 120 lbs./ac. in 480 gal. of water (#156/ac.) or Aerospray 70 (60 gal/ac.) according to manufacturer's instructions. Avoid application during rain. A 24-hour curing period and a soil temperature higher than 45º Fahrenheit are required.

END OF SECTION

SECTION 31 25 73

DIRTBAG® SPECIFICATIONS FOR CONTROL OF SEDIMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work shall consist of furnishing, placing and removing the DIRTBAG® pumped sediment control device for erosion-sediment control. The DIRTBAG® pumped-silt control system is marketed by:

ACF Environmental, Inc.
2831 Cardwell Drive
Richmond, Virginia 23234
Phone: 800-448-3636
Fax: 804-743-7779

B. Four (4) DIRTBAGS® shall be included as part of the base bid.

PART 2 - MATERIALS

2.1 DIRTBAG®

A. The DIRTBAG® shall be a non-woven bag which is sewn with a double needle matching using a high strength thread.

B. The DIRTBAG® seams shall have an average wide width strength per ASTM D-4884 as follows.

DIRTBAG® Style	Test Method	Test Result
DIRTBAG® 53	ASTM D-4884	60 LB/IN
DIRTBAG® 55	ASTM D-4884	100 LB/IN

C. Each standard DIRTBAG® shall be supplied with fill spout large enough to accommodate a 4" discharge hose and straps to secure the hose and prevent pumped water from escaping without being filtered.

D. The geotextile fabric shall be non-woven fabric with the following properties:

Properties	Test Method	Units	Non-Woven	
			53	55
Weight	ASTM D-3776	Oz/yd	8	10
Grab Tensile	ASTM D-4632	Lbs.	203	250
Puncture	ASTM D-4833	Lbs.	130	165
Flow Rate	ASTM D-4491	Gal/Min/Ft2	80	70
Permittivity	ASTM D-4491	Sec.[1]	1.5	1.3

Properties	Test Method	Units	Non-Woven	
			53	**55**
Mullen Burst	ASTM D-3786	Lbs.^{in2}	400	550
UV Resistant	ASTM D-4355	%	70	70
AOS % Retained	ASTM D-4751	%	100	100

All properties are minimum average roll value except the weight of the fabric which is given for information only.

PART 3 – CONSTRUCTION SEQUENCE

3.1 Install DIRTBAG® on a prepared crushed stone pad overlying Mirafi 600X as shown on the contract drawings. Strap the neck of the DIRTBAG® tightly to the discharge hose. The preparation of a DIRTBAG® area is required before any trenching. Any water pumped from the construction site must be discharged through a DIRTBAG®.

3.2 It may be necessary to use hay/poly or other measures to keep the DIRTBAG® from freezing during winter months.

3.3 The DIRTBAG® is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of the DIRTBAG®, the type and amount of sediment discharged into the DIRTBAG®, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most circumstances, the vendor claims DIRTBAGS® will accommodate flow rates of 1,500 gallons per minute. Use of excessive flow rates or overfilling DIRTBAG® with sediment will cause ruptures of the bags or failure of the hose attachment straps.

3.4 Dispose of DIRTBAG® in accordance with Local, State, and Federal regulations. If allowed, the DIRTBAG® may be cut open and the contents seeded after removing visible fabric. DIRTBAG® is strong enough to be lifted with added straps if it must be hauled away (extra option). Off-site disposal may be facilitated by placing the DIRTBAG® in the back of the dump truck or flatbed prior to use and allowing the water to drain from the bag in place, thereby dismissing the need to lift the DIRTBAG®.

END OF SECTION

SECTION 32 11 00

BASE COURSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Granular Base and Subbase (also referred to as base and subbase aggregates or base and subbase gravels).

1.2 RELATED REQUIREMENTS

A. Section 31 10 00 – Site Clearing

B. Section 31 20 00 – Earth Moving

C. Section 32 12 16 – Asphaltic Paving

D. Section 32 16 15 – Curbs and Sidewalks

1.3 REFERENCES

A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lbs (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

C. ASTM D2167 - Test for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

D. ASTM D1556 - Test Method for Density of Soil in-place by the Sand-Cone Method.

E. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) Method B (Direct Transmission).

F. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Submit materials certificate to on-site independent testing laboratory which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein. Materials shall comply with the gradations specified in Section 31 20 00, Earth Moving.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate has been inspected; gradients and elevations are correct, and dry.

3.2 CONSTRUCTION

A. Perform base and subbase course construction in a manner that will drain surface properly at all times and at same time prevent runoff from adjacent areas from draining onto base course or subbase construction.

B. Compact base material to not less than 95% of maximum density as determined by ASTM D-1557 unless otherwise indicated on the Drawings.

C. Granular Subbase: Construct to thickness indicated on Drawings; apply in lifts or layers not exceeding 8", measured loose.

D. Granular Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 4" measured loose.

E. All work of this section shall conform to the requirements of Sections 304 of the Maine Department of Transportation Specification for furnishing, placing, and surface tolerance of aggregate base and subbase courses.

3.3 FIELD QUALITY CONTROL

A. An Independent Testing Laboratory, retained by the Owner, shall perform construction testing of in-place base courses for compliance with requirements for gradation and density. The Contractor shall retain an independent surveyor to verify paving base course tolerances (by rod and level readings on no more than fifty-foot centers) to +0.05’ of design elevation that allow for paving thickness as shown in the Drawings. Contractor shall provide instruments and a suitable benchmark and perform all survey. The Contractor may, at his option, retain his own test laboratory for quality control, production schedules, or for any other reason at no cost to the Owner.

B. The following tests shall be performed on each type of material used as base and subbase course material:

1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
2. Mechanical Analysis: AASHTO T-88
3. Plasticity Index: ASTM D-4318-84
4. Base and subbase material thickness: Perform one test for each 5,000 square feet in-place base material area.

5. Base and subbase material compaction: Perform one test in each lift for each 5,000 square feet in-place base material area.

6. Test each source of base material for compliance with applicable state highway specifications.

C. Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements:

1. Sand-Cone Method: ASTM D1556

2. Balloon Method: ASTM D2167

3. Nuclear Method: ASTM D2922, Method B (Direct Transmission).

D. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. The Engineer, Owner, and Contractor shall be provided with copies of reports within 96 hours of time test was performed. In event that any test performed fails to meet these Specifications, the Owner and Contractor shall be notified immediately by Independent Testing Laboratory. The Owner reserves right to employ a separate testing laboratory and to direct any testing that is deemed by them to be necessary. Contractor shall provide free access to site for testing activities.

E. Any base or subbase courses which become contaminated due to weather, erosion, or other activities, whether or not such contamination is under the control of the Contractor shall be removed and replaced. Said removal and replacement shall be incidental to the work and no additional payment will be made to the Contractor.

END OF SECTION

SECTION 32 12 16

ASPHALTIC PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide all material and labor for the placement of surface course and binder course on roads, access drives, parking lots, sidewalks, and walkways. All pavement shall be produced, supplied, placed and conform to the requirements of Section 401 of the MaineDOT Standard Specifications.

1.2 REFERENCES

A. November 2014 State of MaineDOT Standard Specifications, including relevant updates, except as modified herein.

B. November 2014 State of MaineDOT Standard Details.

C. MS-2 - Mix design methods for asphalt concrete and other hot mix types - The Asphalt Institute (AI).

D. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).

E. Hot Mix Asphalt Paving Handbook - US Army Corp of Engineers, UN-13 (CE MP-ET).

F. MS-19 - Basic Asphalt Emulsion Manual - The Asphaltic Institute (AI).

G. ASTM D946 - Penetration - Graded Asphalt Cement for use in Pavement Construction.

H. AASHTO M-226/ASTM D3381 Asphalt Cement

I. AASHTO M-140/ASTM D997 or AASHTO M-208/ASTM D-2397 Tack Coat

J. AASHTO M-117/ASTM D242 Mineral Filler

K. AASHTO T-245/ASTM D1559 Marshall Mix Design

L. Approved and released for construction plans (for State Highway work, there may be a difference between “Released for Bid” and “Approved and Released for Construction” drawings. Any substantive changes shall be addressed by approved change order before commencing the work).

1.3 RELATED SECTIONS

A. Section 31 20 00 – Earth Moving
B. Section 32 11 00 – Base Courses
C. Section 32 16 15 – Curbs and Sidewalks

1.4 SUBMITTALS

A. Design Mix: Before any asphaltic concrete paving is constructed, the Contractor shall submit the proposed actual design mix to the Owner for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, asphalt cement grade used, Marshall Stability (lbs), flow, effective asphalt content (percent), and direct references to the applicable highway department specifications sections for each material. Design shall be for a mixture listed in the most recent edition of roadway specifications of the state in which the project is to be constructed. In no case shall a mix design over three years old be submitted.

B. Material Certificates: Submit materials certificate to an independent testing laboratory retained by the Owner. The certificates shall be signed by the material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

C. Field density test results, minimum 1 per 100 tons of bituminous pavement placed including station/offset of test.

D. Plant inspection reports to verify pavement batch plant and paving equipment meets or exceeds MDOT Specification 401. The inspections shall be conducted by an independent testing firm retained by the Owner.

1.5 JOB CONDITIONS

A. Weather Limitations:

1. Apply tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application.

2. Construct asphaltic concrete paving when atmospheric temperature is above 40 degrees F base, 50 degrees F surface.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide asphaltic concrete mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet State Department of Transportation specifications and exhibit satisfactory record on previous installations.

B. Asphalt Cement: Comply with AASHTO M-226/ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, AR-80, viscosity grade, depending on local mean annual air temperature. (See following chart):

Temperature Condition	Asphalt Grades
Cold, mean annual air temperature < 7° C (45° F)	AC-10 85/100 pen.
Warm, mean annual air temperature between 7° C (45° F) and 24° C (75° F)	AC-20 60/70 pen.
Hot, mean annual air temperature > 24° C (57° F)	AC-30

Final acceptance of the proper grade of A.C. shall be made by the Owner's Engineer.

C. Tack Coat: Emulsified asphalt; AASHTO M-140/ASTM D 997 or M 208/ASTM D 2397, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.

D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D242, if recommended by applicable state highway standards.

E. Asphalt-Aggregate Mixture: See drawings and details – all materials must meet current Maine DOT Standards and Specifications.

2.2 EQUIPMENT

A. Maintain all batch plant and paving equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose material from compacted base material surface immediately before applying prime coat.

B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.

C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

3.2 APPLICATIONS

A. Tack Coat:

1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.

2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat on the surface of all such bases where asphaltic concrete paving will be constructed.

3. Apply emulsified asphalt tack coat in accordance with APWA Section 2204 and applicable state highway specifications.

4. Apply at minimum rate of 0.05 gallon per square yard of surface.

5. Allow to dry until at proper condition to receive paving.

3.3 ASPHALTIC CONCRETE PLACEMENT

A. Place asphalt concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:

1. When ambient temperature is between 40 degrees F and 50 degrees F: 285 degrees F.
2. When ambient temperature is between 50 degrees F and 60 degrees F: 280 degrees F.
3. When ambient temperature is higher than 60 degrees F: 275 degrees F.

B. Whenever possible, all pavement shall be spread by a finishing machine. Inaccessible or irregular areas, pavement may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated coarse aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10'-0" wide.

D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

3.4 WEATHER AND SEASONAL LIMITATIONS

For weather limitations, the State of Maine will be considered to be divided into two paving zones:

(a) Zone 1: All area north of US Route 2 from Gilead to Brewer and north of Route 9 from Brewer to Calais.

(b) Zone 2: All area south of Zone 1 including the US Route 2 and Route 9 boundaries.

Bituminous plant mix for use other than traveled way wearing course may be placed in either zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer placed in the shade at the paving location is 35 degrees F or higher and the area to be paved is not frozen. Plant mix to be placed as traveled way wearing course may be placed in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th provided the air temperature determined above is 50 degrees F or higher.

Any hot bituminous base or binder course that is to be subject to traffic during the winter months shall have its gradation densified or asphalt content (percent of mix) adjusted through a change in the job mix formula as submitted by the Contractor and approved by the Owner.

3.5 ROLLING AND COMPACTION

A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. Mixture shall be compacted to a minimum, of 92% theoretical maximum density. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 FIELD QUALITY CONTROL

A. An Independent Testing Laboratory, shall be retained to perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, density,

composition and surface smoothness. Asphaltic surface and asphaltic base/binder courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. In no event shall less than three cores in light duty areas and three cores in heavy-duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Asphaltic Concrete pavement samples shall be tested for conformance with the mix design. Refer to the general contract conditions for clarification on the cost for the independent laboratory.

B. Grade Control: Establish and maintain required lines and elevations.

C. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" overlay; or shall be removed and replaced to the proper thickness, at the discretion of the Owner's; until specified thickness of the course is met or exceeded at no additional expense to the Owner.

D. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The results of these tests shall be made available to the owner upon request. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

Base Course Surface:	1/4"
Wearing Course Surface:	3/16"

E. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.

F. Compaction: Field density tests for in-place materials shall be performed by examination of field cores in accordance with one of the following standards:

1. Bulk specific gravity of paraffin-coated specimens: ASTM D-1188.

2. Bulk specific gravity using saturated surface-dry specimens: ASTM D-2726.

Rate of testing shall be one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard-duty areas. Cores shall be cut from areas representative of the project.

Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

G. Pavement Plant Inspection: The paving plant shall be inspected a minimum of one week prior to pavement placement to verify the plant meets the requirements outlined in Section 401. Random inspection and sampling during pavement placement shall be conducted and documented by a testing firm hired and paid for by the Owner.

H. After the binder pavement is placed, the Contractor shall retain an independent surveyor to profile the centerline of the access drive at a minimum of 25-foot stations plus survey the elevations at the locations of any pavement spot grades shown on the drawing and all catch basin inlets. This survey information shall be plotted on the drawing access drive profile and a grading plan. The Contractor shall supply this information in triplicate to the Engineer with copies to the Owner, Architect and Construction Manager. A narrative identifying any areas which do not meet the specification tolerances of subsection E of this specification with an outline of corrective measures shall accompany the submission. The Owner shall have four working days upon certified receipt of these data to issue a letter authorizing surface pavement to be placed.

END OF SECTION

SECTION 32 16 15

CURBS AND SIDEWALKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete, Brick or Bituminous Sidewalks

B. Stonedust Walks

C. Granite Curb

D. Bituminous Curb

E. Slipform Cast in Place Concrete Curb (precast concrete curb is not permitted on this project)

F. Unit Pavers

G. Tactile Warning Strips

H. This specification contains the requirements for multiple types of curbing and sidewalks. Some of these will not be required for this project.

1.2 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing

B. Section 31 20 00 – Earth Moving

C. Section 32 11 00 – Base Courses

D. Section 32 12 16 – Asphaltic Paving

E. State Highway Department Standard Specifications

F. Construction Documents.

1.3 SECTION EXCLUDES STRUCTURAL SLABS AT ENTRANCES

A. Structural slabs are entryway areas consisting of a slab supported by a foundation contiguous with the building foundation.

1.4 REFERENCES

A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

B. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural construction.

C. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

D. ASTM C33 - Concrete Aggregates.

E. ASTM C94 - Ready Mix Concrete.

F. ASTM C150 - Portland Cement.

G. ASTM C260 - Air-Entraining Admixtures for Concrete.

H. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

I. ASTM C494 - Chemical Admixtures for Concrete.

J. FA TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

K. MDOT specifications for Highway and Bridge construction, current edition.

L. American Society for Testing and Materials (ASTM):

1. C33 – Concrete Aggregates
2. C67 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
3. C144 – Aggregate for Masonry Mortar
4. C936 – Standard Specification for Solid Interlocking Concrete Pavers.
5. C979 – Specification for Pigments for Integrally Colored Concrete.

M. Interlocking Concrete Pavement Institute (ICPI).

1. Interlocking Concrete Pavement Manual

1.5 PERFORMANCE REQUIREMENTS

A. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to

form radius bends as required. Coat forms with non-staining type coating that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner.

C. Concrete Materials: Comply with requirements of MDOT Specifications Section 502 for concrete materials, admixtures, bonding materials, curing materials, and others as required. Any concrete outside of the building and not a structural slab shall be part of the site work for the project.

D. Joint Fillers: Resilient pre-molded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A; or AASHTO M 153, Type I.

E. Joint Sealers: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant", Sonneborn "Sonomeric CT 1 Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulken 45", or Woodmont Products "Chem-Caulk".

F. Granite Curb shall be used where required on the Contract Drawings and shall be installed in accordance with the requirements of MDOT Specification 609. All curb shall be of granite mined and cut in the United States of America. Type 1 granite headstones shall be used at all catch basin inlets along the access drive gutter lines. Granite at all ADA ramps shall be Type 1 with a flush reveal. Type V curb is not permitted for tip downs or to directly abut Type 1 curb in any area.

G. Bituminous Curb shall be used where required on the Contract Drawings and shall be installed in accordance with Section 609 of the MDOT specifications. Fiberglass resin shall be used in all curb. Coatings pursuant to MDOT specifications (seal coat) shall be provided for all bituminous curb.

H. Slipform Concrete Curb shall be used where required on the Contract Drawings. Concrete materials for Slipform curb will meet the same requirements for concrete curb under 502.05 of the MaineDOT Standard Specifications including 703.0201 associated with ASR Aggregates. This includes a minimum compressive strength of 4000 psi.

I. Aggregates subbase gravels and base gravels (if appropriate) for sidewalks shall meet the requirements of Section 32 11 00 of these specifications.

J. Asphaltic concrete pavement for sidewalks shall meet the requirements of Section 32 12 16 of these specifications.

K. STONEDUST

i. 3/8” sieve material as supplied by R. J. Grondin and Sons, Route 25, Gorham, ME 839.5544 or approved equal conforming to the following gradations:

Sieve Designation	% by Weight Passing Square Mesh Sieves
#6	100
#16	40-63
#40	20-29
#200	0-8

ii. Construct stone dust on prepared base to lines, grades and sections shown on the drawings and details.

iii. Compact to 95% density.

iv. During the final grading of lawn areas, bring loam to stone dust walk edges and grades. Create a smooth line where loam meets stone dust. Keep stone dust and loam from becoming mixed.

L. Aggregate Base: Material for aggregate base course shall be a graded, granular, non-frost susceptible, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.

1. Material shall conform to MDOT Specifications Section 703.06, "Aggregate for Base" Type A gravel.

M. Unit Pavers:

1. Pedestrian/light traffic clay Pathway paving bricks as manufactured by Pinehall Brick (www.pinehallbrick.com), or approved equal, and as distributed by Morin Brick (Tel. 207-784-9375 – Jason LaChance).

2. Unit specifications:

a. Unit clay paver shall conform to the requirements of ASTM C902, Class SX, Type 1, Application PX.

b. Square, wire-cut edges, no lugs.

c. Minimum average compressive strength of 8,500 psi.

d. Water absorption less than 6%, without sealer.

e. Dimensional tolerance: ± 1/8" in any dimension.

f. Passes CSA-A231.2 freeze thaw test in saline solution without use of sealers or other products applied to the power.

g. Refer to details in the drawings and to the following schedule:

Type/Finish	Size	Uses	Color	Pattern
Pinehall Pathway	4x8x2¼	Sidewalks	Full Range	Runningbond

i. Color selections correspond to manufacturers' designations and City of Portland Technical Standards.
ii. Refer to Enlarged Site Layout Plans for coursing and pattern direction.

3. Detectable Warning Pavers as manufactured by Pavestone, (www.pavestone.com), Whitacre-Greer (www.wgpaver.com or 1-800-947-2837), or approved equal. (N.I.C.)

a. Dry-press solid (uncored) hard-burned, frost-free pavers with chamfered edge.
b. Complies with ADA requirements, 5,000 psi min. compressive strength, 8% maximum absorption.
c. Size: 2 ¼" x 4" x 8".
d. Color: Light Gray.

4. The pavers shall be free of cracks or other imperfections when viewed from a distance of 20 feet (6 meters). The exposed parts of the brick shall be free of chips exceeding 5/16" from the edge and ½" from a corner. All pavers that do not meet these criteria shall be replaced with acceptable units.

N. Cobblestone (N.I.C.):

1. Provide gray granite cobblestones roughly 9"x5"x5" in size.

O. Edge Restraint:

1. Provide injection molded polyethylene edge restraint as manufactured by Snap Edge Corporation or approved equal. Use approved edge restraints where a structure, pavement, or curbing does not abut pavers.

2. Edge restraint spikes shall be 12" x 3/8" diameter galvanized steel.

P. Setting Bed and Joint Filler:

1. Concrete sand conforming to ASTM C33 for bedding sand; ASTM C144 for unit paver joint sand. Bedding sand may be used for unit paver joints, but may require extra sweeping compound and compaction.

a. Sand to be sharp, washed and free of foreign material.

2. Stone dust may be used instead of sand to fill cobblestone joints.

Q. Bituminous Setting Bed:

1. Refer to Section 02525 – Curbs and Sidewalks

R. Water: Water shall be potable and shall be free of injurious contaminants.

S. Catalog cuts and information on the curb supplier shall be submitted to the Engineer for approval prior to ordering the material.

T. Tactile Warning Strips: Materials shall be selected by the Contractor from the materials shown on the drawings or from materials approved by the City of Portland Technical Standards and shall meet all current ADA standards at the time the materials are ordered.

2.2 MIX DESIGN AND TESTING

A. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce the following properties:

1. Compressive Strength: 4,500 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
2. Slump Range: 3"-5" for normal concrete at time of placement
3. Air Entrainment: 4% to 6%

PART 3 - EXECUTION

3.1 PREPARATION FOR SIDEWALKS

A. Prepare subgrade to receive sidewalk subbase gravel in accordance with Section 32 11 00.

B. Place and compact subbase and base gravel in accordance with Section 31 20 00 and 32 11 00 of these specifications.

C. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after the unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.

D. Surface Preparation: Remove loose material from compacted base material surface immediately before placing concrete.

3.2 INSTALLATION OF CONCRETE SIDEWALKS

A. Form Construction:

1. Set forms to required grades and lines, rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.

3. Check completed formwork for grade and alignment to following tolerances:

   Top of forms not more than 1/8" in 10'-0".

   Vertical face on longitudinal axis, not more than 1/4" in 10'-0".

4. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Locate, place and support reinforcement per Division 3 specifications.

C. Concrete Placement:

1. Comply with requirements of Division 033000 – Concrete.

2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structure until they are at the required finish elevation and alignment.

3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels and joint devices.

4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hours, place construction joint.

D. Joint Construction:

1. Contraction Joints: If joints are specified, the curb or gutter shall be constructed in uniform sections of the length specified on the plans. The joints between sections shall be formed either by steel templates 1/8 inch in thickness, or a length equal to the width of the gutter or curb, and with a depth which will penetrate at least 2 inches below the surface of the curb and gutter; or with 3/4 inch thick preformed expansion joint filler cut to the exact cross section of the curb or gutter; or by sawing to a depth of at least 2 inches while the concrete is between 4 to 24 hours old. If steel templates are used, they shall be left in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place.

2. Longitudinal Construction Joints: Concrete curb, concrete gutter, combination concrete curb and gutter, where specified on the plans, shall be tied to concrete pavement with 1/2 inch round, reinforcement bars of the length and spacing shown on the plans.

3. Transverse Expansion Joints: Transverse expansion joint in curb, curb and gutter, gutter or sidewalk shall have the filler cut to the exact cross section of the curb, curb and gutter, gutter or sidewalk. The joints shall be similar to the type of expansion joint used in the adjacent pavement.

E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If not joint sealer, place top of joint filler flush with finished concrete surface. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler section together.

F. Joint Sealants: Exterior pavement joint sealants shall be installed per manufacturer's recommendations.

G. Cold Weather Placing:

1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions or low temperatures, in compliance with ACI 306 and as specified herein. All expenses associated with the protective measures, temporary heating, etc. shall be at the expense of the Contractor.

   When air temperature has fallen to or is expected to fall below 40° F (4° C) uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50° F (10° C) and not more than 80° F (27° C) at point of placement.

   Do not use frozen materials or materials containing ice or snow. Do not place concrete or frozen subgrade or subgrade containing frozen materials.

   Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical agents, unless otherwise accepted in mix design.

H. Concrete Finishing:

1. After striking off and consolidating concrete, smooth surface by screening and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

2. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius. Eliminate tool marks on concrete surface. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

   a. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.

   b. Paving: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.

3. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.

4. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in the "water-curing" section of ACI 308-81. Apply Saltguard© or approved equal to finished concrete surface.

I. Cleaning and Adjusting:

1. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

2. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.4 GRANITE CURB

A. Granite curbing will be installed and backfilled in accordance with provisions of Paragraph 3.06. If Type 5 sloped curb configuration is used, the curb shall be set on a slope as shown on the plans. All granite curb used to form a radius and any granite curb of any type with stone length of less than 36” shall be backfilled with lean concrete to a level equal to the binder pavement surface in front of the curb and a level equal to 3” below finish grade behind the curb.

B. Protect the granite curb from damage throughout construction and until substantial completion.

3.5 BITUMINOUS CURB

A. Bituminous curb shall be installed on the bituminous pavement base course prior to placement of final bituminous pavement wearing course. The curb shall be backfilled with approved materials. That shall be placed in layers not exceeding 8 inches in depth, loose measure and thoroughly tamped.

B. Bituminous curb shall be seal coated after placement in accordance with MDOT Standard Highway specifications.

3.6 SLIPFORM CONCRETE CURB

A. Installation: Concrete may be placed with an approved Slipform machine that will produce a finished product according to the design specified in the plans and will meet the same standards set for cast-in-place curbing. For cold weather slipforming, the outside temperature must be at least 36 °F (2.2 °C) and rising. The curb shall be placed on a firm, uniform bearing surface, shall conform to the section profile specified in the plans and shall match the appropriate grade. Proper curing shall be insured through the use of a curing compound spray that meets ASTM specifications. Expansion joints will be provided at ends of curve radii or wherever the curb meets rigid structures such as building foundations or fire hydrants. Contraction joints will be placed at 10 foot (3 m) intervals using sawing methods, which cut 1-3" into the concrete. Joints shall be constructed perpendicular to the subgrade and match other joints in roadways, sidewalks or other structures when applicable. If the concrete is placed on bituminous pavement, an approved epoxy or adhesive shall be used to bond the curb to the pavement. The

contractor shall form tip downs and transitions to conform to the requirements of the construction documents and details.

B. Backfilling: Same as Section 609.05 (B) of the Maine Department of Transportation Standard Specifications.

C. Protection: Slipform curbing must be adequately protected after placement. The concrete shall be allowed to cure for at least 72 hours. During cold weather conditions, when temperatures drop below the required temperature of 36 °F (2.2 °C) after placement, curbing shall be protected by concrete blankets or a combination of plastic sheeting and straw. After any placement of Slipform curbing, regardless of weather conditions, the placed curbing shall be adequately protected by traffic control devices and flagging as necessary

3.6 HOT BITUMINOUS CONCRETE SIDEWALKS

A. Bituminous concrete pavement for sidewalks shall be placed in two lifts to provide the total thickness specified on the drawings.

B. Compaction shall be by a paver roller having a minimum total weight of 2,000 lb. with a minimum of 65 lbs. per inch of drive roll or by satisfactory vibratory equipment.

C. Placement and quality control shall comply with Section 32 12 16 of these specifications.

3.7 BRICK SIDEWALKS

A. Preparation: Provide and compact base gravel where required as surface to place stone dust or bituminous concrete as shown on the detail.

B. Stone Dust: A layer of sand cement base material one (1”) inch thick shall be spread upon the properly prepared bituminous concrete base. This course of stone dust shall be firm but not compacted.

C. Brick Placement: Perform all masonry work with skilled workmen under adequate supervision. A journeyman brick mason shall supervise all brick placement. Lay all masonry true to lines and grade with all surfaces true, and corners straight and plumb. Lay exposed-to-view bricks smooth side up, with an individual unit-to-unit level tolerance not to exceed 1/8-inch and an overall tolerance from the grade not to exceed ¼-inch in 10 feet in any direction. Lay no unit having chipped edges of face, in exposed-to-view locations. Remove any such unit, if installed and replace with a new undamaged unit.

1. Brick Laying: The brick shall be laid in patterns shown on the drawings. The joints shall be hand tight, leaving only as much space between bricks as occurs naturally from rough surface or slight irregularities. When necessary, the brick shall be cut with a masonry saw. The Owner will require replacement of improperly broken bricks. No struck brick shall be less than two (2’) inches in length.

D. Compaction: After the bricks are carefully laid upon the properly prepared sand cement base, a 2” x 4” board shall be placed upon the bricks and shall be tapped with a hammer until the bricks reach a firm, unyielding bed and present a surface of the proper grade and slope. Any

divergence from line and grade is to be corrected by taking up and relaying the bricks. After setting the bricks, a sufficient amount of sand cement shall be spread over the surface and thoroughly swept or raked so as to fill the joints. All surplus sand cement remaining on the brick paved areas after the joints have been properly filled shall be removed by sweeping. Avoid raking out the joints during the removal of excess sand cement.

E. Moisture: Sufficient moisture shall be applied by sprinkling to permit the sand cement to achieve and set.

F. After 3 days, the surface of the walk shall be cleaned with a solution of muriatic acid to remove any cement film.

3.8 INSTALLATION OF UNIT PAVERS (N.I.C.)

A. Base:

1. Contractor shall inspect and verify that aggregate base and bituminous binder course or concrete frost slab for all work covered in this Section have been placed and compacted in the amounts specified in the Drawings and Specifications (See Section 02200 - Earthwork and Section 02511 – Asphaltic Concrete Paving).
2. Commencement of work by the Contractor signifies acceptance of base conditions. Any deviations or abnormalities in base preparation are to be reported to the owner's representative immediately.

B. Edge Restraint:

1. Place edge restraint to exact lines as shown on drawings.
2. Straight runs to be true to the line, and curves to be smooth and true to form.
3. Install edge as per manufacturer's specifications. Top edge should not be visible from surface.
4. Notify Owner's representative after edge installation and before setting of pavers.

C. Sand Setting Bed:

1. Place and screed sand to grades and lines as required. Thickness after paver installation to be no less than 1" and no greater than 1 1/2".
2. Do not use water-saturated or frozen sand.
3. Do not use sand to compensate for improperly installed or compacted base or for making up any unevenness or irregularity in the base course surface as this will show through to the finished surface of the pavers over time.
4. Do not walk on or otherwise disturb screeded setting bed surface prior to paver installation.

D. Pavers:

1. Set pavers hand tight using specified colors, shapes and textures in patterns and configurations shown.
2. Trim and cut pavers as required using a motor driven masonry saw with a blade designed specifically for the cutting of paving units. Keep cuts to a minimum. Small pieces less than 2” in any dimension, or pieced together to create a larger “whole” will not be accepted.
3. A typical spacing of 1/16" is to be maintained between pavers; maximum joint width 1/8”.
4. Gaps between pavers and adjoining objects of greater than 3/8" shall be filled with sand.
5. After pavers are set, vibrate into place with a plate vibrator capable of 3,000 to 5,000 pounds centrifugal compaction force and operating at a frequency of 80 to 90 hertz. Two passes in opposing directions (at right angles) minimum to be made with vibrator.
6. Sweep joints with dry sand, and vibrate (lightly water when sand/cement used). Repeat process to fill joints. Damp sand may be spread over paver surface and allowed to dry before filling joints.
7. Do not compact closer than 3' to an unrestrained paver edge.
8. All work must be compacted up to 3' from stopping point by the end of each workday. Cover and protect setting bed and uncompacted pavers until resumption of work.

E. Expansion and Control Joints:

1. Provide for sealant-filled joints at building foundation and against concrete slabs or foundations.
2. Provide compressible form filler as backing for sealant-filled joints as necessary.
3. Install joint filler before setting pavers.
4. Make top of joint filler flush with top of pavers.

F. Tolerances:

1. Do not exceed 1/16-inch (1.6 mm) unit–to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and ¼ inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface paving.
2. Surface elevation of pavers are to be 1/8" to 1/4" above adjoining curbs, inlets, walks, etc. (and may be 1/8" to 1/4" above final grades in general) to allow for characteristic minor settling.

G. Repair, Protection, Cleanup:

1. Replace units that are chipped, broken, stained, or in any other way do not conform to or may adversely affect the adjoining work.
2. Work area to be left in a neat and orderly manner upon completion of work, free from debris and swept clean.

3. Finished work is not to be used for storage of materials, unapproved vehicle movement or other operations which may damage, stain or otherwise mar the paver surface.

H. Inspection and Acceptance:

1. When paver installation is complete, the owner's representative will, upon request, inspect work to determine acceptability.
2. Work that does not comply with requirements will be removed and replaced as specified and as shown on drawings, at no additional cost to Owner.
3. The owner's representative will, upon completion and request, inspect replaced areas to determine acceptability.

END OF SECTION

SECTION 32 17 23.13

PAINTED PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. The work shall consist of furnishing and placing permanent reflectorized pavement markings as shown on the plans or as designated by the Engineer.

B. When it is necessary to remove existing pavement lines or markings, it shall be done by grinding, sand blasting, or other acceptable method. The method chosen must be capable of completely eradicating the existing lines or markings without damage to the existing pavement.

1.2 RELATED REQUIREMENTS:

A. Section 31 20 00 – Earth Moving

B. Section 32 11 00 – Base Courses

C. Section 32 12 16 – Asphaltic Paving

D. Construction Drawings

1.3 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The paint shall be a non-bleeding, quick-drying, alkyd petroleum base paint suitable for traffic-bearing surfaces and shall meet FS TTP-85E and mixed in accordance with manufacturer's instructions before application.

PART 3 - EXECUTION

3.1 SITE MEETING

A. A site meeting including the Engineer, Contractor, Pavement Marking Subcontractor, and the Owner shall be conducted prior to conducting the work. Marking locations, colors for the markup, and dates of application shall be confirmed at this meeting. The Owner reserves the right to alter or modify said locations at this meeting.

3.2 PREPARATION

A. Sweep and clean surface to eliminate loose material and dust.

B. Where existing pavement markings are indicated on the drawings to be removed or would interfere with the adhesion of new paint, a motorized device shall be used to remove the markings. The equipment employed shall not damage the existing paving or create a surface hazardous to vehicle or pedestrian traffic. In all areas within public rights-of-way, the method of marking removal shall be approved by governing authority.

3.3 APPLICATION

A. Apply two (2) applications of paint at manufacturer's recommended rate without the addition of thinner, with a maximum of 125 square feet per gallon. Install during calm (low wind) conditions in order that spray or unintended paint does not affect adjacent areas. Where necessary, apply during periods of the day when traffic can be controlled and barricaded from area where markings are being installed. Use proper barricades, traffic and safety officers. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use a straightedge to ensure a uniform, clean, and straight stripe. A minimum of 48 hours shall elapse between the applications.

B. The following items are to be painted with the colors noted below:

1. Pedestrian Crosswalks: White
2. Lane Striping where separating traffic in opposite directions: Yellow
3. Lane Striping where separating traffic in same direction: White
4. Handicap Symbols: Conforming to the modified symbol for International Barrier Free as shown on drawings
5. Parking Stall Striping: White
6. Parking space numbering (if required by plans): White
7. Stop Bars: Provide painted stop bars where shown on the plan
8. Directional Arrows: White
9. Fire Lane: Per Fire Department and Portland Public Works selection
10. Chevrons: Yellow

END OF SECTION

SECTION 32 30 00

SITE IMPROVEMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The CONDITIONS OF THE CONTRACT and all Sections of Division 1 are hereby made a part of this Section.

1.2 SECTION INCLUDES

A. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

B. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, and without limiting the generality thereof furnish and install the following:

1. Bicycle Rack
2. Benches

1.3. RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete.

B. Section 31 20 00 – Earth Moving.

C. Section 32 93 00 – Trees, Plants and Ground Covers.

1.4 QUALITY ASSURANCE; SUBMITTALS

A. Quality Assurance: Conform to requirements of Section 01 33 00 – Submittal Procedures.

B. Submittals: Provide as follows:

1. Product Data:
   a. All manufactured equipment.
   b. Metal fasteners, anchors, other accessories.

C. Shop Drawings: All items where installation methods are not fully described in product data. Where appropriate, and when approved by the Engineer, manufacturer's catalogue cuts may be substituted for shop drawings.

1.5 REFERENCE STANDARDS

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

B. MDOT: Where specified, comply with applicable provision of State of Maine Department of Transportation Standard Specifications for Highways and Bridges, hereinafter referred to as MDOT.

C. Earthwork: Conform to requirements of Section 31 20 00 – Earth Moving.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Products: Supply and install the following:

1. Bicycle Racks: Galvanized steel, in-ground mounted Bike Hitch, as manufactured by Dero (www.dero.com, 800-298-4915), or approved equal. Quantity: 11 Hitches.

2. Benches (N.I.C.):

a. Products as manufactured by Victor Stanley, Inc. (www.victorstanley.com, 301-855-8300); Urbanscape (www.urbanscapefurniture.com 1-866-903-3714), or approved equivalent. Black powder coat finish, with wheat or maple recycled plastic slats. Quantities as indicated in the Drawings.

b. 7 foot bench without back or arms; faux-wood (wheat); in-ground mount; Urbanscape Kentland Collection #24 KE14221.

c. 4 foot bench with back and arms and recycled plastic slat seat; Victor Stanley, GreenSites Series Model CM-50. Maple slats.

d. Benches shall be bolted to concrete pads, in accordance with the details.

3. Bench Alternate (for 7-foot bench) (N.I.C.):

a. 6 foot bench without back or arms: Victor Stanley GreenSites Series Model CM-53, recycled plastic slat; color: Maple; tubular steel frames with black powder coat finish. In-ground mounted in 12” diameter x 2-foot deep foundations.

4. PVC Solid Waste Enclosure and Fence (N.I.C.):

a. Provide as indicated, conforming to manufacturer’s specifications. This work shall include the supply and installation of all PVC fence including posts, gates, fasteners, finishes and ancillary equipment as depicted on the contract drawings or as required to render the installation complete.

b. Acceptable manufacturers include BuffTech by CertainTeed Corporation as distributed by Gorham Fence Co. or equal.

c. All corner and end posts of trash enclosures shall have Schedule 40 galvanized steel inserts. All gate hardware (hinges, latches, handles & pins) shall be galvanized steel.

d. Set all posts in 12" dia. Sonotube filled with concrete.

5. Steel Fencing and Gates (N.I.C.):

a. Fusion-welded steel ornamental fence, Montage II, heavy industrial weight, as manufactured by Ameristar Fence Products (www.ameristarfence.com or 1-800-321-8724).

1. Posts: 2 ½" square, up to and including 6' height, 3" square minimum over 6' height.

2. Pickets: 1" square.

3. Color: Black

b. Security fencing and gates shall be Invincible, Style I3 (3-rail). (Type A).

1. Refer to drawings and details for gates and panel dimensions and locations.

c. Ornamental fencing, railing and gates (Type B), shall be Majestic Series Style M3, (3-rail).

1. Refer to drawings and details for gates and panel dimensions and locations.

PART 3 – WARRANTIES

3.1 GENERAL

A. The supplier shall provide warranties on all materials and workmanship for one year excluding vandalism.

B. Site Contractor shall guarantee concrete for one year excluding vandalism.

END OF SECTION

SECTION 32 40 00

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide traffic control signs complying with U.S. Department of Transportation, Federal Highway Administration's "Manual on Uniform on Traffic Control Devices", local codes, and as specified. See Drawings for type, location, and quantity of signs required.

B. Related Sections:
   1. Construction Drawings.
   2. Manufacturer's Mounting Instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Signs to meet FHWA requirements NCHRP 350 certification, engineer grade reflective.

B. Provide information for all signs, proposed mounting heights, mounting hardware, and posts to be submitted to the Owner for review and approval prior to installation.

C. Posts to be 2" diameter galvanized steel tube.

2.2 MATERIALS

1. To be backed with Alucobond panels, to be tan or light grey or selected by the Owner. To be painted with reflective baked-enamel finish with following colors:
2. "STOP" Signs: (R1-1) 24"x24", Octagon, reflectorized copy and border.
3. "MODIFIED HANDICAPPED SYMBOL" Signs per size shown on the contract drawing, white legend on blue background. Handicapped van accessible sign shall be the dimensions shown on the contract drawings.
4. "DO NOT ENTER" Signs: (R5-1) Highway Dept. standard red and white sign except 24"x24" size.
5. Miscellaneous Signs: Per Manual on Uniform Traffic Control Device recommendations or lettered with dimensions shown on the contract drawings.

2.3 POSTS

A. Posts shall be 2" diameter galvanized steel tube with galvanized steel weather tight closure cap.

PART 3 - EXECUTION

A. Conduct an on-site meeting with the Engineer and Owner prior to start of the work to review/confirm sign location and types.

B. Red signs shall be on top where multiple signs are on a single post, larger signs shall be installed above smaller signs.

C. Install weed control collar when signs are installed in turf areas.

D. All signs in pedestrian areas shall be mounted with the bottom of the sign at 7’ above finish grade. Signs in non-pedestrian areas shall be mounted with the bottom of the sign at 5’ above finish grade except ADA signs which shall be 7’. Set posts vertical and plumb as shown in the plans. Mount signs in accordance with manufacturer's instructions. Check mounting height, replace any posts which are not installed plumb.

END OF SECTION

SECTION 32 92 00

TURF AND GRASSES

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide all materials and equipment, and do all work required to complete the loaming, seeding and sodding including furnishings and placing topsoil, as indicated on the Drawings and as specified.

1.2 SECTION INCLUDES

A. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 31 20 00 – Earth Moving - Establishment of subgrade elevation.

2. Section 31 25 13 – Erosion Controls - Soil stabilization measures.

3. Section 32 93 00 – Trees, Plants, and Ground Covers - Landscaping.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM)

C 136 Sieve Analysis of Fine and Coarse Aggregates
E 11 Wire-Cloth Sieves for Testing Purposes

1.5 SUBMITTALS

A. Submit under provision of Division 1.

B. Product Data: Provide for each product specified herein.

C. Samples: The following samples shall be submitted:

Material	Quantity (lb.)
Topsoil	1
Fertilizer	1

D. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials if to be used on the project:

Aluminum sulfate
Fertilizer
Lime

E. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

Grass seed mix (each)	Commercial fertilizer
Ground limestone	Seed mix for sod

F. Gradation and laboratory analysis:

Topsoil without Admixture
Topsoil with Admixtures

1.6 INSPECTION AND TESTING

A. Work will be subject to inspection at all times by the Engineer/Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with the requirements of Section 01 45 00 QUALITY CONTROL, to analyze and test materials used in the construction of the work. Where directed by the Engineer/Landscape Architect the testing laboratory will make material analyses and will report to the Engineer/Landscape Architect whether material conform to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.

2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Engineer/Landscape Architect, the Contractor shall provide such auxiliary personnel and services needed to accomplish the testing work and to repair damage caused thereto by the permanent work.

3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

B. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.

C. The Contractor shall engage an independent testing agency to perform the following tests and analyses:

Material	Tests and Analysis Required
Topsoil	Mechanical analysis of soil and determination of pH and organic matter content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring nutrient content and pH to satisfactory levels for seeding and sodding. Organic admixtures shall be provided and blended to provide an average organic content of 8% with a minimum of any test having 6% organic content by dry weight.

1. Materials shall not be used in construction until the Engineer/Landscape Architect has reviewed test results.
2. All costs associated with testing shall be at the expense of the Contractor.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Digging Sod:

1. Sod shall not be dug at the nursery or approved source until ready to transport sod to the site of the work or acceptable storage location.

2. Before stripping, sod shall be mowed at a uniform height of 2 in.

3. Cut sod to specified and to standard width and length desired.

B. Transportation of Sod:

1. Sod transported to the Project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury. Closed vehicles shall be adequately ventilated to prevent overheating of the sod.

2. Evidence of inadequate protection following the digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.

3. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or is in temporary storage.

4. Upon arrival at the temporary storage location or the site of the work, sod material shall be inspected for proper shipping procedures. Should the sod be dried out, the Engineer/Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall at once remove it from the area of the work and replace it with acceptable material.

5. Unless otherwise authorized by the Engineer/Landscape Architect, the Contractor shall notify the Engineer/Landscape Architect at least two working days in advance of the anticipated delivery date of sod material. Certificate of Inspection when required shall accompany each shipment.

C. Handling and Storage of Sod:

1. Sod material shall be handled with extreme care to avoid breaking or tearing strips.

2. Sod shall not be stored for longer than 30 hours prior to installation. Sod shall be stored in a compact group and shall be kept moist. Sod shall be prevented from freezing.

3. Sod that has been damaged by poor handling or improper storage will be rejected by the Engineer/Landscape Architect.

D. Deliver seed in original sealed containers, labeled with analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, location of packaging, and name of seed grower. Damaged packages will not be accepted.

E. Deliver fertilizer in sealed waterproof bags, printed with manufacturer's name, weight, and guaranteed analysis.

1.8 PLANTING SEASON

A. Planting season for seeding shall be as follows:

Item	Planting Period	
	Spring	Fall
Grass Seed Mixes	4/15 to 6/15	8/15 to 10/15

B. Planting season for sod shall be as follows:

Item	Planting Period	
	Spring	Fall
Sod	4/15 to 7/1	8/15 to 11/1

C. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.

D. Planting season may be extended with the written permission of the Engineer/Landscape Architect.

1.9 ACCEPTANCE

A. Acceptance:

1. The Engineer/Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.

2. Acceptance of material by the Engineer/Landscape Architect will be for general conformance to specified requirements, and shall not relieve the Contractor of responsibility for full conformance to the Contract Documents.

3. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Engineer/Landscape Architect, the Engineer/Landscape Architect will recommend to the Owner that the work of this Section be accepted.

B. Sod and seed areas will be accepted when in compliance with all the following conditions:

1. Roots are thoroughly knit to the soil;

2. Absence of visible joints (sodded areas);

3. All areas show a uniform stand of specified grass in healthy condition, free of weeds, individual bare spots of over 72 square inches or multiple bar spots in excess of 1 percent of the area.

4. At least 60 days have elapsed since the completion of work under this Section.

PART 2 – PRODUCTS

2.1 SEED

A. Seed shall be of the previous year's crop with 0.5% or less weed seed, and 1.75% or less crop seed, by weight. Seed shall be dry and free of mold. Seed shall meet the following requirements.

B. Seed Mixture:

1. Standard grade seed of the most recent season's crop. Seed shall be dry and free of mold.

2. Seed mixture shall be suitable as follows:

Name of Seed	% by Weight in Mixture	Minimum % Purity	Minimum % Germination
Lawn Areas			
Tall Fescue	40%	95%	85%
Imp. Perennial Ryegrass	35%	95%	85%
Kentucky Bluegrass	25%	95%	85%

Name of Seed	% by Weight in Mixture	Minimum % Purity	Minimum % Germination
Erosion Control – NE Erosion Control Mix – on slopes			
New England Erosion Control Mix as manufactured by New England Wetland Plants, Inc. – Amherst, MA			
Low Maintenance Areas – NE Conservation/Wildlife Mix			
New England Conservation/Wildlife Mix as manufactured by New England Wetland Plants, Inc. – Amherst, MA			
Pearl's Ultra Low Maintenance Areas – infrequent mowing			
Pearl's Premium Ultra Low Maintenance Lawns – Sunny Mix as manufactured by Pearl's Premium (www.PearlsPremium.com)			
Temporary Seeding Plan			
Perennial Ryegrass	50%	95%	85%
Annual Ryegrass	50%	95%	85%

2.2 SOD

A. Sod shall be a triplex mixture of hybrid bluegrass. Mixture shall contain approximately equal portions of each hybrid component. Hybrids shall include Cheri Kentucky Bluegrass, Flying Kentucky Bluegrass, Glade Kentucky Bluegrass, Baron Kentucky Bluegrass, or comparable equal bluegrass hybrids.

B. Sod shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully, and otherwise maintained from planting to harvest.

C. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of 5/8 in., plus or minus ¼ in., at the time of cutting. Measurement for thickness shall exclude top growth and thatch.

D. Strip Size: Individual pieces of sod shall be cut to the supplier's standards width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus ½ in. on width, and plus or minus 5% on length. Broken strips and torn and uneven ends will not be acceptable.

E. Strength of Sod Strips: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.

F. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

G. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 36-hour period unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Engineer/Landscape Architect prior to its installation.

H. Thatch: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.

I. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.

J. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds.

2.3 TOPSOIL

A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent available. Additional topsoil required shall be obtained from off-site sources.

B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam or loam soil as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

Textural Class	**% of Total Weight**	**Average %**
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 m dia. range)	5 to 25	15

1. 95% of topsoil shall pass a 2.0 mm sieve.

2. Topsoil shall be free of stones 1 in. in longest dimension, earth clods, plant parts, and debris. All topsoil shall be screened using a 3/8” screen.

3. Organic matter content shall be an average of 8% of total dry weight with a minimum of any sample being 6%.

C. Topsoil shall have a pH value range of 6.0 to 6.5.

1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.

2. If pH is below desired level add ground limestone. If pH is above desired level add aluminum sulfate.

2.4 LIMESTONE

A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

Sieve Size % Passing by Weight

No. 10	100
No. 20	90
No. 100	60

2.5 WATER

A. Water shall be suitable for irrigation and free from ingredients harmful to seeded or sodded areas.

2.6 ALUMINUM SULFATE

A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer, and net weight of contents.

2.7 COMMERCIAL FERTILIZER

A. Fertilizer shall conform to the following:

1. When applied as a topsoil amendment, fertilizer shall have an analysis that will deliver appropriate amounts of nitrogen, phosphorus, and potassium as required to remedy deficiencies revealed by testing the topsoil.

2. When used as a top dressing for the maintenance of sod, fertilizer shall conform to the following:

Constituent	% Present by Weight
Nitrogen (N)	10
Phosphorous (P)	0
Potassium (K)	20

a. 50% of nitrogen shall be derived from natural organic source of ureaform. Organic and/or slow release forms of Nitrogen are preferred.
b. Recommended fertilizer shall contain zero phosphorus with a nutrient analysis most suitable for supplying test indicated amounts of Nitrogen and Potassium.
c. Potassium shall be derived from muriate of potash containing 60% potash.

B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.

C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equivalent.

2.8 MULCHES

A. Straw Mulch: Air-dried, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

2.9 PESTICIDES, FUNGICIDES

A. General: Pesticide or fungicide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Restricted pesticides or fungicides shall not be used unless authorized in writing by authorities having jurisdiction.

PART 3 – EXECUTION

3.1 PREPARATION OF SUBGRADE

A. Subgrade shall be examined to ensure that rough grading and all other subsurface work in lawn areas and other areas to be seeded is done prior to start of seeding and sodding.

B. Existing subgrade shall be loosened or scarified to a minimum depth of 3 in. prior to spreading topsoil. Subgrade shall be brought to true and uniform grade, and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

3.2 PREPARATION OF TOPSOIL

A. Topsoil shall not be spread until it is possible to follow immediately or within 24 hours with seeding or sodding operations. If topsoil is spread prior to this time it shall be cultivated to loosen soil prior to seeding or sodding.

B. Topsoil shall not be placed when subgrade or topsoil material are frozen, excessively wet, or excessively dry.

C. Topsoil shall be spread in a uniform layer, to a thickness, which will compact to the depth required to bring final lawn and grass surfaces to required elevation. Unless otherwise indicated minimum depth of topsoil shall be 6 in. after compaction.

D. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

3.3 APPLICATION OF FERTILIZER AND CONDITIONERS

A. Fertilizer and conditioners shall be applied at the following rates:

1. Aluminum Sulfate – as required by test results of topsoil.
2. Limestone - as required by test results of topsoil.
3. Fertilizer - as required by test results of topsoil.
   Suggested rate: 1 pound active Nitrogen per 1000 square feet.

B. For maintenance of lawn grasses, fertilizer shall be applied at 1 pound active Nitrogen per 1000 square feet. Application frequency: 3 times per year. Apply lime as determined by annual soil tests.

C. Mixing with topsoil:

1. Fertilizer and conditioners shall be spread (and adjust fertilizer frequency requirements) over the entire areas designated at the application rates indicated above.
2. Materials shall be uniformly and thoroughly mixed into the top 4 in. of topsoil by disking, rototilling, or other approved method.

3.4 FINISH GRADING

A. Final surface of topsoil immediately before seeding shall be within ± 1/2 in. of required elevation, with no ruts, mounds, ridges, or other faults, and no pockets or low spots in which water can collect. Stones, roots, and other debris greater than 1 in. in any dimension, which are visible at the surface, shall be removed and the resulting holes filled with topsoil, leaving a uniform planar surface.

B. Finish grade surface with a drag or rake. Round out all breaks in grade, smooth down all lumps and ridges, fill in all holes and crevices. Rolling with a light roller is acceptable, if the surface is scarified afterward.

C. In the event of settlement, the Contractor shall readjust the work to required finished grade.

3.5 SEED APPLICATION

A. Seed shall be broadcast by means of an approved mechanical slice seeder, to give a uniform application at the following rates:

Seed Mix Rate	Application Rate lb./1,000 S.F.
Lawn	8.00
Erosion Control Mix	1.00
Conservation/Wildlife Mix (Low Maint. Areas)	0.75
Pearls Ultra Low Maintenance-Sunny Mix	7.00
Wetland Areas/within 1 foot of permanent pool	1.00
Temporary Seeding	4.00

B. Seed shall be applied in two equal applications for uniform coverage; direction of travel of spreader for second pass shall be perpendicular to that of the first pass. Seeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 mph.

1. At the Contractor's option, and with the permission of the Engineer/Landscape Architect, seed may be spread by the hydroseeding method in areas where slice seeding is not practicable, utilizing power equipment commonly used for that purpose. Seed, lime, fertilizer, and mulch shall be mixed and applied to achieve application quantities specified herein for the conventional seeding method, with mulch applied at the rate of 1,200 lb./acre. Other provisions specified above for conventional seeding shall apply also to hydroseeding.

C. Following seeding the area shall be lightly raked to mingle seed with top 1/8 to 1/4 in. of soil. Area shall then be fine graded. Stones and other debris greater than 1 in. in any dimension which are visible on surface shall be removed. Surface shall be rolled with a hand roller having a weight of 60 to 90 lb./ft. of width, and a minimum diameter of 2 ft.

D. Following seeding and raking, entire area shall be watered by use of lawn sprinklers, or other approved means. Initial watering shall continue until the equivalent of a 2 in. depth of water has been applied to entire seeded surface, at a rate which will not dislodge the seed. Watering shall be repeated thereafter as frequently as required to prevent drying of the surface, until the grass attains an average height of 1 inch. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.

3.6 SODDING

A. Edges of the sodded areas shall be smooth, and all sodded areas shall conform to the design cross sections and grade. At edges adjacent to curbs, paved areas, etc., top surface of earth in sod shall be 1/2 in. below adjacent hard surface.

B. Sod shall be placed and all sodding operations completed within 72 hours following stripping from sod source bed.

C. On slopes steeper than 2 to 1, sod shall be fastened in place with suitable wood pins or other approved methods, spaced at not less than 1 pin per square foot.

D. Surface of completed sodded area shall be smooth. Sod shall be laid edge-to-edge, with tight-butted, staggered joints. Sod shall be carefully placed to insure that it is neither stretched or overlapped. Immediately after laying sod shall be pressed firmly into contact with sod bed by tamping or rolling, to eliminate air pockets. Following compaction, topsoil shall be used to fill all cracks, and excess soil shall be worked into grass with rakes or other suitable equipment. Sod shall not be smothered with excess fill soil.

E. Immediately after sodding operations have been completed, entire surface shall be compacted with a cultipacker roller or other approved equipment weighing 100 to 160 lb./ft. of roller.

F. Completed sod shall immediately be watered sufficiently to uniformly wet the soil to at least 1 in. below the bottom of sod bed.

3.7 MAINTENANCE

A. Except as otherwise specified below, maintenance shall include all operations required to produce an established lawn, including but not limited to: Fertilizing, resodding, mowing, weeding, watering, or reseeding.

B. Maintenance of seeded areas shall begin upon completion of seeding or and shall continue until full turf establishment and acceptance of the lawn or seeded area, until mowing as specified below is completed, or until average height of grass is 1-1/2 in., whichever occurs later.

C. Maintenance of sodded areas shall begin upon completion of sodding and shall continue for 45 days thereafter, unless sodding is not completed until after September 15, in which case maintenance shall continue until the June 15 following.

D. After grass has sprouted, seeded areas, which fail to show a uniform stand of grass shall be replanted as often as necessary to establish an acceptable stand of grass.

1. Scattered bare spots shall not exceed 50 sq. in. each.
2. Multiple bare spots shall not exceed 5 sq. ft. within a 500 sq. ft. area.

E. First mowing shall be done when average height of grass is 3 in., with mower set to cut at a height of 2 in. Subsequent mowings shall be made at not over one week intervals, with the height of cut set at 2 in. With prior permission of the Owner, mowings during periods of slow growth or dormancy may be spaced at greater intervals.

F. If lawn or grass is established in the fall and maintenance is required to continue into spring months, lawn and grass shall receive an application of lime and fertilizer in the spring. Lime and fertilizer shall be spread in a uniform layer over the entire lawn surface, at the rates recommended by a soil test administered at that time.

END OF SECTION

SECTION 32 93 00

TREES, PLANTS AND GROUND COVERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all materials and equipment, and do all work required to complete the planting, as indicated on the Drawings and as specified.

1.2 SECTION INCLUDES

A. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 31 10 00 – Site Clearing. Clearing and grubbing, and stripping of topsoil.
2. Section 31 20 00 – Earth Moving. Establishment of subgrade elevations and excavation and backfill.
3. Section 32 92 00 – Turf and Grasses. Seeding and sodding.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American National Standards Institute, Inc. (ANSI):

Z60.1	American Standard for Nursery Stock (Sponsor: American Association of Nurserymen, Inc.)

2. American Society for Testing and Materials (ASTM):

C 136	Sieve Analysis of Fine and Coarse Aggregates
E 11	Wire-Cloth Sieves for Testing Purposes

3. American Wood Preservers' Association (AWPA):

C2	Lumber, Timbers, Bridge Ties and Mine Ties – Preservative Treatment By Pressure Processes

4. "Hortus Third", A Concise Dictionary of Plants Cultivated in the United States and Canada, Cornell University, L.H. Bailey Hortorium, MacMillian Publishing Co., New York, NY.

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. Samples: The following samples shall be submitted:

Material	Sample Size or Quantity (lb)
Mulch	1
Planting soil	1
Topsoil from on-site sources	1
Topsoil from off-site sources	1
Each plant species	Actual representative sample, or picture with scale; include information on sources

C. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials:

Aluminum sulfate
Antidessicant
Fertilizer
Fungicide
Insecticide
Compost

D. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

Compost
Commercial fertilizer
Limestone

E. Test Reports: Test reports from an approved testing agency indicating compliance with the specifications shall be submitted for topsoil, planting soil mixture, and any other materials designated by the Engineer/Landscape Architect.

1.6 OWNER'S INSPECTION AND TESTING

A. Work will be subject to inspection at all times by the Engineer/Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with requirements of Section 01 45 00, QUALITY CONTROL to analyze and test materials used in the construction of the work. Where directed by the Engineer/Landscape Architect, the testing laboratory will make material analyses and will report to the Engineer/Landscape Architect whether materials conform to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.

2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Engineer/Landscape Architect, shall provide such auxiliary personnel and services needed to accomplish the testing work.

3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

1.7 CONTRACTOR'S INSPECTION AND TESTING

A. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.

B. The Contractor shall engage an independent testing agency, experienced in the testing of agricultural soils and acceptable to the Engineer/Landscape Architect, to perform the following tests and analyses:

Material	Tests and Analysis Required
Topsoil	Mechanical analysis of soil indicating the percent passing by weight of the following sieve sizes: 1 in., 1/2 in., No. 4, No. 10, No. 100, and No. 200. Determination of pH, organic content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring nutrient content and pH to satisfactory levels for planting.
Compost	Determination of moisture absorption capacity, organic matter content, and pH.

1. Materials shall not be used in construction until test results have been reviewed by the Engineer/Landscape Architect.

2. All costs associated with testing shall be at Contractor's expense.

1.8 SOURCE QUALITY CONTROL

A. Identification of plant names shall be as listed in "Hortus Third".

B. Selection of Plant Materials: Submit to the Engineer/Landscape Architect the names and locations of nurseries proposed as sources of acceptable plant material. Inspect all nursery materials to determine that the materials meet the requirements of this section. Proposed materials shall be flagged at the nurseries by the Contractor prior to viewing by the Engineer/Landscape Architect.

1. Schedule with the Engineer/Landscape Architect a time for viewing plant material at the nursery. Trips to nurseries shall be efficiently arranged to allow Engineer/Landscape Architect to maximize his viewing time. A minimum of six weeks shall be allowed for this viewing prior to time that plants are to be dug.

2. Engineer/Landscape Architect may choose to attach his seal to each plant, or representative samples.

3. Where requested by the Engineer/Landscape Architect, photographs of plant material or representative samples of plants shall be submitted.

4. Viewing and/or sealing of plant materials by the Engineer/Landscape Architect at the nursery does not preclude the Engineer/Landscape Architect's right to reject material at the site of planting.

1.9 UNAVAILABILITY OF PLANT MATERIALS

A. No changes or substitutions may be made without prior approval by the Engineer/Landscape Architect, and municipal authority, if applicable. If unavailability of plant material becomes a concern, then submit satisfactory evidence of advertisement for a one month period in a field-related trade journal or online, without success, or submit written substantiation that specific material is unavailable from at least six reliable and approved sources. Provide alternative availability data or substitution recommendations for approval prior to purchase and installation.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Digging Plant Material: Plants shall not be dug at the nursery or approved source until the Contractor is ready to transport them from their original locations to the site of the work or acceptable storage location.

B. Transportation of Plant Material: Plants transported to the project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury to the plants. Closed vehicles shall be adequately ventilated to prevent overheating of the plants.

1. Plants shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the plants are in transit, being handled, or are in temporary storage.

2. The roots of bareroot stock shall be protected from drying out with wet straw or other suitable material while in transit.

3. Unless otherwise authorized by the Engineer/Landscape Architect, notify the Engineer/Landscape Architect at least two working days in advance of the anticipated delivery date of any plant material. A legible copy of the bill of lading, showing the

quantities, kinds, and sizes of materials included for each shipment shall be furnished to the Engineer/Landscape Architect.

C. Storage: Unless specific authorization is obtained from the Engineer/Landscape Architect, plants shall not remain on the site of work longer than three days prior to being planted.

1. Plants that are not planted immediately shall be protected as follows:

   a. Earth balls shall be kept moist and their solidity carefully preserved.

   b. Plants shall not be allowed to dry out or freeze.

2. Bareroot plants may remain on the site of the work only 24 hours before being planted or placed in storage. During this 24-hour period, injury and desiccation of plants on-site shall be prevented.

   a. Roots of plants in storage shall first be puddled in a paste solution of prepared planting soil and then watered.

   b. Plants shall then be protected and kept moist by "heeling-in" the roots or by placing the plant in a cool moist storage building. The "heeling-in" procedure shall require the plants to be separated and the roots heeled in a suitable moist soil. If plants are stored in a building, the roots shall be covered with suitable moist mulch.

3. Both the duration and method of storage of plant materials shall be subject to the approval of the Engineer/Landscape Architect.

D. Handling of Plant Materials: Exercise care in handling plant materials to avoid damage or stress.

1.11 REJECTION OF MATERIALS

A. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.

B. Upon arrival at the temporary storage location or the site of the work, plants shall be inspected for proper shipping procedures. Should the roots be dried out, large branches be broken, balls of earth broken or loosened, or areas of bark be torn, the Engineer/Landscape Architect will reject the injured plant.

C. When a plant has been rejected, remove it from the area of the work and replace it with one of the required size and quality.

1.12 PLANTING SEASON

A. Spring Planting: Spring planting may commence as soon as the ground has thawed at the nursery and at the site of planting, and weather conditions make it practicable to work both at the nursery and at the site. The planting period shall be April 1 to October 15.

B. Regardless of the dates specified above, planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.

C. Planting season may be extended only with the written permission of the Engineer/Landscape Architect.

1.13 ACCEPTANCE

A. The Engineer/Landscape Architect will inspect all work for Substantial Completion upon written notice of completion. The request shall be received at least ten calendar days before the anticipated date of inspection.

B. Acceptance of installed plant material will be given by the Engineer/Landscape Architect for general conformance to specified installation procedures, size, character, and quality, and shall not diminish responsibility for full conformance to the Contract Documents.

C. Upon completion and reinspection of all repairs or renewals necessary in the judgment of the Engineer/Landscape Architect, the Engineer/Landscape Architect will recommend to the Owner that Acceptance of the work of this Section be given.

D. Acceptance in Part:

1. The work may be accepted in parts when it is deemed to be in the Owner's best interest to do so, and when permission is given to the Contractor in writing to complete the work in parts.

2. Acceptance and use of such areas by the Owner shall not waive any other provisions of this Contract.

1.14 MAINTENANCE

A. Plant material shall be maintained as described in Part 3 of this Section until the Acceptance of work.

B. Following Acceptance, maintenance of plant material shall become the Owner's responsibility. Provide instructions and service as follows:

1. Provide Owner with typewritten recommended maintenance program at time of Substantial Completion.

2. Make as many periodic inspections as necessary during the guarantee period, at no additional cost to the Owner, to inspect the condition of all plant materials. Submit written report of each inspection to the Engineer/Landscape Architect outlining corrective measures required to keep the guarantee valid.

1.15 GUARANTEE

A. Plants shall be guaranteed for a period of one year after the date of Acceptance by the Owner and Engineer/Landscape Architect.

1. When the work is accepted in parts, the guarantee periods shall extend from each of the partial acceptances to the terminal date of the last guarantee period. Thus, all guarantee periods terminate at one time.

B. Plants shall be healthy, free of pests and disease, and in flourishing condition at the end of the guarantee period. Plants shall be free of dead and dying branches and branch tips, and shall bear foliage of normal density, size, and color.

C. Replace dead plants and all plants not in a vigorous, thriving condition, as determined by the Engineer/Landscape Architect during and at the end of the guarantee period, without cost to the Owner, as soon as weather conditions permit and within the specified planting period.

1. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this Specification.

2. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.

3. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended guarantee period, the Owner may elect one more replacement or credit for each item.

D. At the end of the guarantee period, and no less than five days prior to final inspection, staking and guying materials shall be removed from the site.

1.16 FINAL INSPECTION AND FINAL ACCEPTANCE

A. At the end of the guarantee period, the Engineer/Landscape Architect will, upon written notice of end of guarantee period inspect the work for Final Acceptance. Request shall be received at least ten calendar days before the anticipated date for Final Inspection.

B. Upon completion and reinspection of full repairs or replacements necessary in the judgment of the Engineer/Landscape Architect at that time, the Engineer/Landscape Architect will recommend to the Owner that Final Acceptance of the Work of this Section be given.

PART 2 - PRODUCTS

2.1 PLANTS

A. Except as otherwise specified, size and grade of plant materials shall conform to ANSI Z60.1. In no case shall ball size be less than 11 in. in diameter for each inch of caliper.

B. Plants shall have outstanding form; symmetrical, heavily branched with an even branch distribution, densely foliated and/or budded, and a strong, straight, distinct leader where this is characteristic of species. Plants shall possess a normal balance between height and spread. The Engineer/Landscape Architect will be the final arbiter of acceptability of plant form.

C. Plants shall be healthy and vigorous, free of disease, insect pests and their eggs, and larvae.

D. Plants shall have a well-developed fibrous root system.

E. Plants shall be free of physical damage such as scrapes, broken or split branches, scars, bark abrasions, sunscalds, fresh limb cuts, disfiguring knots, or other defects. These defects shall not interrupt more than 25% of the circumference of the plant cambium.

F. Plants shall meet the sizes indicated on the Plant List. Plants larger or smaller than specified may be used only if accepted by the Engineer/Landscape Architect.

G. Where a size or caliper range is stated, at least 50% of the material shall be closer in size to the top of the range stated.

H. Plants shall not be pruned before delivery.

I. Plants indicated as "B&B" shall be balled and burlapped.

1. Unless otherwise permitted by the Engineer/Landscape Architect, plants shall be nursery grown.

2 Plants shall be grown for at least two years under climatic conditions similar to those in the locality of the Project.

3. Nursery grown plants shall be freshly dug. No heeled in plants or plants from cold storage will be accepted, unless otherwise permitted by the Engineer/Landscape Architect.

J. Container grown plants shall be well rooted and established in the container in which they are growing. They shall have grown in the container for a sufficient length of time for the root system to hold the planting medium when taken from the container, but not long enough to become root bound. Container grown plants exceeding the sizes indicated in ANSI Z60.1 shall have containers which are not less than 75% of the ball sizes for comparable B&B plant material. Each container plant shall be inspected and root pruned as needed.

1. Canes or Trunk(s) and Branches:

a. Very well formed and sturdy.
b. Branching plentiful and uniformly distributed to form a well-balanced plant.
c. Scars shall be free of rot and not exceed 1/4 the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
d. Pruning scars clean cut leaving little or no protrusion from the trunk or branch.
e. Graft union completely healed.

f. No mechanical or pest damage.
g. No extreme succulence.

2. Foliage:

a. Densely supplied with healthy, vigorous leaves of normal size, shape, color, and texture (except shrubs moved bare-root or deciduous shrubs when dormant).
b. No holes, cavities, or depressed areas caused by broken or dead branches or insufficient foliage.
c. No chlorosis.
d. Pest or mechanical damage barely perceptible with no more than 5% of total foliage affected.
e. No frost or cold damage discernible.

3. Root System:

a. Sturdily established in container.
b. Shall not be excessively rootbound except plants deliberately grown rootbound to produce a dwarf plant.
c. No large roots growing out of container.
d. No noxious weeds in container.

K. Bareroot stock, where specified or approved by Engineer/Landscape Architect, shall meet the standards of ANSI Z60.1 and shall conform to the following:

1. Root System. The root system of bareroot stock shall be sufficient to insure plant growth.

2. Bareroot Trees. Bareroot trees shall have a heavy fibrous root system that has been developed by proper cultural treatment, transplanting, and root pruning. The spread of the root system shall be 12 times greater than the trunk diameter plus an additional 6 in.

3. Bareroot Shrubs. Bareroot shrubs shall have a well-developed fibrous root system, with a minimum spread conforming to the following:

Plant Height, ft.	Minimum Spread of Roots, in.
1.5 to 2	10
2 to 3	11
3 to 4	14
4 to 5	16
5 to 6	18
6 to 8	20

2.2 TOPSOIL

A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent that suitable material is available. Additional topsoil required shall be obtained from off-site sources.

B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

Textural Class	% of Total Weight	Average %
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 mm dia. range)	5 to 25	15

1. 95% of topsoil shall pass a 2.0 mm sieve.

2. Topsoil shall be free of stones 1 in. in longest dimension, earth clods, plant parts, and debris.

3. Organic matter content shall be 4 to 12% of total dry weight.

2.3 COMPOST

A. Compost shall be highly organic dark brown to black containing 6-10% organic matter tested on a dry weight basis with pH between 6.0 – 8.0, free of plants, their roots, debris; other extraneous matter >1 in. diameter and shall be uncontaminated by foreign matter, or substances harmful to plant growth. Do not use soil for planting while in a frozen or muddy condition.

2.4 PLANTING SOIL

A. Planting soil for all plant material except trees shall be a mixture of 2 parts existing soil and 1 part compost or topsoil or 1 part sandy fill if heavy soils.

B. Planting soil shall have pH value range of 5.5 to 7.0.

1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.

2.5 LIMESTONE

A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

Sieve Size	% Passing by Weight
No. 10	100
No. 20	90
No. 100	60

2.6 WATER

A. Water shall be suitable for irrigation and shall be free from ingredients harmful to plant life.

2.7 ALUMINUM SULFATE

A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer and net weight of contents.

2.8 COMMERCIAL FERTILIZER

A. Fertilizer content shall conform to the following:

Constituent	% Present by Weight
Nitrogen (N)	10
Phosphorus (P)	0
Potassium (K)	10

1. 50% of nitrogen shall be derived from natural organic source of ureaform.
2. Fertilizer shall be phosphorus-free.
3. Potassium shall be derived from muriate of potash containing 60% potash.

B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.

C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equal to that specified.

D. Controlled-release fertilizer shall be equal to the following:

Product	Manufacturer
Agriform 20-10-5	Sierra Chemical Co.
Planting Tablets	Milpitas, CA 95035
EZY-Grow Fertilizer Packet	EZY-Grow - Landscape Specialties

Phosphorus-free controlled-release fertilizer is preferred, if available.

E. Slow release fertilizer for seasonal plantings shall be Osmocote slow release 14-14-14 analysis (or preferred phosphorus-free).

2.9 EROSION CONTROL MATERIAL – JUTE MESH

A. Jute Mesh: Jute mat 4 feet in width, made of unbleached, undyed and loosely twisted yarn woven in a grid with approximately ½ inch openings.

B. Anchoring Staples: Cold-drawn 14-gauge or wider in diameter formed in a U-shape from a wire 12 inches or longer.

2.10 SOIL SEPARATION FABRIC

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric 3 oz./sq. yd. minimum.

2.11 MULCH

A. Mulch shall be a 100% fine-shredded pine bark, of uniform size and free from rot, leaves, twigs, debris, stones, or any material harmful to plant growth. Bark shall have been shredded and stockpiled no less than two months and no more than two years before use.

2.12 GUYING AND STAKING MATERIALS

A. Wood Stakes: For trees under 10 ft. in height, straight, sound, rough sawn lumber not less than 2 x 2 in., if square, or 2-1/2 in. diameter, if round. Wire for staking shall be 12-gauge steel or polyethylene ties per the detail.

B. Wire for Guying: Galvanized steel 1 x 19 preformed 3/16 in. diameter.

C. Turnbuckles: Galvanized steel fitted with eyebolts.

D. Deadman: Sound, rough sawn lumber 2 x 4 in., or other material approved by the Engineer/Landscape Architect.

E. Hose: High quality braided rubber hose, 3/4 in. diameter and suitable length, black in color.

2.13 ANTIDESICCANT

A. Antidesiccant shall be an emulsion specifically manufactured for plant protection which provides a protective film over plant surfaces which is permeable enough to permit transpiration. Antidesiccant shall be delivered in manufacturer's sealed containers and shall contain manufacturer's printed instructions for use.

B. Antidesiccant shall be equal to the following:

Product	Manufacturer
Wilt-Pruf	Wilt-Pruf Products, Inc. P.O. Box 469 Essex, CT 06426

2.14 FUNGICIDE

A. General: Chemicals registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as

required for Project conditions and application. Do not use restricted chemicals unless authorized in writing by authorities having jurisdiction.

1. Fungicide shall be zinc ethylene bisdithiocarbonate (Zineb), or equal.

PART 3 - EXECUTION

3.1 EXAMINATION OF SUBGRADE

A. Examine subgrade and rough grading before planting. Alert Engineer/Landscape Architect to unacceptable rough grading or subgrade.

3.2 DRAINAGE OF SOILS

A. Test drainage of five plant beds and pits chosen by the Engineer/Landscape Architect shall be done by filling with water twice in succession. The time at which water is put into the pit or bed for a second filling shall be noted. Engineer/Landscape Architect shall then be notified of the time it takes for pit or bed to drain completely. Planting operations shall not proceed until Engineer/Landscape Architect has reviewed test drainage results.

B. Notify the Engineer/Landscape Architect in writing of all soil or drainage conditions that he considers detrimental to growth of plant material. Submit proposal and cost estimate for correction of the conditions for Engineer/Landscape Architect's approval before starting work.

3.3 LAYOUT OF PLANTING AREAS

A. Individual plant locations and outlines of shrub and ground cover areas to be planted shall be staked by the Contractor in ample time to allow inspection by the Engineer/Landscape Architect.

B. Digging shall not begin until locations are approved by the Engineer/Landscape Architect.

C. Location of trees shall be staked using color-coded stakes. A different stake color shall be used for each tree species.

3.4 PREPARATION OF SUBGRADE

A. Subgrade of planting areas shall be loosened or scarified to a minimum depth of 3 in. prior to spreading planting soil. Subgrade shall be brought to true and uniform grade and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

3.5 PLANT PIT EXCAVATION

A. Planting pits for trees and shrubs shall be excavated to the depth and dimension indicated on the Drawings.

B. Excavation shall not begin until locations are approved by the Engineer/Landscape Architect.

3.6 EROSION CONTROL MATERIAL – JUTE MESH

A. After grassing, jute mesh shall be installed in areas indicated on the Plans on slopes between 2H:1V and 3H:1V, or as directed by the Engineer/Landscape Architect. It may also be installed across areas to be planted on slopes between 3H:1V and 4H:1V.

1. Roll out in the direction of flow.

    a. Anchor the top edge of the mesh in a 6 inch deep trench.
    b. For all overlaps, place the upstream or uphill section on top.

2. Overlap adjacent strips and adjoining ends by at least 6 inches.
3. Apply jute mesh without stretching. Lay it evenly but loosely on the soil surface.
4. To keep the area smooth, do not walk directly on the seedbed before or after applying mesh.
5. Crosses may be cut to install plants, with yarn flattened in place after backfilling.

B. Hold matting strips firmly in place with one row of staples as follows:

1. Staple along each edge, spacing staples no more than 3 ft. apart in each row.
2. At the ends of the covered area and at overlapping joints, space staples no more than 18 inches apart.
3. Ensure that staples remain flush with the ground.

3.7 SOIL SEPARATION FABRIC

A. Filter fabric shall be installed where indicated on the Drawings. Unless otherwise indicated on the Drawings, filter fabric shall be overlapped 6 in. along all edges

B. Soil separation fabric shall be installed in raised planters to separate soil backfill from lower drainage layer or larger aggregates.

3.8 SPREADING OF PLANTING SOIL

A. Planting soil shall be spread and placed to required depths.

B. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

3.9 PLANTING

A. Walls of plant pits shall be dug so that they are vertical and scarified.

B. Plants shall be set as indicated on Drawings. Plants shall have same relationship to finished grade as in the nursery.

C. Plants shall be turned to the desired orientation when required by Engineer/Landscape Architect.

D. Containerized plants shall be removed from container taking care not to damage roots. The side of the root ball shall be scarified to prevent root-bound condition and plant positioned in planting pit.

E. Planting shall be positioned in center of planting pit, set plumb, and rigidly braced in position until all planting soil has been tamped solidly around the ball.

F. Pits for shrubs shall be backfilled with planting soil. Tree pits shall be backfilled with existing soil, no planting soil. Soil shall be worked carefully into voids and pockets, tamping lightly every 6 in.

1. When pit is two-thirds full, plants shall be watered thoroughly, and water left to soak in before proceeding.

2. At this time, ropes or strings on top of ball shall be cut and removed. Burlap or cloth wrapping shall be completely removed once plant is set in pit. Ball wrapping and support wire shall be totally removed from ball and planting pit.

3. Remove nursery plant identification tags.

G. Backfilling and tamping shall then be finished and a saucer formed around plant pits as indicated on the Drawings.

H. Saucer shall be filled with water and water left to soak in. Saucer shall then be filled with water again.

I. Following planting of aquatic plant material, 3 in. layer of gravel shall be spread to stabilize soil beneath.

3.10 BULBS AND HERBACEOUS PERENNIALS

A. Prepare perennial planting beds by application of fertilizers and pH-altering amendments and thoroughly rototilling into the top 12 in. prior to planting bulbs and flowering plants.

3.11 APPLICATION OF FERTILIZER

A. Fertilizer shall be applied when planting pits are backfilled two-thirds full. Fertilizer application shall be of the type, rate, and timing recommended by the testing agency for each plant type.

B. Slow-release fertilizer:

1. Fertilization schedule for trees and shrubs using slow release 4 oz. packet system shall be per manufacturer's recommendations.

2. Fertilizer packets shall be placed 6 to 8 in. deep below top of planting soil around root balls of plants. Packets shall be spaced evenly depending on the number of packets required.

3.12 FUNGICIDE SPRAYING

A. Immediately after planting, all trunks of deciduous trees shall be sprayed with fungicide, applied as directed by chemical manufacturer.

3.13 STAKING AND GUYING

A. Each tree shall be staked or guyed immediately following planting. Plants shall stand plumb after staking or guying.

B. Duckbill Tree Support Systems shall be installed in strict conformance with manufacturer's published installation instructions.

C. Duckbill Root Ball Fixing Systems shall be installed in strict conformance with manufacturer's published installation instructions.

3.14 MULCHING

A. Mulch shall be applied as follows (entire area listed shall be mulched):

Plant Type	Mulch Area	Mulch Depth, in.
Tree	Saucer	3
Shrub	Saucer or Bed	3
Groundcover	Bed	3

3.15 PRUNING

A. Each tree and shrub shall be pruned to preserve the natural character of the plant. Pruning shall be done after delivery of plants and after plants have been inspected and approved by the Engineer/Landscape Architect. Pruning procedures shall be reviewed with Engineer/Landscape Architect before proceeding.

B. Pruning shall be done with clean, sharp tools. Cuts shall be made flush, leaving no stubs. No tree paint shall be used.

C. Dead wood, suckers, and broken and badly bruised branches shall be removed.

3.16 MAINTENANCE OF PLANTING

A. Maintenance shall begin immediately after each plant is planted and shall continue until Final Acceptance. The Contractor shall provide water for irrigation if none is available on site.

B. Maintenance shall consist of pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, resetting

plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings free of insects and disease, and in a healthy growing condition.

C. Planting areas shall be kept free of weeds, grass, and other undesired vegetative growth.

D. Note: Extend maintenance beyond Substantial or Final Acceptance of Project if necessary to meet above requirements. Engineer/Landscape Architect may withhold funds from Substantial and Final Completion payments as necessary to assure proper performance of maintenance operations.

END OF SECTION

SECTION 33 05 00

COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Sleeves.
3. Identification devices.
4. Grout.
5. Piping system common requirements.
6. Equipment installation common requirements.
7. Concrete bases.
8. Supports and anchorages.
9. Utility testing.

1.2 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Storm drain, underdrain, water, sewer, pipe and fittings.
2. Appurtenances including manholes, catch basins, grease traps, cleanouts, pipe manifolds, pipe insulation, flared inlets, rain guards, and manhole bases.
3. Submittals for appurtenances shall show the angle for any pipe entrances as well as the height or elevation of the penetration.

1.4 QUALITY ASSURANCE

A. Testing of Sanitary Sewer System (Gravity Main):

1. Sanitary Sewer Testing: Testing of a section of sewer between manholes shall be performed using the below stated equipment according to stated procedures and under the observation of the Owner's representative. The Contractor shall notify the City of Portland Public Works Department, Division of Stormwater and Sewer (PPW) at least 72 hours in

advance of the date and time of the testing in order for PPW to have an opportunity to have a representative on site during the tests.

a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

c. All air used shall pass through a single control panel.

d. Three (3) individual hoses shall be used for the following connections:

1) From control panel to pneumatic plugs for inflation.
2) From control panel to sealed line for introducing the low pressure air.
3) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

2. Procedures: All pneumatic plugs shall be seal tested before being used in the actual test installation. One (1) length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against the pressure without bracing and without movement of the plugs out of the pipe.

a. After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

Diameter (inches)	**Minimum Allowable Pipe Minutes to Decrease from 3.5 - 2.5 psig Pressure In**
4	2.0
6	3.0
8	4.0
10	5.0
12	6.0
15	7.5
18	9.0
21	10.5

3. In areas where ground water is known to exist, the Contractor shall install a one-half (1/2) inch diameter capped pipe nipple, approximately ten (10) inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple.

   The hose shall be held vertically, and a measurement of the height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same.)

4. If installation fails to meet the above requirements for the air test, the Contractor shall locate and repair the pipeline until an acceptable test is achieved.

5. The Contractor shall provide as required the proper plugs, weirs, and other equipment required to perform all tests. Testing of each section of sewer installed shall include the portions of service connections that are to be installed under the Contract.

6. Where ground water is confirmed to be high, the Engineer at his option may elect to accept infiltration measurements in lieu of air testing.

7. These tests shall be conducted at all times in the presence of the Owner's representatives. Should a line which has previously been tested indicate any water infiltration, or otherwise appear suspect to the representatives, the Contractor shall conduct confirmation air tests on the line at no additional costs.

1.5 DEFLECTION TESTING

A. Deflection tests shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days.

B. No pipe shall exceed a deflection of 5 percent.

C. If the deflection test is to be run using a right ball or mandrel, it shall have a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.

1.6 MANHOLE AND APPURTENANCE TESTING

A. All sanitary manholes, wet wells, septic tanks, holding tanks, and other appurtenant structures shall be tested as to water tightness. If the initial test fails, a retest shall be required. The Contractor has the option of either of the following methods:

1. Water Test: The inlet and outlet of the structure shall be plugged by watertight plugs furnished by the Contractor, and the manhole shall be filled with water. The water shall remain for sufficient time for the absorption into the concrete pipe to have been substantially completed. The amount of water loss from the manhole shall then be determined. The rate

shall not exceed five (5) gallons per hour. Obvious leaks shall be repaired by the Contractor by excavating outside the structure, if required, at no cost to the Owner.

2. Vacuum: The manholes shall be vacuum tested by a method and apparatus subject to the prior approval of the Engineer. Vacuum testing shall be performed in the following manner:

   The manhole shall be fully assembled, including all pipe connections into the structure. The manhole shall be in its final location and shall not have been backfilled prior to the performance of the test.

   All lift holes shall be plugged with a non-shrinking mortar, as approved by the Engineer.

   The seal between the manhole sections shall be in accordance with ASTM C923.

   The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe.

   With the vacuum tester set in place:

   - Inflate the compression band to effect a seal between the vacuum base and the structure.

   - Connect the vacuum pump to the outlet port with the valve open.

   - Draw a vacuum to 10" of Hg. and close the valve.

   - The test shall pass if the vacuum remains at 10" Hg. or drops to 9" Hg. in a time greater than one minute. If the manhole fails the initial test, the Contractor shall locate the leak and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material.

   Any appurtenant structure which shows obvious infiltration, whether tested or not, shall be sealed to eliminate said infiltration.

1.7 WATER MAIN TESTING:

A. Test water distribution system installed below grade and into the building to the base of the riser in accordance with following procedures:

1. The Contractor shall notify Portland Water District (PWD) at least 72 hours in advance of any testing on new water mains, in order for PWD to have an opportunity to have a representative on site during the tests.

2. Before pressure testing the water main, air shall be completely expelled from the pipe. If permanent air valves are not located at all high points, corporation stops shall be installed at all high points so that the air can be expelled as the pipe is being filled. After completion of the test, the corporation stops shall either be removed or left in place at the discretion of the Owner.

3. 2. If fire hydrants are installed on the new water main, the test shall be conducted against a closed hydrant valve.

4. The test pressure shall be 1.5 times the static pressure at the lowest point of elevation of the line and shall not be less than 150 p.s.i.

5. The test shall not exceed the pipe or thrust restraint design pressures, nor exceed twice the rated pressure of the valves or hydrants and shall not exceed the rated pressure of the valves, if resilient – sealed butterfly valves are used.

6. Water, only, shall be used to bring the main to the required test pressure. The type of pump shall be approved by the Mechanical Engineer.

7. The test shall be of at least two hours in duration. A leakage test shall be conducted immediately after the pressure test.

8. After the pressure test period, water shall be pumped into the main to bring the pressure back up to the initial test pressure. No pipe installation shall be accepted if the leakage is greater than that listed in Table 1 attached to this Section.

   If any pipe installation shows a leakage greater than that specified in Table 1, the contractor at his own expense shall locate and repair the leak until it is within the specified allowance.

9. The pressure and leakage tests shall be witnessed by the Owner's representative.

10. New hydrants shall be flowed with the static and residual pressures measured in accordance with NFPA 291.

B. Utility Grade/Alignment Check of the Design Alignment. Survey checks, mirrors, or lasers may be employed to verify conformance with these standards.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.

2. CPVC Piping: ASTM F 493.

3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

4. PVC to ABS Piping Transition: ASTM D 3138.

E. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 SLEEVES

A. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.3 IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

2. Location: Accessible and visible.

B. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.

1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.

2. Color: Comply with ASME A13.1, unless otherwise indicated.

C. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.

1. Material: Valve manufacturer's standard solid plastic.

2. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.

3. Shape: As indicated for each piping system.

D. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

E. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.

2. Thickness: 1/8 inch (3 mm), unless otherwise indicated.

3. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.

4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

F. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.

2. Yellow: Heating equipment and components.

3. Brown: Energy reclamation equipment and components.

4. Blue: Equipment and components that do not meet criteria above.

5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.

6. Terminology: Match schedules as closely as possible. Include the following:

a. Name and plan number.

b. Equipment service.

c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

2.4 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. PVC Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.

3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.

6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

K. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.

2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

L. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Install dielectric fittings at connections of dissimilar metal pipes.

3.4 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.5 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.

2. Locate pipe markers on exposed piping according to the following:

   a. Near each valve and control device.
   b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
   c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
   d. At manholes and similar access points that permit view of concealed piping.
   e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.

2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in "Cast-in-Place Concrete" Section of the specifications.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.8 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

Table 1

Allowable Leakage for Mechanical-Joint or Push-On Joint Pipe in 18-ft. Nominal Lengths*

Avg. Test Pressure (psi)	Pipe Size - inches															
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
Allowable Leakage per 1,000 ft-gph																
250	0.48	0.71	0.95	1.42	1.90	2.38	2.85	3.33	3.80	4.28	4.75	5.70	7.13	8.55	9.98	11.40
225	0.45	0.68	0.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50	5.40	6.76	8.11	9.46	10.81
200	0.42	0.64	0.85	1.27	1.70	2.12	2.55	2.97	3.40	3.82	4.25	5.10	6.37	7.61	8.92	10.19
175	0.40	0.60	0.79	1.19	1.59	1.99	2.38	2.78	3.18	3.58	3.97	4.77	5.96	7.15	8.34	9.54
150	0.37	0.55	0.74	1.10	1.47	1.84	2.20	2.58	2.94	3.31	3.68	4.41	5.52	6.62	7.72	8.83
140	0.36	0.53	0.71	1.07	1.42	1.78	2.13	2.49	2.84	3.20	3.55	4.26	5.33	6.40	7.46	8.53
130	0.35	0.51	0.69	1.03	1.37	1.71	2.06	2.40	2.74	3.08	3.42	4.11	5.14	6.16	7.19	8.22
120	0.33	0.49	0.66	0.99	1.32	1.64	1.98	2.30	2.63	2.96	3.29	3.95	4.93	5.92	6.91	7.89
110	0.31	0.47	0.63	0.94	1.26	1.58	1.89	2.21	2.52	2.83	3.15	3.78	4.72	5.67	6.61	7.56
100	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.40	6.31	7.21
90	0.28	0.43	0.57	0.86	1.14	1.42	1.71	1.99	2.28	2.56	2.85	3.42	4.27	5.13	5.98	6.84
80	0.27	0.40	0.54	0.80	1.08	1.34	1.61	1.88	2.15	2.42	2.69	3.22	4.03	4.84	5.64	6.45
70	0.25	0.38	0.50	0.75	1.00	1.26	1.51	1.76	2.01	2.26	2.51	3.01	3.77	4.52	5.28	6.03
60	0.23	0.35	0.46	0.70	0.93	1.16	1.39	1.63	1.86	2.09	2.32	2.79	3.49	4.19	4.89	5.58
50	0.21	0.32	0.42	0.64	0.85	1.06	1.28	1.49	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.10
40	0.19	0.28	0.38	0.57	0.76	0.95	1.14	1.33	1.52	1.71	1.90	2.28	2.85	3.42	3.99	4.56

*The allowable leakage for a pipeline is calculated by multiplying the leakage per hour per 1,000 feet at the average test pressure and for the diameter of pipe tested as obtained from the above table by the duration of the test in hours and the total length of the line being tested divided by 1,000. If the line under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, services, equipment, and other necessary items required for accompanying the construction of the water systems. This shall include, but not be limited to the following: pipe and fittings for onsite and offsite water line including domestic water line and fire water line, valves, set lines, elevations, and grades for water distribution systems. **Also, supply all tapping sleeves, tees and valves for connection to the existing water main.** Provide rigid insulation where cover is designated to be less than 4 ’-0”.

B. Related Sections:

1. Section 32 11 00 – Base Courses.
2. Section 31 20 00 – Earth Moving.
3. Local Governing Authority and Code Requirements.
4. All Necessary Construction Permits.

C. The public water supply is owned and operated by the Portland Water District. All materials, installation, and workmanship shall comply with the requirements of the local water department, the Public Utilities Commission, the Maine State Plumbing Code and these specifications. Where a more stringent standard exists, the more stringent standard shall apply.

1.2 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, hydrants, valves and accessories including ASTM designations, AWWA certifications and UL labels as required.

B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

1.3 QUALITY ASSURANCE

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 Kg) Rammer and 18-in. (457 mm) Drop.

C. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe Fittings for Water.

D. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquid.

E. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

F. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

G. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.

H. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.

I. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

J. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.

K. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.

L. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

M. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

N. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

O. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

P. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, ½ inch through 3 inch, for water.

Q. UL 246 - Hydrants for Fire - Protection Service.

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, and invert elevations. Record a minimum of two (2) lateral measurement “swing ties”, as close to 90 degrees opposed as practical, prior to backfilling pipeline from permanent fixtures such as building corners, telephone poles, fire hydrants, catch basins, manholes etc. to all valves, fittings, couplings, tees etc. for purposes of future location. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. These ties must be legibly recorded in sketch form and submitted to the Owner prior to final project acceptance. Record the same information with coordinates on the Maine State coordinate grid system for the record drawings.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with utility company and/or municipality requirements.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

PART 2 - PRODUCTS

2.1 PIPE

A. Pipe: Sizes less than 3" that are installed below grade and outside building shall comply with the following:

1. Seamless Copper Tubing: Type "K" roll form to comply with ASTM B88-62. Fittings shall be brass compression manufactured by Ford, Mueller, or McDonald.

B. Pipe: Sizes 4" and larger shall comply with the following:

1. Ductile Iron Water Pipe: In accordance with ANSI A21.51. (AWWA C151) ductile iron pipe shall be cement mortar lined in accordance with AWWA C104. Joints shall meet requirements of AWWA C111. Push-on joint pipe to be supplied with gaskets and gasket lubricants. Pipe shall be 62-42-10 strength; 60,000 psi minimum tensile strength; 42,000 psi minimum yield strength; 12 but not including 16 inch shall have a Class 52 wall thickness. Size 16" and over shall have Class 51 wall thickness. The bituminous coating used for the sealing of the cement mortar lining shall be of a quality that will not have a deleterious effect on the quality, color, taste or odor of potable water.

C. Ductile Iron Fittings: Fittings shall be North American manufactured by and material shall be ASTM A536-72 mini grade 70-50-05, in accordance with AWWA C110. Fittings shall be cement lined (AWWA C104-74). Interior seal coated (AWWA C104-74) and exterior bituminous coated. Mechanical joint with accessories furnished; D.I. glands, gaskets, Cor-Ten T-bolts and nuts; Class 350 pressure rating in accordance with AWWA C110. Thickness shall be equal to ductile iron pipe Class 53 in accordance with AWWA C151. All plain end fittings shall be beveled-edged (60o) to fit slip-joint fitting and shall be long body design.

D. Retainer Glands: Glands shall be heavy duty ductile iron body as manufactured be Romac or Ebba Iron and shall have a minimum working pressure rating as follows:

1. 4" – 350 psi (pounds per square inch)
   6" – 350 psi
   8" – 350 psi
   12" – 350 psi

Set screws shall be:

1. cupped syle ends;
2. composed of Cor-Ten Steel or Ductile Iron

The number of set screws shall be equal to or greater than the number of inches of nomial diameter of the gland (i.e. 4" – 4 set screws; 6" – 6 set screws, etc).

Gland shall meet AWWA specifications.

E. Bolts and Nuts: General description of properties required.

1. Stainless Steel: Type 316 - contains the addition of molybdenum to the nickel-chromium steels.

   Specific Chemical Composition:

   a) Carbon - 0.08% max.
   b) Manganese - 2.00% max.
   c) Silicone - 1.00% max.
   d) Phosphorus - 0.04% max.
   e) Sulphur - 0.03% max.
   f) Chromium - 16-18.00%
   g) Nickel - 10-14.00%
   h) Molybdenum - 2-3.00%
   i) SAE No. - 30316
   j) ASM No. - 5361A, 5524A, 5573, 5648B, 5690D

2. Cor-Ten Steel: Trade name for cold formed T-head bolts containing alloying elements such as copper, nickel, and chrome.

   Specific Chemical Composition:

   a) Carbon - 0.2% max.
   b) Manganese - 1.25% max.
   c) Sulphur - 0.05% max.
   d) Nickel - 0.25% min.
   e) Copper - 0.20% min.
   f) Combined (Ni,Cu,Cr) - 1.25% min.

F. Resilient Sealed Gate Valve: Valve shall meet all provisions of ANSI/AWWA C509-87 specification as latest revised; shall have a smooth unobstructed water way which shall be a minimum of the nominal diameter of the valve. Valve ends to be specified and shall be furnished with Cor-Ten (or equal) bolts and nuts. Valves shall be manufactured by Mueller, American Flow Control or U.S. Pipe and shall open right.

G. Valve Boxes: The valve box bottom section shall be slide-type with bell-type base. The valve box top section shall be slide-type. It shall have a top flange, but shall not have a "bead" or bottom flange. The valve box cover shall be a 2" drop-type cover to fit the 7-1/4" opening of the top section. The valve box extension shall be slide-type with a minimum 3" belled bottom. Material shall be cast iron or ductile free from defects. Interior and exterior of all components shall be bituminous coated with a minimum of 4 mils dry film thickness.

H. Service Box and Rod:

1. Service Box Specification:

Shall be North American and 1.0" (in.) I.D. steel size (SCHEDULE 40) black iron with top having N.P.I. threads for 1.0" screw-on cover.

Shall be Erie style with 4-6’ / 5-6' (ft.) slide-type riser.

2. Service Box Cover Specifications:

Shall be North American, Quincy type (heavy-duty) cover that screws on (1.1 above).

Shall be tapped with a 1" rope thread with a solid brass plug with pentagon operating head.

3. Service Box Foot Piece Specifications

The standard foot piece shall be North American, heavy-duty (Ford style or equal) cast iron design.

The large, heavy-duty foot piece shall have an arch that will fit over 2" ball-valve curb-stops.

4. Service Rod Specifications

Shall be 24"-30" in length and have a self-aligning design.

Shall be of circular dimension and constructed of:

a) 1/2" diameter minimum #304 stainless steel.

Shall have a yoke design that is an integral part of the rod.

The curb-stop attachment point shall be a brass cotter pin.

The rod "wrench-flat" shall have a minimum thickness of 1/4" tapered to 1/16" and width of 5/8" or 1/2".

I. Tapping sleeves shall be as approved by Portland Water District. Options include the following:

The tapping sleeve shall be; 304 Stainless Steel Tapping Sleeves with ductile iron flange. Flange bolts shall be stainless steel or silicon bronze. The sleeve shall be rated for a maximum, working pressure of 200 psi. The interior and exterior shall be bituminous coated with a minimum of 4 millimeters dry film thickness. The sleeve shall be provided with a 3/4" F.I.P.T. test port and plug.

J. Corporation Stop:

1. 1" shall be a ball valve design with a brass ball that is Teflon (or equal) coated. 1-1/2" - 2" shall be ball corporation design with an on-off identification mark on the operating nut.

2. The valve shall be supported by 2 seats for water, tight shut-off in either direction.

3. The valve shall have a full port opening.

4. The body of the corporation-stop shall be of heavy-duty design.

K. Specifications for Services:

1. Material:

   Copper Tubing: ASTM B88, Type K, Seamless, Annealed, 2 Inch Diameter Maximum.

2. Fittings:

   Brass compression manufactured by Ford, Mueller or McDonald.

L. Curb Stops:

1. For sizes 1”-2”, the valve shall be a brass ball that is Teflon (or equal) coated.

2. The bass shall be supported by seats, which are water tight in either direction.

3. The valve shall have a full-port opening.

4. The valve shall open with ¼ turn (90°) with a check or stop.

5. The valve shall NOT have a drain.

6. The valve stem shall have 2 “o” rings and a bronze ring lock, which holds the stem solidly in the valve body.

7. The valve body shall be a heavy-duty design.

M. Hydrant: Hydrants shall be either American Flow Control’s B-62-B, Mueller Centurion or U.S. Pipe’s Metropolitan 250 all with stainless steel nuts and bolts below grade. The hydrant shall have an epoxy-coated base, and open right. The nozzles shall have National Standard Threads. Operating nut shall be 1-15/16".

All material used in the production of fire hydrants for ordinary service shall conform to the specifications designated for each material listed in AWWA Standard C502.

N. Joint Restraint: Place thrust blocking consisting of 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 lbs./sq. ft. when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft.	90 Deg.Bend Sq. Ft.	45 Deg.Bend Sq. Ft.	22 Deg.Bend Sq. Ft.
4"	1.0	1.0	1.0	1.0
6"	1.5	2.0	1.0	1.0
8"	2.5	3.5	1.8	1.0
10"	4.0	5.5	2.8	1.5
12"	6.0	8.0	4.0	2.0
14"	8.0	11.0	5.5	3.0
16"	10.0	14.2	7.0	4.0

O. Rigid Insulation: Installation, when required by the Drawings, shall be 2" Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.

Materials submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05 meet Federal Specifications HH1524B Type II, Class B.

P. Temporary Water Service: Provide temporary water service as necessary during the site work and building construction. Utilize materials as approved by Portland Water District.

PART 3 - EXECUTION

3.1 WATER DISTRIBUTION SYSTEM

A. Building Service Lines: Install water service lines to point of connection within approximately five feet outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed provide temporary caps. Connections of service lines to distribution mains shall be constructed in accordance with the following requirements.

1. 2 Inch and Larger: Connect by rigid connections and provide gate valve below frost line.

B. Regrading: Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

C. Pipe Laying, General

1. Install to same tolerances as specified for storm drain (Section 33 41 00).

2. Do not lay pipe on unstable material, in wet trench, or, when trench or weather conditions are unsuitable.

3. Support pipe laid in fill area at each joint, by brick or concrete piers carried down to solid undisturbed earth.

4. Do not lay pipe in same trench with other pipes or utilities.

5. Hold pipe securely in place while joint is being made.

6. At least one foot shall separate water lines vertically from other pipes or underground structures.

7. Where water pipes cross sanitary sewers or are laid parallel and adjacent to them, bottom of water pipe shall be separated by not less than one foot above top of sewer and ten feet horizontally.

8. Do not work over, walk on, pipes in trenches until covered by layers of earth well tamped in place to a depth of 12 inches over pipe.

9. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.

10. Install water lines to avoid storm and sanitary sewer lines.

11. Clean interior or pipe thoroughly of all foreign matter before installation. Keep pipes clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.

12. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. Pipe clamps and tie rods, or concrete thrust blocks may be used. Type of pipe and soil conditions determine methods. Anchor water mains as specified in NFPA No. 24.

13. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work thoroughly clean exposed materials and equipment.

D. Laying Ductile Iron Pipe

1. Installing Pipe: Lay pipe in accordance with AWWA C600.

2. Joints:

a. Mechanical: AWWA C111. Provide sufficient quantities of bolts, nuts, glands and gaskets for each socket opening on pipe and fittings.

b. Push-On: Apply thin film of lubricant to gasket and place in proper position in contour of bell. Insert beveled end of joining pipe and make contact with

gasket. Force beveled end of pipe to bottom of bell without displacing gasket. Do not caulk. Only lubricant furnished by manufacturer of pipe shall be used.

c. Flanges: AWWA C115. Install only in concrete pits. Must be watertight and set not less than six inches from walls to floor.

E. Setting of Valves:

1. Install gate valves as indicated on the Drawings and support on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body.

2. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.

3. Clean valves and curb stops interior before installation.

F. Setting of Fire Hydrants

1. Install fire hydrant assemblies as indicated on Drawings in vertical and plumb position with steamer nozzle pointed toward building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil or concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.

2. Clean interior of hydrants of all foreign matter before installation.

3. Set center of each hydrant not less than two (2) feet nor more than six (6) feet back of edge of road or face of curb. Set barrel flange not more than two (2) inches above finished grade and eighteen (18) inches between center of steamer nozzle and finished grade.

G. Pipe Sleeves: Install where water lines pass through retaining and foundation walls. Properly secure in place, with approximately 1/4-inch space between pipe and enclosing sleeve, before concrete is poured. Caulk annular opening between pipe and sleeves, and seal with asphaltic compound consisting of bituminous materials mixed with mineral matter. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

H. Meter: The Contractor will obtain the meter from the Portland Water District and install the domestic water meter for the installation and will pay all usage charges connected with water supply until the installation is accepted by the Owner.

3.2 DISINFECTION

A. Disinfect distribution system with chlorine before acceptance for domestic operation in accordance with the following procedures:

1. The only acceptable method of disinfection shall be the continuous Feed Method of chlorine.

2. The rates of introduction of the chlorine and water shall be so proportioned so that the chlorine concentration in the water is maintained at a minimum of 50 mg/l available chlorine.

3. During the application of the chlorine, valves shall be operated in such a manner that the treatment dosage shall not flow back into the line supplying the water. The operation of the valves shall be done under Water Department supervision.

4. The chlorinated water shall be retained in the main for at least 24 hours. At the end of the 24 hour period, the treated water shall contain no less than 25 mg/l available chlorine.

5. At the end of the retention period, the chlorinated water shall be flushed from the main until the chlorine in the water leaving the main is no higher than the normal residual in the system, or less than 1 mg/1.

6. All bacteriological tests shall be collected in sample bottles and shall be tested at a State certified laboratory. All costs for disinfection of the main as well as bacteriological costs shall be borne by the Contractor.

3.3 TESTING OF WATER DISTRIBUTION SYSTEM

A. Test water distribution system pipe sizes installed below grade and outside building in accordance with following procedures:

1. Before pressure testing the water main, air shall be completely expelled from the pipe. If permanent air valves are not located at all high points, corporation stops shall be installed at all high points so that the air can be expelled as the pipe is being filled. After completion of the test, the corporation stops shall either be removed or left in place at the discretion of the Water District.

2. If fire hydrants are installed on the new water main, the test shall be conducted against a closed hydrant valve.

3. The test pressure shall be 1.5 times the static pressure at the lowest point of elevation of the line and shall not be less than 150 p.s.i.

4. The test shall not exceed the pipe or thrust restraint design pressures, nor exceed twice the rated pressure of the valves or hydrants and shall not exceed the rated pressure of the valves, if resilient - sealed butterfly valves are used.

5. Water, only, shall be used to bring the main to the required test pressure. The type of pump shall be approved by the Portland Water District.

6. The test shall be of at least two hours in duration. A leakage test shall be conducted immediately after the pressure test.

7. After the pressure test period, water shall be pumped into the main to bring the pressure back up to the initial test pressure. No pipe installation shall be accepted if the leakage is greater than that listed in Table 1 attached to this Section.

   If any pipe installation shows a leakage greater than that specified in Table 1, the contractor at his own expense shall locate and repair the leak until it is within the specified allowance.

   The pressure and leakage tests shall be conducted under Portland Water District's supervision.

END OF SECTION

SECTION 33 39 00

APPURTENANCES FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage and accessories.
2. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage and accessories.
3. Masonry manholes sections with masonry transition to lid frame, covers, anchorage and accessories.
4. Precast septic tank, holding tank, grease traps, and SEWER SYSTEM accessories when required on the contract drawings.

B. Related Sections:

1. Section 33 05 00 – Common Work Results for Utilities
2. Section 33 31 00 – Sanitary Utility Sewerage Piping
3. Local Governing Authority and Code Requirements
4. Construction Drawings

1.2 REFERENCES

A. ANSI/ASTM C55 - Concrete Building Brick.

B. ASTM A48 - Gray Iron Castings

C. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

E. ASTM C1227-13 – Standard Specification for Precast Concrete Septic Tanks

F. ASTM D1248 - Precast Polyethylene Manholes.

G. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.3 SUBMITTALS

A. Shop Drawings: For all precast structures indicate manhole locations, rim elevation, piping, sizes and elevations of proposed penetrations. For all other precast appurtenances, provide dimensional data, ASTM compliance certificates, and load capacity where applicable.

B. Product Data: Provide manhole covers, component construction, features, configuration and dimensions. Each precast structure shall have a diagram showing the dimensions and location of all openings or penetrations.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE ITEMS

A. Precast Manhole and Sections: Manhole and super-structures shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Sections shall be installed with a flexible plastic gasket equal to or better than "Ram-Nek" as manufactured by K. T. Snyder Co., Houston, Texas, or sections may be fabricated to accept Tylox "0" rubber gaskets as manufactured by Hamilton Kent Manufacturing Co., Kent, Ohio. The casting and the outside of the brick work required to bring the rim to grade shall be plastered with at least 3/8" mortar, thoroughly troweled to leave a smooth waterproof vertical exterior surface.

Manhole steps shall be forged aluminum safety type, alloy 6061, temper T6, or reinforced polypropylene plastic. Steps shall be cast or anchored into walls of precast sections to form a ladder with a distance of 12 inches between steps.

The Contractor shall furnish the name of the manufacturer to the Engineer prior to commencing work.

B. Precast Manhole Bases: Manhole bases shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Bases shall be placed on a well compacted layer of crushed stone.

Jointing system for pipe entering or leaving manholes shall be a flexible manhole sleeve cast in the base. A stainless steel pipe clamp shall be used to fix the pipe into the sleeve. All materials shall meet or exceed rubber quality standards of ASTM C-443 and C-361.

For manhole bases, a minimum of 4 inches shall be allowed between pipe invert and inside bottom of base for construction of brick inverts.

Where precast bases are used for drop manholes, a 6 inch concrete slab is to be placed under the base section large enough to receive the concrete encased drop pipes. Provide suitable ties between manhole sections and drop pipe encasements.

Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.

C. Precast Tanks, Vaults and Appurtenances: Precast tanks, vaults, and appurtenances shall be constructed of precast reinforced concrete with inside dimensions conforming to those indicated on the contract drawings and conforming to ASTM C478. The tank may be a monolithic section or constructed with tongue and grooves with approved watertight sealants such as "o" rings. All penetrations through the tank shall use either cast in place wall sleeves with Link Seals or a flexible boot secured in the casting such as Kor N Seal. Any clamps or metallic connections shall be stainless steel.

The tanks, vaults, and appurtenances shall include shop drawings and submittals with supporting computations which demonstrate the tank can support an H20 loading, an equivalent external fluid pressure of 105 lb./cubic ft. (with the tank empty), and an internal fluid pressure of 65 lb./cubic ft. The pressures shall be assumed to apply from the base of the structure to the finish grade surface.

Tanks which require attachment to an anti-flotation slab shall use stainless steel angles and anchors sized to resist the uplift force.

The tanks shall be coated with a waterproof seal on the interior and exterior. Sections shall be fabricated to receive a watertight seal.

2.2 CASTINGS

A. The Contractor shall furnish all cast iron frames, grates, and covers conforming to the details shown on the Drawings, or as hereinbefore specified.

B. Castings shall be at least Class 25 conforming to the ASTM Standard Specifications for Gray Iron Castings, Designation A-48-64 except for the 12” NDS risers and 12” inlets.

C. Sanitary sewer covers shall have the name "Sewer" cast therein.

D. The manhole castings shall be a non-perforated manhole frame and cover, 24” clear opening as manufactured by the East Jordan Works Foundry or approved equal.

2.3 MORTAR

A. Mortar used to adjust rims and covers for manholes shall consist of the following materials and proportions by volume: 1 part of Portland cement; 1/4 part lime hydrate; and 3 parts sand.

B. For precast reinforced concrete manholes, mortar for invert construction shall consist of the following materials and proportions by volume: 1 part Portland cement and 2 parts sand. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5-1/2 gallons of water per sack of cement.

2.4 BRICK

A. Brick for manholes and catch basins shall meet Standard Specifications for Sewer Brick, AASHTO Designation M-91-42, Grade SA, Size No. 1 wire cut. Any brick rejected by the Engineer as unsuitable shall be immediately removed from the work.

2.5 SITE CONCRETE

A. Site concrete shall meet the requirements set forth below:

1. Aggregate: The aggregate shall conform to the Standard Specifications for Concrete Aggregates, ASTM Designation C-33, as revised.

   (a) Sand shall be a medium sand with a fineness modules of 2.60 - 2.90.
   (b) Coarse aggregate shall not exceed 1-1/2 inches for mass concrete.

2. Cement: All cement shall be a Portland Cement conforming to the requirements of Standard Specifications of the American Society for Testing Materials, Designation C-150, as revised, Type II. An air entraining agent, approved by the Engineer, shall be used.

3. Proportioning Concrete:

Maximum Size Coarse Aggregate (Inches)	Air Content Percent by Volume
1-1/2, 2, or 2-1/2	5 +/- 1
3/4 or 1	6 +/- 1

The strength of the concrete shall be fixed in terms of water-cement ratio in accordance with trial batches of the materials to be used. All concrete placed under this Specification shall be mixed in the ratio not to exceed six (6) U.S. gallons of water per sack of cement, including surface water carried by the aggregate in each case. The Contractor shall determine the approximate amount of surface water contained in the aggregate, and make proper allowance. Concrete shall have a minimum 28 day strength of 4000 psi. The Contractor shall submit the proposed mix proportions to the Engineer for approval ten (10) days prior to placing concrete. Copies of recent test results for the proposed mix design shall also be submitted.

2.6 REINFORCEMENT

A. The Contractor shall submit detailed shop drawings for concrete reinforcement in accordance with ACI 318 and ACI 315. The steel shall be deformed Grade 60 bars which conform to ASTM 615, ASTM 616, or ASTM 617. Supports, spaces, and chairs shall permit the steel to be supported in accordance with ACI 318.

2.7 TREATMENT OF INTERIOR SURFACES

A. All interior surface of cast in place concrete structures shall have a liquid hardener applied. The application shall consist of two coats of VANDEX or approved equal installed in accordance with manufacturer's instructions including requirements for surface preparation. Catalog cuts of the hardener shall be submitted to the Engineer for approval. All interiors of concrete items shall be treated with a waterproof coating (18 mil. Film thickness).

2.8 TREATMENT OF EXPOSED SURFACES

A. All exposed exterior concrete surfaces shall have a "rub finish". Structures and appurtenances shall have an applied coating of Tnemec Series 104 H5 Epoxy applied in 2 coats or approved equal to achieve a minimum dry film thickness of 18 mils. All light pole bases shall have an epoxy finish colored to match the pole color. One coat shall be applied in the factory, a second coat shall be applied in the field.

2.9 TREATMENT OF ALL OTHER EXTERIOR SURFACES

A. All buried surfaces shall be double coated with a concrete hardener to achieve a minimum dry film thickness of 18 mils.

2.10 RAIN GUARD MANHOLE INSET

A. A self sealing removable insert shall be provided and installed in the frame of each manhole casting. The purpose of this device is to collect and store illicit water that may enter the manhole casting. The units shall be “RAINGUARD™” or approved equal.

PART 3 - EXECUTION

3.1 MANHOLES

A. General: All appurtenant structures shall be set level on compacted material as shown on the Plans.

B. Manhole Channels: Channels shall be constructed in all sanitary sewer manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the Engineer or a channel of reinforced concrete cast with the manhole base. The sides shall be raised by brick masonry construction from the spring line perpendicular to the height of the crown of the pipe. Where changes in directions are made at manholes, the invert shall be shaped with as great a radius as possible, and to the complete satisfaction of the Engineer. Brick shall be carefully laid to present a smooth surface as indicated on the Plans and to the satisfaction of the Engineer.

C. Pipe Connections:

1. Stubs in Manholes: Stubs placed as specified and indicated on the Drawings shall be short pieces cut from the bell ends of appropriate pipe and shall have compatible watertight stoppers. Stubs shall be set accurately to the required line and elevation and encased in the structure masonry as indicated on the Drawings:

2. Wall Sleeves and Castings: Wall sleeves and castings as specified and indicated on the Drawings shall be accurately cast to the required location and elevations as indicated on the Drawings.

D. Steps: Manhole and appurtenant steps shall be cast in the wall and installed in a straight vertical alignment.

E. Infiltration Seal: Install rain guard or approved equal manhole inserts.

3.2 ALTERATIONS TO EXISTING MANHOLES

A. Existing manholes to be altered shall be reconstructed as indicated on the Plans or as directed by the Engineer. Adjusting to grade or connecting to an existing pipe stub is not considered an alteration.

B. Alterations covered include, but are not limited to, adjustments to manhole invert channel caused by new pipe connections or removal of existing pipe connections, and removal and plugging of existing catch basin lead and replacing with a new lead connection conforming to the appropriate section of the Specifications contained herein.

3.3 ADJUSTING EXISTING MANHOLES

A. Existing manholes to be adjusted to grade shall be reconstructed to the required grade. The existing frames, grates, and covers shall be re-used unless otherwise directed.

B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.

C. Adjustment will take place just prior to placing of surface pavement for adjustments of the frame and cover. Adjustments which require dismantling and reconstruction of the super structure shall be accomplished at the time of subgrade preparation. Pavement which is removed for this adjustment shall be cut square, tack coated, and capped with 2" of bituminous concrete. No separate payment will be made for furnishing the bituminous cap.

D. Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.

3.4 ABANDONING MANHOLES

A. Existing manholes designated to be abandoned shall be removed to a depth of one (1) foot below the subgrade line, unless otherwise indicated on the Plans or directed by the Engineer. The existing pipes shall be plugged with concrete and brick masonry and the catch basins and manholes shall be filled with heavy gravel satisfactorily compacted in 9 inch lifts. Prior to backfilling, the sump shall be pumped and cleaned of all water and foreign material.

3.5 MANHOLE ADAPTERS

A. When altering an existing manhole or where a pre manufactured manhole adapter cannot be installed in precast manhole sections, the Contractor shall use a Fernco, or equal, concrete manhole adapter. The adapter shall be designed to provide a positive, watertight seal between the manhole and pipe and shall be mortared in place with Five Star grout or approved equal non-shrink grout.

3.6 PRECAST TANKS, VAULTS, AND APPURTENANCES

A. These precast items shall be set in a dry excavation, proof-rolled, and prepared with one of the following bedding materials:

- Compacted ¾" crushed stone (8" min.),
- Compacted MDOT 703.06 Type D gravel.

If the subgrade is weak and/or unstable, a layer of Mirafi 600X shall be installed between the prepared subgrade and the bedding.

B. The anti-flotation slab shall be carefully laid out and aligned, and set on the bedding with reinforcement and forms set on a dry excavation site. Concrete shall be poured and protected from inclement weather during the cure period.

C. Tanks shall be set on the anti-flotation slab. Where necessary for plumbness and level, the tank shall be shimmed with a strong slurry grout installed to fill the void space.

D. Multiple section tanks shall be set in place using approved sealants. Double rows shall be required when joint mastics are used. An approved adhesive primer shall be installed prior to installing the mastics and setting the concrete.

E. The tank shall be anchored to the anti-flotation slab with approved stainless steel masonry anchors. All anchors shall be inspected by the Contractor to assure the anchor is secure and will provide the required resistance.

F. After anchorage, the tank excavation shall remain dewatered and backfilled. The backfill shall be brought up uniformly around the tank and compacted in place. Pipe connections shall occur after the tank has been backfilled to the level of the bottom of the pipe bedding.

G. Any voids created by removal of sheeting, bracing or shielding shall be filled and recompacted.

3.7 TESTING

A. Testing shall meet the requirements of Section 33 05 00 “Common Work Results for Utilities”.

END OF SECTION

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, non-pressure storm drainage outside the building, with the following components:

1. Cleanouts.
2. Precast concrete manholes.
3. Flared inlets/outlets.
4. Catch basins.

1.2 PERFORMANCE REQUIREMENTS

A. Perimeter building underdrains are required and shall be installed as part of the site work. Refer to Section 33 46 00.

B. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: Watertight when installed below permanent pond elevation, silt tight in other areas.

1.3 SUBMITTALS

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

B. Shop Drawings: For manholes and catch basins. Include plans, elevations, sections, details, and manhole frames and covers and catch basin frames and grates.

C. Coordination Drawings: Show pipe sizes, locations, and elevations for all manholes and appurtenances.

D. Field quality-control test reports. Product Data: For each type of product indicated.

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly beside pipe to midpoint of pipe, prior to subsequent backfill operations.

B. Special Backfill: Fill placed above bedding beside and over pipe prior to other backfill operations.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipes and mains, connections, catch basins, cleanouts and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 COORDINATION

A. Coordinate the work with termination of storm connections outside building and trenching.

B. The exact location of roof drain leaders shall be determined from the Architectural Plans and including as shown on the plumbing drawings. The number and location of the roof drains may be different than shown in the site drawings. Verify roof drain lead locations with the Owner. Provide fittings to raise grade to accept roof drain 5’-0” outside of building where necessary.

C. All building underdrains shall be connected to the storm drainage system. Refer to Section 33 46 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Provide any one of the following materials subject to any restrictions noted in this subsection or on plans. The Contractor shall provide catalog cuts to the Owner and indicate the proposed materials to be used prior to ordering materials. The approval of the Owner must be obtained prior to ordering materials.

A. Reinforced Concrete Pipe: Comply with requirements of ASTM C 76, Class IV unless another class type is indicated on Drawings, installed with flexible plastic (Bitumen) gaskets at all joints. Gaskets shall comply with AASHTO M-198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations.

B. Polyvinyl Chloride (PVC) Pipe: Pipe and fittings shall comply with ASTM D 3034, rated SDR 35. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant. PVC shall not be used for any drainage pipe which will be permanently exposed to sunlight.

C. Corrugated Polyethylene Pipe (CPP), Smooth Interior: Shall conform with AASHTO Designations M294 and M252. Pipe must be installed in accordance with manufacturer’s installation guidelines for culvert and other heavy duty drainage applications. Acceptable manufacturers: Advanced Drainage Systems, Inc. (ADS) N-12 and HANCOR, INC. (HiQ smooth interior). CPP pipe shall not be used for any drainage pipe which will be permanently exposed

to sunlight. Piping below the water table, subject to surcharge, or which could affect a pond level, shall be watertight. All other piping shall be silt tight.

D. Polyvinyl Chloride (PVC) Large Diameter Closed Profile Gravity Sewer Pipe, UNL-B-9: Pipe and fittings shall be installed in accordance with pipe manufacturer's installation guidelines. Acceptable manufacturer: CARLON (Vylon HC). PVC pipe shall not be used for any drainage pipe which will be permanently exposed to sunlight.

E. Storm drain inlets, outlets, and culverts to include:

- Rip rapped aprons.
- Concrete flared inlets/outlets for pipes larger than 18" in diameter.
- Bar racks for pipes larger than 18" diameter.
- HDPE flares for pipe smaller than 18" in diameter. High density polyethylene flares with added carbon black for exposure to sunlight.

F. Manholes and Catch Basins Outlet Control Structures, Stilling, Basins, Water Quality Unit, and Water Quality Control Structures shall be provided where shown on the contract drawings.

2.2 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Manufacturers:

a. Josam Company.
b. MIFAB Manufacturing Inc.
c. Smith, Jay R. Mfg. Co.
d. Wade Div.; Tyler Pipe.
e. Watts Industries, Inc.
f. Watts Industries, Inc.; Enpoco, Inc. Div.
g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): Heavy duty.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.3 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

4. Riser Sections: 4-inch (100-mm) minimum thickness, and of length to provide depth indicated.

5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.

7. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.

8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches (900 mm).

9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.

11. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 8-inch (203-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

    a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

2.4 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

2.5 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.

3. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) by 8-inch (203-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with bicycle proof drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2. The location of catch basins shall be accurately located by a registered land surveyor. Catch basins shall be located as follows:

- Edge of frame 6" off face of curb where shown near slopes granite or bit concrete curblines.
- The center of aisle or parking modules when shown on plans.
- In other cases, verify with Engineer.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use non pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping, unless otherwise indicated.

a. Flexible couplings for same or minor difference OD pipes.

b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves,

and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, non-pressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at the slope provided on the contract drawing.

2. The pipe shall be accurately laid to the line and grades to the satisfaction of the Engineer. The line and grade may be adjusted by the Engineer from that shown on the Drawings to meet field conditions and no extra compensation shall be claimed therefore. The Owner or his representative reserves the right to check the elevations and alignment on any pipe for conformance with proposed line and grade. Installed grades shall be within the tolerance of plus or minus 0.02 feet from theoretical computed grades. Alignment shall be within a tolerance of plus or minus 0.04 feet. Pipe grade shall be defined as the invert elevation of the pipe. Pipe not meeting the grade tolerance or of poor alignment shall be adjusted by the Contractor.

3. No pipe laying will be allowed to begin at any point other than a manhole or other appurtenance without the expressed consent of the Engineer. The interior of each length of pipe will be swabbed and wiped clean before laying the next length. No length of pipe shall be laid until the previous length has had sufficient fine material placed and tamped about it to secure it firmly in place to prevent any disturbance. Bell ends shall be laid uphill. Whenever the work is stopped temporarily, or for any reason whatsoever, the end of the pipe shall be carefully protected against dirt, water, or other extraneous material. Bedding shall be as shown on the Plans.

4. The pipe shall be cut as necessary for appurtenances. In general, the pipe material shall be cut by using a saw or milling process, approved by the pipe manufacturer and not by using any impact device, such as a hammer and chisel, to break the pipe. The pipe shall be cut, not broken. The cut end of the pipe shall be square to the axis of the pipe and any rough edges ground smooth.

5. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely, in a manner approved by the Engineer, to prevent entrance of trench water, dirt, or other substances.

6. All joints shall be made in a dry trench in accordance with the manufacturer's recommendations.

7. A minimum of two (2) pipe lengths or pipe stubs shall be used between any two (2) appurtenances.

8. When connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline service. Provide facilities for dewatering and for disposal of water removed from dewatering lines and excavations without damage to adjacent properties.

9. Install piping below frost line or with rigid insulation where required by profiles and details.

10. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

11. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.3 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, non-pressure drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
3. Join dissimilar pipe materials with non-pressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.

3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

4. Use extra-heavy-duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch (25 mm) above surrounding grade in lawn areas.

C. Set cleanout frames and covers in pavement with tops flush with pavement surface.

3.5 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 0-1" (0-25 mm) above finished surface elsewhere, unless otherwise indicated.

3.6 CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

B. Outlet Control Structure: Provide precast concrete unit, covers, weirs, orifices and appurtenances as shown on the drawings. Provide information on the method, materials, installation, and quality control measures which will be used to seal the wall between the inlet and outlet side of the manhole.

Precast Tanks, Vaults and Appurtenances: Precast tanks, vaults, and appurtenances shall be constructed of precast reinforced concrete with inside dimensions conforming to those indicated on the contract drawings and conforming to ASTM C478. The tank may be a monolithic section or constructed with tongue and grooves with approved watertight sealants such as butyl sealant. All penetrations through the tank shall use either cast in place wall sleeves with Link Seals or a flexible boot secured in the casting such as Kor N Seal. Any clamps or metallic connections shall be stainless steel.

The tanks, vaults, and appurtenances shall include shop drawings and submittals with supporting computations which demonstrate the tank can support an H20 loading, an equivalent external fluid pressure of 105 lb./cubic ft. (with the tank empty), and an internal fluid pressure of 65 lb./cubic ft. The pressures shall be assumed to apply from the base of the structure to the finish grade surface.

Tanks which require attachment to an anti-flotation slab shall use stainless steel angles and anchors sized to resist the uplift force.

The tanks shall be coated with a waterproof seal on the interior and exterior. Sections shall be fabricated to receive a watertight seal.

3.7 MANHOLES

A. General: All appurtenant structures shall be set level on compacted material as specified in Section 2 of these Specifications and as shown on the Plans.

B. Manhole Channels: Channels shall be constructed in all sanitary sewer and storm drain manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the Engineer or a preformed manhole channel: "FIBERLINER" or equal. The sides shall be raised by brick masonry construction from the spring line perpendicular to the height of the crown of the pipe. Where changes in directions are made at manholes, the

invert shall be shaped with as great a radius as possible, and to the complete satisfaction of the Engineer. Brick shall be carefully laid to present a smooth surface as indicated on the Plans and to the satisfaction of the Engineer.

C. Pipe Connections:

1. Stubs in Manholes: Stubs placed as specified and indicated on the Drawings shall be short pieces cut from the bell ends of appropriate pipe and shall have compatible watertight stoppers. Stubs shall be set accurately to the required line and elevation and encased in the structure masonry as indicated on the Drawings.

2. Wall Sleeves and Castings: Wall sleeves and castings as specified and indicated on the Drawings shall be accurately cast to the required location and elevations as indicated on the Drawings.

D. Steps: Manhole and appurtenant steps shall be cast in the wall and installed in a straight vertical alignment.

3.8 ALTERATIONS TO EXISTING MANHOLES AND CATCH BASINS

A. Existing manholes and catch basins to be altered shall be reconstructed as indicated on the Plans or as directed by the Engineer. Adjusting to grade or connecting to an existing pipe stub is not considered an alteration.

B. Alterations covered include, but are not limited to, adjustments to manhole invert channel caused by new pipe connections or removal of existing pipe connections, and removal and plugging of existing catch basin lead and replacing with a new lead connection conforming to the appropriate section of the Specifications contained herein.

3.9 ADJUSTING EXISTING MANHOLES AND CATCH BASINS

A. Existing manholes and catch basins to be adjusted to grade shall be reconstructed to the required grade. The existing frames, grates, and covers shall be re-used unless otherwise directed.

B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.

C. Adjustment will take place just prior to placing of surface pavement for adjustments of the frame and cover. Adjustments which require dismantling and reconstruction of the super structure shall be accomplished at the time of subgrade preparation. Pavement which is removed for this adjustment shall be cut square, tack coated, and capped with 2" of bituminous concrete. No separate payment will be made for furnishing the bituminous cap.

D. Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.

3.10 ABANDONING EXISTING CATCH BASINS AND MANHOLES

A. Existing catch basins and manholes designated to be abandoned shall be removed to a depth of one (1) foot below the subgrade line, unless otherwise indicated on the Plans or directed by the Engineer. The existing pipes shall be plugged with concrete and brick masonry and the catch basins and manholes shall be filled with heavy gravel satisfactorily compacted in 9 inch lifts. Prior to backfilling, the sump shall be pumped and cleaned of all water and foreign material.

3.11 MANHOLE ADAPTERS

A. When altering an existing manhole or where a pre manufactured manhole adapter cannot be installed in precast manhole sections, the Contractor shall use a Fernco, or equal, concrete manhole adapter. The adapter shall be designed to provide a positive, watertight seal between the manhole and pipe and shall be mortared in place with Five Star grout or approved equal non-shrink grout.

3.12 PRECAST TANKS, VAULTS, AND APPURTENANCES

A. These precast items shall be set in a dry excavation, proof-rolled, and prepared with one of the following bedding materials:

- Compacted ¾" crushed stone (8" min.)
- Compacted MDOT 703.06 Type D gravel

If the subgrade is weak and/or unstable, a layer of Mirafi 600X shall be installed between the prepared subgrade and the bedding.

B. The anti-flotation slab shall be carefully laid out and aligned, and set on the bedding with reinforcement and forms set on a dry excavation site. Concrete shall be poured and protected from inclement weather during the cure period.

C. Tanks shall be set on the anti-flotation slab when required to resist floatation. Where necessary for plumbness and level, the tank shall be shimmed with a strong slurry grout installed to fill the void space.

D. Multiple section tanks shall be set in place using approved sealants. Double rows shall be required when joint mastics are used. An approved adhesive primer shall be installed prior to installing the mastics and setting the concrete.

E. The tank shall be anchored to the anti-flotation slab with approved stainless steel masonry anchors when the anti-floatation slab is required. All anchors shall be inspected by the Contractor to assure the anchor is secure and will provide the required resistance.

F. After anchorage, the tank excavation shall remain dewatered and backfilled. The backfill shall be brought up uniformly around the tank and compacted in place. Pipe connections shall occur after the tank has been backfilled to the level of the bottom of the pipe bedding. The

dewatering shall continue until the finish grade around the tank has been reached with the backfill.

G. Any voids created by removal of sheeting, bracing or shielding shall be filled and recompacted.

3.13 CONNECTIONS

A. Connect non pressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

2. Insulation, when required by the Drawings, shall be Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.

3. Material submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05% by ASTM C272-53 and meet Federal Specification HH1524B Type II, Class B.

4. The Contractor shall coat the insulation material in accordance with the manufacturer’s instructions.

3.14 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

a. Horizontal Alignment: Less than full diameter of inside of pipe is visible between structures or ½” off design alignment.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

f. Vertical Alignment: Within ¼” of design grade.

2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

3. Re-inspect and repeat procedure until results are satisfactory.

B. Test new watertight piping systems that have been installed below the elevation of the permanent pool in the wet pond.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

SECTION 33 46 00

SUBDRAINAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes subdrainage systems for the building underdrains.

B. This section also includes subdrainage within the pavement and lawn areas as shown on the contract drawings.

1.2 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: For each type of drainage panel or piping indicated on the drawings.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, fitting, and joining materials.

2.2 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.

1. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.3 SOLID-WALL PIPES AND FITTINGS

A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

B. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.

1. Gaskets: ASTM F 477, elastomeric seal.

2.4 SPECIAL PIPE COUPLINGS – VACANT

2.5 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

2.6 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Section 31 20 00 "Earth Moving”.

2.7 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491.

2.8 FLAT PANEL UNDERDRAINS

A. Flat Underdrains shall be ADS material wrapped in fabric. ADS Advanedge or equal shall be used. The flat drain underdrain shall be twelve inches in width and installed vertically. Flat panel underdrains shall be installed with the top flush with finish grade at any location where the finish grade is above the weep holes at the building face.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving”.

3.2 PIPING APPLICATIONS

A. Underground Subdrainage Piping:
1. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. Underslab Subdrainage Piping:
1. Perforated PVC sewer pipe and fittings and loose, bell-and-spigot joints.

C. Header Piping:
   1. PE drainage tubing and fittings, couplings, and coupled joints.
   2. PVC sewer pipe and fittings, couplings, and coupled joints.

3.3 CLEANOUT APPLICATIONS

A. In Underground Subdrainage Piping:
   1. At Grade in Earth: PVC cleanouts.
   2. At Grade in Paved or Walkway Areas: Cast-iron cleanouts.

3.4 FOUNDATION DRAINAGE AND UNDERDRAIN INSTALLATION

A. Install underdrainage system at locations shown on the Drawings. Lay pipe with the invert positioned down with invert elevation as shown on the Drawings.

B. Completely surround the underdrains pipes with a minimum of 6 inches of ¾" crushed stone and geotextile fabric. Place pipe with joints tightly closed in accordance with manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down.

C. Any sections of piping that are not true to lines and grades, or that show any undue settlement after being laid, or are damaged will be removed and re-laid or replaced at no additional cost.

D. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

E. Provide cleanouts for drainage piping at changes of direction, bend of lines, and wherever indicated on the drawings, and necessary to enable system to be cleaned out. Extend cleanouts to finished grade and provide surface protection. Coordinate cleanout locations with structural and architectural improvements.

F. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

G. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

H. Install PVC piping according to ASTM D 2321.

3.5 PIPE JOINT CONSTRUCTION

A. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.

B. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.6 CLEANOUT INSTALLATION

A. Cleanouts for Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches (450 by 450 by 300 mm) in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in non-vehicular-traffic areas.
3. In non vehicular-traffic areas, use NPS 4 (DN 100) cast-iron pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) in depth. Set top of cleanout plug 1 inch (25 mm) above grade.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

C. Where required, connect low elevations of foundation underslab subdrainage to stormwater sump pumps.

3.8 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.9 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION