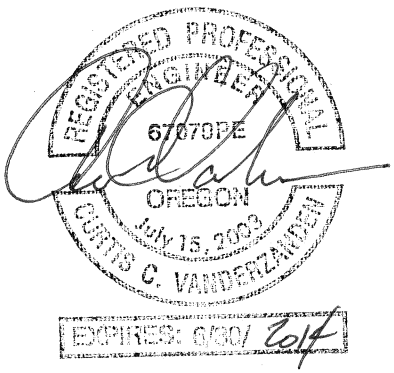
Technical Specifications

for

M. James Gleason Boat Ramp
Parking Lot Facility Improvements

PROFESSIONAL OF RECORD CERTIFICATION(S):

Seal with Signature	Sections 011000, 011423, 011425, 011427, 012250, 013300, 014200, 015719, 020000, 22113, 221313, 311000, 312000, 321216, 321313, 321443, 334100
	

Technical Specifications

for

M. James Gleason Boat Ramp
Parking Lot Facility Improvements

PROFESSIONAL OF RECORD CERTIFICATION(S):

Seal with Signature	Sections 328400, 329200, 329300
	

Technical Specifications

for

M. James Gleason Boat Ramp
Parking Lot Facility Improvements

PROFESSIONAL OF RECORD CERTIFICATION(S):

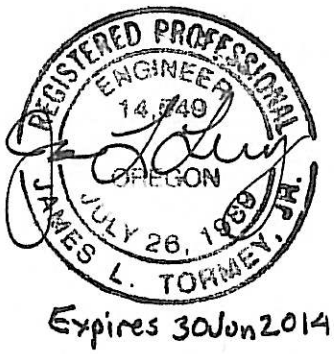
Seal with Signature	Sections 260500, 260519, 260526, 260529, 260533, 260553, 262000, 262726
	

Technical Specifications

for

M. James Gleason Boat Ramp
Parking Lot Facility Improvements

PROFESSIONAL OF RECORD CERTIFICATION(S):

Seal with Signature	Sections 220000
 Expires 30Jun2014	

Technical Specifications
for
M. James Gleason Boat Ramp
Parking Lot Facility Improvements

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These specifications are subject to the administrative and procedural requirements specified in the State of Oregon Standard Conditions for Public Improvement Contracts.

1.2 DESCRIPTION OF WORK

A. Location of work is at M. James Gleason Boat Ramp, 4325 NE Marine Drive, Columbia River Mile 109.4, in Portland, Oregon.

B. Project is to:

1. Coordinate with Metro's other Contractor that will be installing a pre-fabricated restroom structure on site.
2. Furnish and construct parking lot improvements as shown.
3. Construct striping as shown.
4. Provide bank protection as shown.
5. Furnish and install landscaping and irrigation.
6. Construct storm water facilities and utilities as shown.
7. Furnish and install sanitary lift station.
8. Install electrical utilities as shown.
9. Install sanitary improvements as shown.
10. Install waterline improvements as shown.

C. Project is for METRO, referred to hereafter as Owner.

D. The Project Manager and Owner's Authorized Representative is:

Lydia Neill
METRO
600 NE Grand Ave.
Portland, OR 97232-2736

Phone: (503) 797-1830
Fax: (503) 797-1797
Cell: (503) 975-4522

E. Contractor shall furnish all labor, equipment, and materials necessary to complete work in accordance with the Drawings, Specifications, and terms of the contract.

1.3 DRAWINGS

A. The following Drawings hereby form a part of this Contract:

1. C1.0 COVER SHEET
2. C1.1 CIVIL NOTES
3. C2.0 EXISTING CONDITIONS AND REMOVAL PLAN
4. C2.1 EXISTING CONDITIONS AND REMOVAL PLAN
5. C3.0 CIVIL SITE PLAN
6. C3.1 CIVIL SITE PLAN

7.	C3.2	CURVE AND LINE TABLE
8.	C4.0	GRADING AND STORM DRAIN PLAN
9.	C4.1	GRADING AND STORM DRAIN PLAN
10.	C4.2	DETAILED GRADING
11.	C5.0	SANITARY SEWER AND WATER PLAN
12.	C5.1	SANITARY SEWER AND WATER PLAN
13.	C6.0	DETAILS
14.	C6.1	DETAILS
15.	C6.2	DETAILS
16.	C6.3	DETAILS
17.	C7.0	SIGNAGE PLAN
18.	C7.1	SIGNAGE DETAILS
19.	L1.0	LANDSCAPE IRRIGATION PLAN
20.	L1.1	LANDSCAPE IRRIGATION PLAN
21.	L1.2	LANDSCAPE IRRIGATION DETAILS
22.	L2.0	LANDSCAPE PLANTING PLAN
23.	L2.1	LANDSCAPE PLANTING PLAN
24.	L2.2	LANDSCAPE PLANTING DETAILS
25.	P1.0	PLUMBING PLAN
26.	E1.0	ELECTRICAL SITE PLAN – WEST END
27.	E2.0	ELECTRICAL SITE PLAN – EAST END
28.	E3.0	ELECTRICAL ONE-LINE DIAGRAM
29.	EC1.0	EROSION AND SEDIMENT CONTROL COVER SHEET
30.	EC20	EROSION AND SEDIMENT CONTROL PLAN
31.	EC2.1	EROSION AND SEDIMENT CONTROL PLAN
32.	EC3.2	EROSION AND SEDIMENT CONTROL DETAILS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

PART 1 - GENERAL

1.1 SPECIAL PROJECT REQUIREMENTS

A. The immediate areas surrounding the construction site shall be open to the public from start of construction until the specified completion date. The Contractor shall coordinate with the Project Manager to provide both access and public safety during construction. Devices required to provide for public safety during construction shall be provided and installed by the Contractor.

B. Construction operations shall be restricted to the hours between 7:00 a.m. and 7:00 p.m.

C. No work shall be performed on any legal holiday or weekends without approval from the Project Manager.

D. Comply fully with manufacturer's instructions. Should manufacturer's instructions conflict with Contract Documents, request clarification from Project Manager before proceeding.

E. Coordinate with the Multnomah County Sheriff's Department to provide continued access to the existing Sheriff's office building on site.

1.2 CONSTRUCTION STAKEOUT

A. The Project Manager has provided reference points for the Contractor's stakeout of the construction work. The reference points are in the form of reference elevation and coordinates from existing survey control points, as shown on the Drawings. The Contractor will be solely responsible for laying out the work from coordinate point stakeout control shown on the Drawings, and no additional stakeout will be provided by the Project Manager.

1.3 SPECIFICATION LANGUAGE

A. Portions of the Specifications are written in imperative and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" shall be included by inference where a colon (:) is used within sentences or phrases. Example: Aggregate: ASTM C33.

1.4 TEMPORARY UTILITIES

A. Contractor shall provide toilet and wash-up facilities for the work force at the site. Comply with applicable laws, ordinances, and regulations pertaining to public health and sanitation.

PART 2 - MATERIALS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION 011423

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for coordinating and sequencing the work under the Contract and requirements regarding existing site conditions.

1.2 JOBSITE COORDINATION

A. The Contractor is responsible for overall coordination of the project.

B. Secure storage for tools and materials at the site is limited. Contractor is encouraged to schedule material deliveries to minimize laydown requirement.

1.3 SITE CONDITIONS

A. Information On Site Conditions

1. General: Information obtained by the Owner regarding site conditions, topography, subsurface information, ground water elevations, existing construction of site facilities as applicable, and similar data will be available for inspection at the Metro Regional Center, upon request. Such information is offered as supplementary information only. Neither the Engineer nor the Owner assumes any responsibility for its accuracy or completeness or for the Contractor's interpretation of such information.
2. Control Points: The Project Manager has provided reference points for the Contractor's stakeout of the construction work. The reference points are in the form of reference elevation and coordinates from existing survey control points, as shown in the Drawings. The Contractor will be solely responsible for laying out the work from the coordinate point stakeout control shown on the Drawings. Electronic copies of the drawings may be provided for use at the Contractor’s risk.
3. Contractor will provide all field engineering services and record changes in the location, or layout, of permanent structures on the Project Record Documents (As-Built drawings).

B. Existing Utilities

1. Location
   a Known utilities and facilities adjacent to or within the work area are shown on the Drawings. The locations shown are taken from existing records and the best information available from existing utility plans; however, it is expected that there may be some discrepancies and omissions in the locations and quantities shown. Those shown are for the convenience of the Contractor only, and no responsibility is assumed by either the Owner or the Architect for their accuracy or completeness. Contractor's request for additional compensation or Contract time resulting from encountering utilities not shown will be considered as set forth in the General Conditions.
2. Contractor's Responsibilities

a. Where Contractor's operations could cause damage or inconvenience to telephone, power, water, sewer, or fire protection systems, the Contractor shall make arrangements necessary for the protection of these utilities and services. Replace existing utilities removed or damaged during construction, unless otherwise provided for in these Contract Documents.

B. Interfering Structures

1. Take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Drawings. While the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed.
2. Protect existing structures from damage, whether or not they lie within limits of easements obtained by the Owner. Where existing fences, gates, buildings, or other structure must be removed to properly carry out work, or are damaged during work, restore them to original condition and to the satisfaction of property owner.
3. Contractor may remove and replace in equal or better than original condition, small structures such as guardrails, that interfere with Contractor's operations.

C. Field Relocation

1. During construction, it is expected that minor relocation's of proposed facilities will be necessary. Make such relocation's only by direction of the Engineer or Owner. If existing structures are encountered that prevent construction as shown, notify the Engineer or Owner before continuing with work so Engineer or Owner may make necessary field revisions.
2. Where shown or directed by and acceptable to the Engineer or Owner, provide relocation of existing facilities to include piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other miscellaneous items. Use only new materials for relocation of existing facilities. Match materials of existing facilities, unless otherwise shown or specified. Perform relocation's to minimize downtime of existing facilities. Install new portions of existing facilities in their relocated position prior to removing existing facilities, unless otherwise accepted by Engineer or Owner. Comply with cutting and patching requirements in this section.

D. Salvage of Materials: Contractor shall salvage materials where shown on Drawings and deliver to Metro.

E. Connecting to Existing Facilities: Unless otherwise shown or specified, determine methods of connecting new work to existing facilities, and obtain Engineer's review and acceptance of connections.

1. Determine location, elevation, nature, materials, dimensions, and configurations of existing facilities where necessary for connecting new work.
2. Inspect existing record drawings and shop drawings, conduct exploratory excavations and field inspections, and conduct similar activities as needed.
3. Shutdown of Owner's existing facility prior to connection, if necessary, shall be by Owner or as specified.

1.2 PROJECT MEETINGS

A. Preconstruction Conference: Within 5 days following execution of Contract but before start of work at the site, Contractor shall meet with Owner and Engineer for discussion of scheduling requirements, procedures for handling shop drawings and other submittals, processing application for payment, and establishing a working understanding among the parties. The conference shall be attended by:

1. Contractor's office representative.
2. Contractor's general superintendent.
3. Subcontractors' representatives whom Contractor may desire or Engineer may request to attend.
4. Engineer's representatives.
5. Owner's representatives.

B. Progress Meetings: Contractor will schedule regular progress meetings to be held once every week to review work progress, schedules, and other matters needing discussion and resolution.

1.3 SEQUENCE OF WORK

A. Operation and Shutdown of Existing Facilities

1. Operation of the boat ramp operations is of critical importance for Multnomah River Patrol and the Port of Portland.
   a Schedule and conduct activities to minimize disruption of operations and to enable at least one lane of the existing facilities to operate, unless otherwise specified.

B. Modifications to Existing Facilities: Where existing facilities are to be modified during the course of work, obtain Engineer’s and Owner's review and acceptance of submittals for temporary shutdown, demolition, modification, connections between new and existing work, and other related work. Conform to other sections as applicable.

C. Time of Work: Refer to Sections 0700 and 0800 for scheduling requirements, and coordinate with Owner.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION 011425

PART 1 - GENERAL

1.1 SPECIAL PROJECT REQUIREMENTS

A. Contractor is advised that this is a public recreation facility. The facility will remain open to the public during the construction period. Also, construction activity must not interfere with the public's right to free navigation on all navigable waters of the United States.

B. All construction debris shall be disposed of in such a manner that it cannot enter the waterway.

C. Care shall be taken to prevent any petroleum products, chemicals, or other deleterious material from entering the water.

D. All areas along banks, disturbed or newly created by the construction activity, shall be seeded, sodded, revegetated, or given some other type of protection against subsequent erosion and returned back to its original condition.

E. Work in waterways shall be done so as to minimize turbidity increases in the water that tend to degrade water quality and damage aquatic life.

F. Contractor shall complete and submit any FAA notification and permits as required to perform construction adjacent to the Portland airport.

1.2 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipes and other closed or remote spaces.

C. Remove waste materials, debris, and rubbish from the site immediately upon such materials becoming unfit for use in the work. In the event this material is not removed, Project Manager reserves the right, but does not have the duty, to have the material removed, and the expense shall be charged to the Contractor.

1.3 TEMPORARY UTILITIES

A. Provide toilet and wash-up facilities for the work force at the site. Comply with applicable laws, ordinances, and regulations pertaining to public health and sanitation.

1.4 PERMITS

A. Construction shall comply with requirements and conditions of all applicable permits. Permits include, but shall not be limited to the following:

1. U.S. Army Corps of Engineers – Permit No. 2001-00957
2. DSL Fill Permit – Permit No. 24832-RF Modified
3. City of Portland – Building Permit Application No. XX-XXXXX-XXX-XX (permit

pending)
4. City of Portland – Demolition Permit Application No. XX-XXXXX-XXX-XX (permit pending)
5. All trade permits must be obtained through the City of Portland's Facility Program.

PART 2 – MATERIALS (not applicable)

PART 3 – EXECUTION (not applicable)

END OF SECTION 011427

PART 1 - GENERAL

1.1 DESCRIPTION

A. All Payments shall be as provided in the State of Oregon Standard Conditions for Public Improvement Contracts. References to other documents in the Drawings and in the Technical Specifications, such as ODOT and ODOT/APWA are not intended to include references to measurement and payment that may exist in those other documents. Specific Measurements for Payment are detailed in this specification Section 012250.

B. If no Bid Item exists for a portion of the work, include the costs in a related Bid Item.

C. No separate payment will be made for any item that is not specifically set forth in the Proposal Schedule, and all costs therefore shall be included in the prices named in the Proposal Schedule for the various appurtenant items of work.

D. Quantities listed in the Proposal do not govern final payment. Payments to the Contractor will be made only for actual quantities of Contract items performed in accordance with terms of the Contract and for items of work actually performed under Change Orders.

E. Indirect costs, such as supervision and overhead, profit, the general conditions specified in the Contract, all shall be allocated to each bid item as applicable for work defined in the bid item. No separate payment will be made to the Contractor for these items.

1.2 BID ITEM MEASUREMENT AND PAYMENT

A. BID ITEMS:

1. Mobilization: Payment for Mobilization shall be made on a lump sum basis. The amount to be allowed for Mobilization in the partial payment to be made under the Contract will be as follows:
   a) When 5% of the total original contract amount is earned from other bid items, not including advances on materials, 50% of the amount bid for Mobilization, or 2.5% of the original contract amount, whichever is the least, less normal retainage, will be paid.
   b) When 10% of the total original contract amount is earned from other bid items, not including advances on materials, 100% of the amount bid for Mobilization, or 5% of the original contract amount, whichever is the least, less normal retainage, will be paid.
   c) Upon completion of all work on the project, payment of any amount bid for Mobilization in excess of 5% of the total original contract amount will be paid.
   d) The above schedule of progress payments for Mobilization shall not limit or preclude progress payments otherwise provided by the Contract.
2. Erosion Control:
   a) Measurement for Erosion Control shall be made on a lump sum basis.

b) Payment shall include full compensation for all materials, tools, equipment, and labor necessary for the installation and maintenance of erosion control measures, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

3. Removal of Existing Structures and Obstructions:
   a) Measurement for Removal of Existing Structures and Obstructions shall be made on a lump sum basis for all material removed as shown on the Drawings.
   b) Payment shall include full compensation for all labor, materials, tools, and equipment necessary for the removal of all structures, hauling and legal disposal of excess material off-site, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
4. Vegetated Bank Protection:
   a) Measurement for vegetated bank protection shall be made on a square foot basis installed.
   b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for providing and installing vegetated bank protection as shown on the plans and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
5. Earthwork:
   a) Measurement for Earthwork shall be made on a lump sum basis for all excavation and embankment required as shown on the Drawings.
   b) Payment shall include full compensation for all labor, materials, tools, and equipment necessary for performing all excavation and/or embankment required to complete the project, removal of excess material from the site, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
6. Concrete Curb:
   a) Measurement for Concrete Curb shall be made on a lineal foot basis installed.
   b) Payment shall include full compensation for all materials, tools, equipment, and labor necessary for the installation of the Concrete Curb, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Base rock aggregate used for curbs shall be considered incidental to this bid item.
7. Asphalt Pavement:
   a) Measurement for Asphalt Pavement shall be made on a per ton in-place basis installed.
   b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for providing, installing, and testing asphalt pavement in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
8. Aggregate Base:
   a) Measurement for Aggregate shall be made on a cubic yard in place basis installed.
   b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for the providing, installing, and testing aggregate subbase under the asphalt pavement in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
9. Concrete Sidewalk & Bike/Pedestrian Path:
   a) Measurement for concrete sidewalk and the bike/pedestrian path shall be made on a square foot basis installed.

b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for installing concrete sidewalk in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Aggregate base, expansion joints, thicken edges, detectable warnings and curb ramps are considered incidental to this bid item.

10. Accessible Path to Beach:
    a) Measurement for the accessible path to beach shall be made on a square foot basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for installing concrete pathway in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Aggregate base, expansion joints, and thicken edges are considered incidental to this bid item.
11. Concrete Stairs:
    a) Measurement for concrete stairs shall be made on a square foot of projected horizontal area basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installing concrete stairs in accordance with the requirements of the Contract Documents and as shown on the Drawings. Handrails are not included in this bid item.
12. Handrails:
    a) Measurement for handrails shall be made on a liner foot basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installing handrails in accordance with the requirements of the Contract Documents and as shown on the Drawings.
13. Retaining Walls:
    a) Measurement for walls shall be made on a square foot of wall face basis installed.
    b) Payment shall include full compensation for all materials, excavation, backfill, equipment, tools, and labor necessary for furnishing and constructing the retaining wall in accordance with the requirements of the Contract Documents and as shown on the Drawings. The portion of perforated drain pipe behind the retaining wall and the graffiti guard shall be considered incidental to this bid item.
14. Wheel Stops:
    a) Measurement for wheel stops shall be made on a per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installing wheel stops in accordance with the requirements of the Contract Documents and as shown on the Drawings.
15. Removable Bollards:
    a) Measurement for removable bollards shall be made on a per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installing the removable bollards in accordance with the requirements of the Contract Documents and as shown on the Drawings.
16. Trash Cans:
    a) Measurement for trash cans shall be made on a per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installing the trash cans in accordance with the requirements of the Contract Documents and as shown on the Drawings.
17. Pavement Striping and Signing:
    a) Measurement for pavement striping and signing shall be made on a lump sum basis installed.

b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for complete the work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

18. Vegetated Storm Water Planter Walls:
    a) Measurement for Vegetated Storm Water Planter Walls shall be made on a unit price per linear foot basis installed.
    b) Payment shall include full compensation for all materials, tools, equipment, and labor necessary for the construction of the planter walls and weirs to the heights shown on the plans and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Weir rounded drain rock scour protection is considered incidental to this bid item.
19. Vegetated Storm Water Planters and Basins:
    a) Measurement for Vegetated Storm Water Planters and Basins shall be made on a square foot of planter and basin bottom area basis installed. Square foot of basin side slopes will not be measured in this bid item.
    b) Payment shall include full compensation for all materials, tools, equipment, and labor necessary for the excavation, haul off, construction, and installation of the vegetated storm water planters, such as, but not limited to, growing media and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Plantings shall be covered under the landscaping bid item.
20. Storm Drain Piping - X Inch:
    a) Measurement shall be made on a lineal foot basis installed for the sizes indicated in the plans.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing, transportation, and installation of the 6 inch storm sewer pipe including fittings, trench excavation, pipe zone material, backfill, tracer wire, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
21. Storm Drain Clean Out:
    a) Measurement shall be made on a per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installation of the clean out including fittings, trench excavation, backfill, lid, concrete backfill and ballast, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
22. Storm Drain Outfalls:
    a) Measurement for Storm Drain Outfalls shall be made on a per each basis installed.
    b) Payment shall include full compensation for all materials, tools, equipment, and labor necessary for the fabrication, furnishing, and installation of the outfall grates on the pipe outfalls and any additional riprap splash pad shown on the plans and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
23. Trench Drain:
    a) Measurement shall be made on a lineal foot basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing, transportation, and installation of the trench drain including fittings, trench excavation, backfill, grating, concrete backfill and ballast, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
24. Area Drain:

a) Measurement shall be made on a per each basis installed.
b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing, transportation, and installation of the area drain including fittings, trench excavation, backfill, grating, concrete ballast, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

25. Sanitary Sewer Piping – 4 Inch Gravity:
    a) Measurement shall be made on a lineal foot basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing, transportation, and installation of the 4 inch gravity sanitary sewer pipe including fittings, trench excavation, pipe zone material, backfill, tracer wire, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
26. Sanitary Sewer Piping – 3 Inch Pressure:
    a) Measurement shall be made on a lineal foot basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing, transportation, and installation of the 3 inch sanitary sewer force main including fittings, trench excavation, pipe zone material, backfill, tracer wire, pipe thrust restraint, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
27. Sanitary Sewer Clean Out:
    a) Measurement shall be made on a per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installation of the clean out including fittings, trench excavation, backfill, lid, concrete backfill and ballast, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
28. Connect to Existing Sanitary Sewer Manhole:
    a) Measurement shall be made on a per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installation of the sanitary sewer force main to the existing City of Portland manhole including core holing, backfill, surface restoration, rechanneling of the manhole, any required manhole testing, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
29. Water Pipe and Fittings – X Inch:
    a) Measurement shall be made on a lineal foot basis installed for the sizes indicated in the plans.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installation of the 1 inch water service pipe including fittings, valves, thrust restraint, trench excavation, pipe zone material, backfill, tracer wire, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
30. Sanitary Sewer Pump Station:
    a) Measurement for Sanitary Sewer Pump Station shall be made on a lump sum basis installed.

b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for the design, fabrication, furnishing, transportation, and installation of the pump station, pump controls, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Buoyancy calculations and any required ballast are incidental to this bid items.

31. Electrical Service, Complete:
    a) Measurement shall be made on a lump sum basis installed.
    b) Payment shall include full compensation for all materials, equipment, and labor to complete installation of power service to the site as shown on the plans, including but not limited to utility vaults, primary feeders, transformer, and meter. Coordination with the PUD and PUD fees are incidental to this bid item.
32. Topsoil, Imported:
    a) Measurement for Topsoil, Imported shall be made on a cubic yard basis in place.
    b) Payment shall include full compensation for all materials, equipment, transportation, clean up, and labor to install topsoil or amend existing in place surface soil to produce topsoil in the areas designated in the plans or specifications.
33. Organic Soil Amendment:
    a) Measurement for Organic Soil Amendment shall be made on a lump sum basis installed.
    b) Payment shall include full compensation for all materials, equipment, transportation, clean up, and labor to add organic soil amendments to site soils as called for on the plans or specifications.
34. Organic Mulch:
    a) Measurement for Organic Mulch shall be made on a cubic yard basis in the hauling vehicle or in containers delivered to the project site.
    b) Payment shall include full compensation for all materials, equipment, transportation, clean up, and labor to place organic mulch as called for on the plans or specifications.
35. Deciduous Trees:
    a) Measurement for Deciduous Trees shall be made on per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, excavation, and labor to install the tree as shown on the plans. Fertilizer and lodge pole stakes shall be incidental to this bid item.
36. Coniferous Trees:
    a) Measurement for Coniferous Trees shall be made on per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, excavation, and labor to install the tree as shown on the plans. Fertilizer, guys, and stakes shall be incidental to this bid item.
37. Shrubs:
    a) Measurement for Shrubs shall be made on per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, excavation, and labor to install the shrub as shown on the plans. Fertilizer shall be incidental to this bid item.
38. Ground Cover:
    a) Measurement for Ground Cover shall be made on square foot of planting area basis installed.
    b) Payment shall include full compensation for all materials, equipment, excavation, and labor to install the ground cover as shown on the plans. Fertilizer shall be incidental to this bid item.
39. Swale Planting:

a) Measurement for Swale Planting shall be made on square foot of planting area basis installed.
b) Payment shall include full compensation for all materials, equipment, excavation, and labor to install the swale planting as shown on the plans. Fertilizer shall be incidental to this bid item.

40. Hydroseed:
    a) Measurement for Hydroseed shall be made on a square foot basis installed.
    b) Payment shall include full compensation for all materials, equipment, labor, and incidentals necessary to apply hydroseeding to the site as shown on the plans.
41. Riverbank Stablization:
    a) Measurement for Riverbank Stabilization shall be made on a square foot basis installed.
    b) Payment shall include full compensation for all materials, equipment, labor, and incidentals necessary to complete installation of the riverbank stabilization plantings as shown on the plans.
42. Landscaping Establishment:
    a) Measurement for Landscaping Establishment shall be made on a lump sum basis installed.
    b) Payment shall include full compensation for all materials, equipment, labor, and incidentals necessary for plant establishment work as described in the specifications. A (1) one year maintenance warranty, including inspections, with a 100% plant survival rate is included in this bid item.

       Partial payment for this bid item will be made as follows:
       After the first plant establishment inspection……...30%
       After the second plant establishment inspection……...30%
       At completion of the establishment period…….....40%

43. Irrigation Controller:
    a) Measurement for Irrigation Controller shall be made on a per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, labor, and incidentals necessary to complete installation of the irrigation controller to the site as shown on the plans.
44. Irrigation:
    a) Measurement for Irrigation shall be made on a square foot of area irrigated basis installed.
    b) Payment shall include full compensation for all materials, tools, equipment, labor, and incidentals necessary for the furnishing, transportation, and installation of the irrigation system and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
45. Pervious Pavers:
    a) Measurement for Pervious Pavers shall be made on a square foot basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for installing pervious pavers in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Drainage fill, bedding course, subbase course, and drainage fabric are considered incidental to this bid item.
46. Boulders:
    a) Measurement for Boulders shall be made on a per each basis installed.

b) Payment shall include full compensation for all materials, equipment, labor, and incidentals necessary to install boulders as shown on the plans.

PART 2 - PART 2 – MATERIALS (not applicable)

PART 3 - PART 3 – EXECUTION (not applicable)

END OF SECTION 012250

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies transmittal instructions, the number of copies of Contractor submittals to be provided, and distribution of those submittals as required in the State of Oregon Standard Conditions for Public Improvement Projects (B.18).

PART 2 – MATERIALS (not applicable)

PART 3 – EXECUTION

3.1 SUBMITTALS

A. General:

1. For each required submittal, the Contractor shall submit four (4) copies of all the required information not less than fourteen (14) calendar days prior to purchase and/or installation. Two (2) will be returned to the Contractor. For items designated as Bidder Design Items, the Contractor shall submit eight (8) copies of all the required information not less than twenty-eight (28) days prior to purchase and/or installation. Two (2) copies will be returned to the Contractor. Individual sheets shall not exceed 22 inches x 34 inches.
2. Submittals regarding material and equipment shall be accompanied by Submittal/Transmittal Form. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete sections for which the submittal is required. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package, or are so functionally related that expediency indicates checking or review of the group or package as a whole.
3. unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX"; where "XXX" is the sequential number assigned by the Contractor. Resubmittals shall have the following format: "XXX-Y"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of Submittal 25.

B. Deviation from Contract: Submit a request for substitution for deviations from the Specifications or Drawings. Include the reason for the deviation and cost differential for the deviation. Deviations from the Contract shall be authorized by change order only.

C. Submittal Completeness: Submittals which do not have all the information required to be submitted are not acceptable and will be returned without review.

D. The Project Manager reserves the right to ask for Submittals that are not referenced in this document.

3.2 REVIEW PROCEDURE

A. The Project Manager will review the submittal and return it to the Contractor. The returned material will consist of two (2) marked-up copies of the submittal. The returned submittal will indicate one of the following actions:

1. If the review indicates the material, equipment or work method is in general conformance with the Contract Drawings/Specifications, the submittal copies shall be marked "Approved." In this event, the Contractor may begin to incorporate the material/equipment/work method covered in the submittal.
2. If the review indicates the submittal is insufficient or that limited corrections are required, the submittal copies may be marked "Approved as Noted." The Contractor may begin to implement the work method or incorporate materials/comments covered in the submittal in accordance with the corrections/comments noted.
3. If the review reveals the submittal is insufficient or contains incorrect data and the comments require revision and resubmittal, the submittal copies shall be marked "Not Approved, Resubmit." In this case, the Contractor shall not then undertake work covered by this submittal until the submittal has been revised, resubmitted, and returned to the Contractor with a marking of "Approved" or "Approved as Noted."
4. If the review reveals the material, equipment, or work does not require submittal, then the submitted copies shall be marked "Review Not Required Per Contract Documents." In this event, the Contractor may begin to incorporate the material/equipment/work covered by the submittal and no further action is required.

3.3 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

A. A mark of "Approved" or "Approved as Noted" shall mean the Project Manager has no objection to the Contractor, upon the Contractor's own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

B. The Contractor shall furnish to the Project Manager the following items for equipment, articles, and materials incorporated in the work:

1. Submittals for items identified in individual specification sections.
2. Manufacturer's special tools and special accessories normally furnished by the manufacturer and which, by their specific nature and special design, are suited for convenient and expeditious adjustment, maintenance, and repair.
3. Two sets of installation instructions, parts lists; routine preventative maintenance and operation manuals; corrective maintenance instructions; drawings and other like data pertinent for maintenance and repair.
4. Manufacturer's and dealer's warranties and guarantees which are normally available to purchasers. Such warranties and guarantees shall be made effective to the State as the purchaser.

END OF SECTION 013300

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association (The) www.aluminum.org	(703) 358-2960
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APWA	American Public Works Association www.apwa.net	(800) 848-APWA

ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
ICB	International Building Code, as amended by the Current Oregon Structural Specialty Code (OSSC)	
NEC	National Electric Code (Oregon Amended)	
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
ODOT	Oregon Standard Specifications for Highway Construction by the Oregon Department of Transportation.	
OHSA	Occupational Safety and Health Administration	
OSSC	Oregon Structural Specialty Code	
QPL	Qualified Products Listing by the Oregon Department of Transportation, Materials and Research Section.	
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
UBC	Uniform Building Code State of Oregon. OSSC Amended	
UPC	Uniform Plumbing Code State of Oregon, Plumbing Specialty Code	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies environmental mitigation and temporary environmental controls required to be maintained during construction. Nothing in this section shall relieve any person from the obligation to comply with the regulations or permits of any Federal, State, or Local authority.

B. Construction shall comply with requirements and conditions of all applicable permits. Permits include, but shall not be limited to the following:

1. U.S. Army Corps of Engineers – Permit No. 200100957
2. DSL Fill Permit – Permit No. 24832-RF Modified
3. City of Portland –Demolition and Building Permit (pending)

PART 2 – MATERIALS

2.1 SUBMITTALS

A. Submittal: Develop and maintain for the duration of the contract an Erosion Control Plan that will effectively incorporate and implement environmental protection precautions. The Contractor's Erosion Control Plan shall include methods and interim facilities to be constructed and/or used concurrently during construction to control erosion in such a manner as to ensure that sediment and sediment-laden water does not enter any drainage system, or violate applicable water quality standards. The Erosion Control Plan shall be in strict conformance with the requirements of the permits. Visible or measurable erosion which enters, or is likely to enter, a public storm and surface water system, wetland or stream is prohibited. The Plan shall include the name of the Contractor's employee authorized to supervise and enforce compliance with the Erosion Control Plan and telephone number(s) to contact that person at any time.

B. The Erosion Control Plan shall be submitted prior to initiating clearing activities.

C. In the event a regulatory agency or jurisdiction determines the Erosion Control Plan to be inadequate to protect the environment:

1. The Contractor shall immediately stop the affected work in progress until adequate environmental protection measures are implemented.
2. The Contractor shall modify the Erosion Control Plan to meet the requirements of said regulatory agencies or jurisdictions and provide the Engineer with the revisions to the Plan within five (5) calendar days of the notice of deficiency.

2.2 EROSION CONTROL

A. Temporary Sediment Fences

1. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers.
2. Filter fabric fence shall have manufactured stitched loops for 2”x2” post installation. Stitched loops shall be installed on the up-hill side of the sloped area, with posts spaced a maximum of 6 feet apart.
3. Where practical, the filter fabric shall be purchased in a continuous roll to the length required to avoid the use of joints.
4. The physical integrity of all materials shall be sufficient to meet the requirements of their intended use and withstand normal wear and tear.

B. Straw Bale Sediment Barrier/Bio-Filter Bags: Standard 40 to 60-pound rectangular bales of cereal grain or seed straw. Wooden stakes (2”x2”x 3 feet) shall be used for straw bales and bio-filter bags.

C. Plastic Sheeting: Polyethylene and have a minimum thickness of 6 mil.

PART 3 – EXECUTION

3.1 SITE MAINTENANCE

A. Dust shall be minimized by the Contractor to the extent practicable, utilizing all measures necessary including, but not limited to:

1. Sprinkling haul and access roads and other exposed dust-producing areas with water.
2. Use of covered haul equipment.

3.2 NOISE CONTROL

A. Comply with all local controls and noise level rules, regulations and ordinances.

B. Each internal combustion engine used on the job, or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without said muffler.

C. Noise levels for scrapers, pavers, graders, backhoes and trucks shall not exceed 90 dBA. For other equipment, noise levels shall not exceed 85 dBA. Equipment that cannot meet these levels shall be quieted by use of improved exhaust mufflers, noise attenuation barriers or other means approved by the Engineer.

D. If special circumstances or emergency conditions require work beyond the hours as specified, the Contractor shall:

1. Notify the Owner 72 hours in advance of any proposed extended work hours for preauthorization. The Contractor’s written request shall specify the work to be performed and the circumstances that warrant the request. The request shall include any additional measures to mitigate noise generated by this construction activity, if deemed necessary by the Engineer.
2. If an emergency situation occurs that warrants extended hours, the Contractor shall notify the Engineer immediately upon determining the need for this work.

3.3 DEWATERING AND WATER CONTROL

A. Maintain excavations free from water while construction is in progress. Keep trenches and other areas free from water as required to permit continuous progress of, or to prevent damage to, the work or the work of others.

3.4 FISH AND WILDLIFE HABITAT

A. The requirements of Local, State, and Federal agencies charged with wildlife and fish protection shall be adhered to by the entire construction work force.

B. A copy of all permits shall be available at the work site whenever operations authorized by the permit are being conducted.

C. Project construction involving work below the jurisdictional limits will occur within the in-water work window guidelines established by the Oregon Department of Fish and Wildlife (ODFW). The ODFW work window for this reach of the Columbia River is November 1 to February 28.

D. Hazardous, toxic and waste materials. Petroleum products, chemicals, fresh cement sandblasted material and chipped paint or other deleterious waste materials shall not be allowed to enter waters of the state. No wood treated with leachable preservatives shall be placed in the waterway. Machinery refueling is to occur off-site or in a confined designated area to prevent spillage into waters of the state. Project-related spills into water of the state or onto land with a potential to enter waters of the state shall be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311.

E. All construction debris shall be disposed of in such a manner that it cannot enter the waterway.

F. Equipment will be checked daily, prior to starting work, for leaks and any necessary repairs will be completed prior to commencing work activities.

G. Alteration or disturbance of the bank and bank vegetation will be limited to that necessary to construct the project. Upland staging for equipment will occur away from the embankment.

3.5 EROSION CONTROL

A. Execute the approved Erosion Control Plan.

B. Temporary Sediment Fences:

1. Filter fabric fence shall have a minimum vertical burial of 6 inches. All excavated material from filter fence installation shall be firmly re-deposited along the entire trenched area on the uphill side of the fence.
2. The filter fabric shall be installed to follow the contours where feasible. The fence posts shall be spaced a maximum of 6 feet apart and driven securely into the ground a minimum of 24 inches.

3. Sediment fences shall be inspected by the Contractor immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs, relocations, or additions shall be made immediately.
4. At no time shall more than one foot of sediment be allowed to accumulate behind a sediment fence. Sediment should be removed or regraded into slopes, and the sediment fences repaired and reestablished as needed.

C. Straw Bale Sediment Barrier/Bio-Filter Bags: This method may be used to divert runoff around active work areas or into sediment filtration/sedimentation areas.

1. Bio-filter bags can be used in drainage ditches and/or swales.
2. Straw bales and bio-filter bags shall be secured with stakes driven through them and into the ground to a minimum depth of 12 inches. Straw bales shall be keyed into the existing ground 2 to 4 inches.
3. At no time shall more than one foot of sediment be allowed to accumulate behind a straw bale sediment barrier and/or bio-filter bag system. Sediment should be removed or regraded into slopes, or new lines of barriers installed uphill of sediment-laden barriers.

D. Plastic Sheeting:

1. Spoils piles and exposed earth slopes shall be covered in wet weather or if wet weather is anticipated. Plastic sheeting shall be installed and maintained tightly in place by using sandbags or tires on ropes with a maximum 10 feet grid spacing in all directions. All seams shall be taped or weighted down full length and there shall be at least 12-inch overlap of all seams. For seams parallel to the slope contour, the uphill sheet shall overlap the downhill sheet. No runoff shall be allowed to run under the plastic covering.
2. Drainage from areas covered by plastic sheeting shall be controlled such that no discharge occurs directly onto uncontrolled, disturbed areas of the construction site.

E. Excavated materials shall be placed on the uphill side of the excavation except when there are overriding safety requirements or lack of available space. In no case shall excavated material be placed in streams, watercourses, or wetlands without required permits.

F. Vegetative Buffer Protection: Areas within or adjacent to the project may have steep slopes, or buffers of associated streams, watercourses, or wetlands that need to be avoided and protected from disturbance. The Contractor shall limit disturbance to existing vegetation in these areas to the extent possible. In no case shall the Contractor cause disturbance in associated streams, watercourses, or wetlands without required permits.

G. Under no circumstance shall Contractor’s vehicles or equipment enter a property adjacent to a stream, watercourse, or other storm and surface water facility, or a wetland without an Erosion Control Plan having been approved by the Engineer and implemented.

H. The Contractor shall not drag, drop, track, or otherwise place or deposit, or permit to be deposited, mud, dirt, rock or other such debris into any part of the public storm or surface water system, or any part of a private storm or surface water system. The Contractor at the Contractor’s expense shall immediately remove any such deposit of material. No material shall be washed or flushed into any part of the storm or surface water system without erosion control measures installed to the satisfaction of the Engineer.

I. The Contractor shall maintain the facilities and techniques contained in the approved Erosion

Control Plan so as to continue to be effective during the construction or other permitted activity. If the facilities and techniques approved in an Erosion Control Plan are not effective or sufficient as determined by the Owner, the Contractor shall revise the plan upon notification by the Owner. Upon approval of the revised plan by the Owner, the Contractor shall immediately implement the additional facilities and techniques. In cases where erosion is occurring, the Owner may require the Contractor to install interim control measures prior to submittal of the revised Erosion Control Plan.

J. The Contractor shall ensure that all necessary pollution control equipment, supplies, or materials are available to implement the Plan.

K. Filter fabric fences, sediment barriers and other erosion control devices shall be removed by the Contractor when they have served their useful purpose, but not before the upslope area has been permanently protected, stabilized, and any revegetation is established.

3.6 CULTURAL RESOURCES

A. Attention is directed to the National Historic Preservation Act of 1966 and 36 CFR 800, which provide for the preservation of potential historical, architectural, archaeological or cultural resources (hereinafter "cultural resources").

B. The Owner intends to conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources and fair compensation to the Contractor for delays resulting from such cultural resources investigations.

C. Monitoring: In the event potential cultural resources are uncovered during subsurface excavations at the worksite, the following procedures will be instituted:

1. Owner will issue a verbal work suspension directing the Contractor to cease all construction operations at the location of a potential cultural resources discovery. Engineer will contact a professional archaeologist to evaluate the significance of the find. A written Work Suspension Order will be issued within four hours of the verbal Work Suspension Order.
2. Such work suspension will be effective until such time as the qualified archaeologist can evaluate the potential cultural resources for their significance and make recommendations to the State Historic Preservation Officer. Any work suspension direction will contain the following:

    a. A clear description of the work to be suspended.
    b. Any instructions regarding issuance of further orders by the Contractor for material services.
    c. Specific direction to the Contractor to minimize the work suspension costs (i.e., work elsewhere while archaeologist is evaluating find).
    d. Estimated duration of the temporary suspension.

3. If the archaeologist determines the cultural resource is eligible to be nominated to the National Register of Historic Places, Owner may extend the duration of the Work Suspension Order in writing.
4. Equitable adjustment of the construction Contract time will be made for temporarily suspended work in accordance with the General Conditions.

3.7 FINES

A. Contractor shall be responsible for all fines incurred from non-compliance with regulations of governing authorities.

END OF SECTION 015719

PART 1 - GENERAL

1.1 SUBSURFACE INVESTIGATION

A. A copy of the Geotechnical Report, with respect to the project site, titled "Geotechnical Investigation Gleason Boat Ramp Project Northeast Marine Drive Portland, Oregon" dated June 20, 2001, by GRI may be obtained by request from the Owner.

B. This report identifies properties of below grade conditions and recommendations for the earth work.

C. These reports, by their nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of work will be made, with resulting additions or reductions to the Contract Sum accruing to the Owner.

END OF SECTION 020000

PART 1 - GENERAL

1.1 DESCRIPTION

A. Requirements Included:

1. The provisions of the General Requirements, Supplementary Requirements, and Division 1 apply to the plumbing work specified in this Division.
2. All materials, labor and equipment required to install complete plumbing work.
3. Cooperate with other trades.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, standards and specifications, except where more stringent requirements are shown or specified.

1. State of Oregon Structural Specialty Code.
2. State of Oregon Mechanical Specialty Code.
3. State of Oregon Plumbing Specialty Code.

B. Field Measurements: Take prior to preparation of shop drawings and fabrication, where possible.

C. Permits, Licenses, Fees, and Taxes: Obtain and pay for all permits, licenses, fees and taxes applicable to this project as required by law.

D. Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections provided. Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings. Bring to the attention of the Architect in writing all conflicts, incompatibilities, and/or discrepancies prior to bid. Provide all field wiring diagrams with each equipment submittal requiring same.

E. Drawings: Drawings are diagrammatic and show the general design, arrangement, and extent of the systems. Do not scale drawings for roughing-in measurements, nor use as shop drawings. Make field measurements and prepare shop drawings as required. Coordinate work with shop drawings of other specification divisions.

1.3 SUBMITTALS

A. Installation Submittals: Submit all equipment submittals bound together in groups.

B. Wiring Diagrams: Submit complete diagrams showing field installed wiring and devices.

C. Submittal Review: Comply with the contract documents where deviations, discrepancies, and conflicts between the submittals and the contract documents are discovered prior to or after the review process.

D. Project Record (As-Installed) Drawings:

1. Obtain and pay for reproducible drawings from Architect.
2. Keep Drawings clean, undamaged and up to date.
3. Accurately depict locations and changes of piping and ductwork and eradicate extraneous information.
4. Make Drawings available when requested by Architect for his review.
5. Submit as part of project close-out documents.

E. Maintenance Manuals: Submit five (5) sets of Operating and Maintenance Instructions.

1.4 STORAGE AND HANDLING

A. Delivery: Deliver to project site with manufacturer's labels intact and legible.

B. Handling: Avoid damage.

C. Storage: Inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.

1.5 PROJECT CONDITIONS

A. General: Provide products which are compatible with other portions of the work and provide products with the proper or correct power and fuel-burning characteristics, and similar adaptations for the project.

B. Arrangement: Arrange piping parallel with primary lines of the building construction, and with a minimum of 7' overhead clearance in unfinished equipment rooms where possible. Conceal all piping where possible unless indicated otherwise. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance. Give right-of-way to piping which must slope for drainage. Set all equipment level or as recommended by manufacturer.

C. Coordination: Where several elements of the work must be sequenced and positioned with precision in order to fit into the available space, prepare shop drawings showing the actual physical dimensions (at accurate scale) required for the installation and submit prior to purchase/fabrication/installation of any of the elements involved in the coordination.

1.6 STANDARDS

A. General: Provide all new materials and equipment identical to apparatus or equipment in successful operation for a minimum of two years. Provide materials of comparable quality omitted here but necessary to complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved in each case.

B. Governing Standards: The following are typical standards generally referenced in these specifications and identified by their acronym. Federal Specifications (FS), American Society for Testing Materials (ASTM) American National Standards Institute (ANSI), Manufacturers Standardization Society of the Valve and Fitting Industry - Standard Practice (MSS SP-69), Cast Iron Soil Pipe Institute (CISPI) numbers are given.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Copper Pipe and Tube:

1. Application: Domestic hot and cold water and priming lines
2. Pipe: ASTM B88.
   a. Above Ground Domestic Water: Type L hard temper copper with soldered joints.
   b. Underground Domestic Water and Priming Lines: Type L soft annealed with no joints or type K hard tempered copper with silver soldered joints.
3. Fittings: Wrought copper solder-joint fittings, ANSI B16.22.

B. Plastic Pipe - Drainage:

1. Application: Sanitary gravity waste, plumbing vent and rain drain.
2. Pipe: Polyvinyl chloride (PVC) plastic drain, waste and vent pipe and fittings (DWV), ASTM D2665.
3. Fittings: Provide fittings of the type indicated, matching piping manufacture. Where not otherwise indicated, provide fittings produced and recommended for the service indicated by the piping manufacturer.

C. Plastic Pipe:

1. Application: Pressure sewer
2. Pipe: Polyvinyl Chloride Plastic Pipe: Schedule 80, ASTM D1785.
3. Fittings: Provide fittings of the type indicated, matching piping manufacturer. Where not otherwise indicated, provide socket style, solvent weld fittings produced and recommended by the piping manufacturer for the service indicated.

2.2 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with installation requirements.

1. Tin-Antimony Solder: ASTM B32, Grade 95TA.
2. Lead Free Solder: ASTM B-32, Grade HB. Harris "Bridgit."
3. Silver Solder: ASTM B 32, Grade 96.5TS.

B. Tracer Wire: 14 gauge, single strand copper wire with blue insulation for water and green for sanitary sewer. 3M "DBY" direct bury splice kit required at all splices.

C. Valves: Provide factory fabricated valves of the type, body material, and pressure class indicated and service indicated. Where possible, provide valves from a single manufacturer.

1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping.
2. Locate valves in accessible spaces (or behind access panels) and so that separate support can be provided when necessary.

3. Install valves with stems pointed up, in the vertical position where possible, but in no case with stems pointed downward from a horizontal plane.
4. Valve Access: Provide access panels to all valves installed behind walls, in furring or otherwise inaccessible.

D. Supports and Anchors: Provide pipe and equipment hanger, support, anchors and related items for complete anchor, hanger and support systems. Install hangers, supports, clamps, and attachments to support piping and equipment properly from the building structure. Use no wire or perforated metal to support piping, and no supports from other piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.

2.3 PUMPS

A. Sewage Pump Station:

1. General: Provide two vertical mount non-clog close coupled non-overloading submersible sewage pumps complete with basin, pump support rail system, and controls. Pumps shall be approved for Class 1, division 1, group C & D hazardous environments. All hardware exposed to the pumped fluid shall be 300 series stainless steel. Size, capacity and arrangement as shown on the Drawings. Provide start-up service by manufacturers authorized representative.
2. Impeller: Heavy cast iron vortex design, balanced at the factory to ensure hydraulic and mechanical balance and threaded to the shaft to maintain smooth water passageway. Well rounded vane edges for smooth flow and back side pump out vanes. Powder coat epoxy protective finish
3. Volute: Heavy cast iron sections with bolted contoured cleanout plug. Powder coat epoxy protective finish.
4. Wear Rings: Peripheral type requiring no vertical adjustment and pressed into the case for ready placement in the field.
5. Motor shaft: Stainless steel.
6. Bearings: Ball type bearings of sufficient size to withstand all radial and thrust loads applied. Bearing s are permanently lubricated by the motor oil fill.
7. Seals: Dual silicon carbide mechanical shaft seals installed in a tandem arrangement.
8. Vertical Frame: One piece cast iron, minimum 40,000 pounds tensile strength, normalized to prevent post machining distortion. Lined, bored bearing fits for exact concentricity and to prevent misalignment and roller finished to exact size for further alignment and heat transfer.
9. Motor: Oil filled NEMA B design with cooling fins, watertight junction box, and stainless steel lifting bail. Single phase motor with internal thermal sensor. Provide with SO type multiconductor power and control cord. Watertight through wall terminals between the junction box and the motor housing.
10. Control:

a. Provide complete operating controls including pump start and stop float switches, high level alarm, control panel and automatic alternator. NEMA 3R or 4X outdoor rated control panel with control circuit transformer, electric alternator, pump running lights, circuit breaker for each motor, pump motor magnetic starters with HOA switches, overload and undervoltage protection, and elapsed time meter for each pump. Include intrinsically safe float controls to stop pump, start lead pump, start lag pump (both running together) and signal high level alarm. Pump safety systems to include motor high temperature and moisture detection. Provide corresponding safety circuits in pump controller. All switches and pilot lights mounted on inner door with blank lockable external door.

b. Include audible alarm with silencing switch and flashing red light. Light to remain on until high level is corrected.

c. Float switches of externally weighted style.

11. Basin:

a. Fiberglass basin with non-flotation ring, stainless steel float support brackets, inlet and discharge pipe fittings, conduit fittings, and watertight solid fiberglass bolted cover.

b. Pump rail support system with epoxy coated cast iron base elbow and pump and rail support. Stainless steel rail pipes and lifting cables.

c. Install pump discharge piping with full way shutoff and check valves on each pump discharge line.

12. Manufacturer: Zoeller Co. or approved substitute.

2.4 PLUMBING MATERIALS

A. Utility Connections: Make utility and equipment connections and install distribution piping as shown on the Drawings and specified herein. Verify size, location, depth, elevation and arrangement of connection points before bidding or starting work.

B. Cleanouts:

1. Manufacturer: J.R. Smith, Josam, Zurn, Wade. Smith numbers used as a basis of selection.

2. Types:

a. Tile Floor Cleanouts: Smith 4053-U with square heavy-duty nickel bronze top, taper thread, bronze plug, and vandalproof screws.

b. Concrete Floor Cleanout: Smith 4023 with round heavy-duty nickel bronze top, stainless steel shallow cover and vandalproof screws.

c. Wall Cleanouts: Smith 4472-U, bronze ferrule with raised head bronze plug, stainless steel shallow cover and vandalproof screws.

d. Outside Area Walks and Drives: Smith 4253-U-G with galvanized cast iron body, top secured with vandalproof screws, taper thread and bronze plug. Install in 18" x 18" x 6" deep concrete pad flush with grade.

PART 3 - EXECUTION

3.1 LAYOUT AND COORDINATION

A. Site Examination: Before starting work, carefully examine site and all contract Drawings. Become thoroughly familiar with conditions governing work on this project.

B. Utility Locations: The location of all utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the Drawings and are taken from existing public records.

C. Discrepancies: Any error, conflict or discrepancy in Plans, Specifications and/or existing conditions shall be reported immediately. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of ducts or piping be necessary, provide for approval the simplest layout possible for that particular portion of the work.

3.2 CONTINUITY OF EXISTING SERVICES

A. Existing water, sewer, power, and other services shall remain in service during new construction work. Coordinate any interruption of these services with the Owner's representative a minimum of twenty-four (24) hours in advance. Arrange work to minimize number and extent of all interruptions.

B. Protect from damage active utilities existing and evident by reasonable inspection of the site whether shown or not on the Drawings. Protect, relocate or abandon utilities encountered in the work which are not shown on the Drawings or evident by inspection of the work as directed by the Architect. Maintain continuity of all utility services to existing buildings.

3.3 EQUIPMENT REMOVAL

A. All removed mechanical equipment is the property of the Contractor unless indicated otherwise. Disconnect and remove all such equipment from the project property.

B. Where equipment is to be reused, reconnect piping, wiring and/or controls to allow this equipment to function as it had prior to this renovation unless indicated otherwise.

3.4 INSTALLATION

A. Locating and Positioning Equipment: Observe all Codes and Regulations and good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment. Installation of any equipment with less than minimum clearances shall not be accepted.

B. Anchorage: Anchor and/or brace all mechanical equipment, piping and ductwork to resist displacement due to seismic action, include snubbers on equipment mounted on spring isolators.

C. Adjusting: Adjust and calibrate all automatic mechanical equipment, mixing valves, flush valves, float devices, etc. Adjust flow rates at each piece of equipment or fixture.

D. Concrete Work: Coordinate with other work, particularly other concrete work and accessories.

E. Sewage Lift Station: Assemble, install, and adjust lift station in accordance with the manufacturers installation instructions.

3.5 PROTECTION

A. Protect all work and materials against loss or damage. Close all pipe openings with caps or plugs. At final completion, thoroughly clean and deliver all work and equipment in an unblemished new condition. Keep all motors and bearings in watertight and dustproof covers during entire course of installation.

3.6 CUTTING AND PATCHING

A. Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of mechanical work. Do all necessary cutting and patching of existing building and yard surfaces required for completion of the mechanical work. Patch to match finish and color of adjacent surfaces. Coordinate work in remodel and new areas to avoid cutting of new finished surfaces.

3.7 UTILITY SERVICE

A. Plumbing Utility Connections: Complete installation. Contact local serving utilities to determine conditions involved and make or arrange to have connection made at the proper time and pay all costs involved.

3.8 EXCAVATION AND BACKFILL

A. Do all necessary trenching and excavating for installation of all underground piping and equipment. Use all necessary precautions not to affect the bearing value of soil under and near footings. Excavate pipe trenches to exact depth with proper pitch so piping will rest on undisturbed earth with recesses for fittings. Tamp bottom of trenches hard. Use clean gravel under lines for correction of elevation where excavation is deeper than required. Where piping passes through solid rock, excavate trench through rock 6" deeper than required by line grade and pre-fill to line grade with pea gravel or sand. Where trenching occurs through existing paving, walks, curbs, etc., patch and repair to original conditions. Puddle, tamp, and/or crown all backfill in not more than 6" layers as required by material as directed. Backfill under floor slabs and under hard surfaced yard areas (i.e. walks, drives, parking areas) to be crushed rock compacted in 6" layers. Backfill material and compaction to comply with Site Work section of these Specifications.

3.9 PIPE INSTALLATION

A. General: Install pipe, tube and fittings in accordance with recognized industry practices for each indicated service without piping failure. Install each run with a minimum of joints and couplings, but with adequate and accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections. Under no conditions shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.

B. Tracer Wire: Install tracer wire as close to underground non-metallic water, sanitary and storm sewers and gas pipe in the trench as possible. Tracer wire shall be accessible at grade via all services, valve and meter boxes, curb cocks, cleanouts at the building, manholes (inside the cover near the top), etc. Locate all points on the record as-installed drawings. Splice into utility tracer system where available. Comply with code requirements.

3.10 PIPING JOINTS

A. General: Provide joints of the type indicated in each piping system, and where piping and joint as manufactured form a system, utilize only that manufacturer's material.

B. Solder Copper Tube and Fitting Joints: In accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in a manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens. "T-Drill" field-formed tees may be utilized where the main is at least two pipe sizes larger than the branch.

C. Braze Copper Tube and Fitting Joints: Where indicated, in accordance with ANSI B31. Pass a slow stream of dry nitrogen gas through the tubing at all times while brazing to eliminate formation of copper oxide.

D. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:

1. Heat Joining of Thermoplastic Pipe: ASTM D-2657.
2. Making Solvent-Cemented Joints: ASTM D-2865 and ASTM F-402.

E. Changes in Direction: Use fittings for all changes in direction. Run lines parallel with building surfaces.

F. Line Grades:

1. Drainage Lines: Run at maximum possible grade and in no case less than 1/4" per foot within building.
2. Vents: Pitch for drainage 1/4" per 10'.
3. Water: Pitch to low points and install hose bib drains. 3' minimum depth of ground cover for all lines outside building unless otherwise noted.

G. Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good installation practice.

3.11 MISCELLANEOUS PIPING EQUIPMENT

A. Floor, Wall and Ceiling Plates: Chrome-plated pressed steel or brass screw locked split plates on all pipe penetrations in finished spaces.

B. Strainers: Install in a manner to permit access for cleaning and screen removal and with blow-off valve.

C. Sleeves: At all penetrations of concrete or masonry construction. PVC, 24 gauge galvanized steel or Schedule 40 galvanized steel pipe. Use steel pipe sleeves through beams, footings, girders or columns and for all penetrations of walls or floors below grade. Where floor finish is ceramic tile, terrazzo, or similar material extend standard steel pipe sleeves 1-1/2" above finished floor. Fabricate sleeves 1" diameter larger than pipe or insulation. PVC and sheet metal sleeves at non-structural penetrations only.

D. Sleeve Caulking: Caulk insulated pipe with rubber link seal. Grout uninsulated pipe with cement mortar or waterproof mastic. All caulking or grouting shall extend full depth of sleeve. Utilize rubber sealing links in lieu of caulking.

3.12 CLEANING

A. Remove construction protection, tags and labels and thoroughly clean all plumbing equipment and trim and scour all fixtures just prior to building acceptance.

B. General: Clean all dirt and construction dust and debris from all mechanical piping systems and leave in a new condition. Touch up paint where necessary.

C. Domestic Water System: Flush with clean water to eliminate grease, cuttings and foreign matter; run water until clear and free of oil. Chlorinate domestic water as per procedure outlined by Board of Health.

D. Waste and Storm Drainage System:

1. Remove construction debris from cleanouts, drains, strainers, baskets, traps, etc., and leave same accessible and operable.
2. Clear the interior of sewer piping of dirt and other superfluous material as the work progresses. Flush lines between manholes to remove collected debris. Place plugs in the end of uncompleted conduit at the end of the day or whenever work stops.
3. Before final acceptance of completed sewer system, flush and clean the entire system with water. Trap and remove solid material obtained from flushing and cleaning from the new system. Do not allow debris to enter the existing sewer system.

3.13 TEST

A. General:

1. Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
2. Provide all necessary temporary equipment for testing, including pump and gauges. Remove control devices before testing and do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure and time.
3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

B. Repair:

1. Repair piping systems sections which fail the required piping test by disassembly and re-installation, using new materials to the extent required to overcome leakage. Do not use chemical stop-leak compounds, solder, mastics, or other temporary repair methods.
2. Drain test water from piping systems after testing and repair work has been completed.

C. Sewer: Furnish all facilities and personnel for conducting the test. Test in accordance with the requirements of the State Plumbing Inspector and local authorities.

D. Drainage and Vent Piping: Hydrostatic test by filling to highest point, but not less then 10' water column on major horizontal portion.

E. Water Piping: Hydrostatic pressure of 100 psig without loss for four hours.

3.14 MECHANICAL WORK CLOSEOUT

A. Refer to the Division 1 sections for general closeout requirements. Calibrate all equipment requiring same.

END OF SECTION 220000

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Valves and accessories.

B. Field quality-control test reports.

C. Operation and maintenance data for the following:

1. Valves.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

D. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. PVC, Schedule 40 Pipe: ASTM D 1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

2.2 JOINING MATERIALS

A. Refer to Division 22 Section "Plumbing Materials and Methods" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Soldering Flux: ASTM B 813, water-flushable type.

E. Solder Filler Metal: ASTM B 32, lead-free type with 0.20 percent maximum lead content.

2.3 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

a. Standard: AWWA C219.

2.4 GATE VALVES

A. Bronze Gate Valves:

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

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corporation.
h. Or approved equal.

2. Nonrising-Stem Gate Valves:

a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

1) Standard: MSS SP-80.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.6 WATER METERS

A. Connect to Existing 1-1/2” water meter.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 shall be any of the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 40 pipes; PVC, Schedule 40 socket fitting; and solvent-cemented joints.

F. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2shall be same as underground water-service piping.

G. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 shall be hard copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Use the following for valves in vaults and aboveground:

a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Connect to existing water meter.

B. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

C. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

D. Bury piping with depth of cover over top at least 36 inches, with top at least 12 inches below level of maximum frost penetration.

E. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping within five (5) feet of building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

F. Mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.5 JOINT CONSTRUCTION

A. See Division 22 Section “Plumbing Materials and Methods" for basic piping joint construction.

B. Make pipe joints according to the following:
1. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
2. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 22 Section "Common Work Results for Plumbing" for joining piping of dissimilar materials.

3.6 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.8 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. See Division 22 Section "Plumbing Materials and Methods" for piping connections to valves and equipment.

C. Connect water-distribution piping to existing water meter.

D. Connect water-distribution piping to interior domestic water piping.

3.9 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.10 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

3.11 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, nonpressure and pressure sanitary sewerage outside the building, with the following components:

1. Pump station per Section 220000 Plumbing Materials and Methods.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

B. Force main: pressure piping pressure rating: at least equal to system operating pressure but not less than 150 psig.

1.3 SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations.

B. Field quality-control test reports.

C. Product Data: For the following:

1. Cleanouts.
2. Pipe material.

1.4 PROJECT CONDITIONS

A. Site Information: Research public utility records and verify existing utility locations prior to ordering any materials. Notify the Engineer immediately if any discrepancies are found in the project survey.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 PVC PRESSURE PIPE

A. Pipe: ASTM D 1785, Schedule 80 Pipe with Plain ends for solvent cement joints.

B. Standard Fittings: ASTM D 2467, Schedule 80 socket type fittings.

2.4 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings: According to the following:

1. PVC Sewer Pipe and Fittings, NPS 4 to NPS 15 ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.

a. Gaskets: ASTM F 477, elastomeric seals.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
2. For Dissimilar Pipes: ASTM D 5926, PVC, or other material compatible with pipe materials being joined.

2.6 PRESSURE-TYPE COUPLINGS

A. Reducing or transition, metal, bolted, sleeve-type, reducing or transition coupling, for joint underground pressure piping. Include 150-psig minimum pressure rating and ends of same sizes to be joined.

B. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

1. Manufacturers:

a. Cascade Waterworks Mfg.

b. Dresser, Inc.: DMD Div.
c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
d. JCM Industries.
e. Romac Industries, Inc.
f. Smith-Blair, Inc.
g. Viking Johnson.

2. Center-Sleeve Material: Manufacturer's standard.
3. Gasket Material: Natural or synthetic rubber.
4. Metal component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Couplings: With split sleeve with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.

1. Manufacturers:

a. Brico Industries.

2. Sleeve Material: Manufacturer's standard
3. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
4. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
5. Metal Component Finish: Corrosion-resistant coating or material.

2.7 CLEANOUTS

A. At grade clean outs shall have an adjustable sleeve-type housing, a threaded brass plug with counter sunk slot, and a cast iron frame and cover.

B. Clean outs for force mains shall have pressure rated components.

C. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

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 nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. Shielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range.

1. NPS 4: PVC sewer pipe and fittings gaskets, and gasketed joints.

2. Force Main, Pressure Piping: use PVC Schedule 80 pipe, preschedule 80 fittings and solvent-cemented joints.

3.2 PIPING INSTALLATION

A. Excavating, trenching, and backfilling are specified in Section 312000.

B. Identification: Materials and their installation are specified in Section 312000. Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

1. Use detectable warning tape over all piping and over edges of underground structures.

C. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage 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.

D. 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.

E. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

F. 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.

G. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.
2. Install piping with 36-inch minimum cover.
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

H. Install force-main, pressure piping according to the following:

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer’s proprietary restraint system, or cast-in-place concrete supports or anchors.
2. Install piping with 36-inch minimum cover.
3. Install piping below frost line.
4. Install PVC pressure piping according to AWWA M23 or ASTM D2774 and ASTM F 1668.

I. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

J. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

K. Install backwater valves in piping where indicated.

3.3 PIPE JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 22 Section "Common Work Results for Plumbing." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure, 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 hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
5. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

C. Join force-main, pressure piping according to the following:

1. Join PVC water-service piping according to ASTM D 2855.
2. Join dissimilar pipe materials with pressure-type 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, per plans. Set with tops 1-inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent 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 overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

C. Make connections to existing piping and underground structures so finished Work complies with requirements specified for new Work.

3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
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.

2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

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. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
b. Close openings in system and fill with water.
c. Purge air and refill with water.
d. Disconnect water supply.
e. Test and inspect joints for leaks.

f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig.

6. Air Tests: Test sanitary sewerage 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. Manholes: Perform hydrostatic test according to ASTM C497 .

D. Leaks and loss in test pressure constitute defects that must be repaired.

E. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 221313

PART 1 - GENERAL

1.1 DESCRIPTION

A. The provisions of the General Requirements, Supplementary Requirements, and Division 1 apply to the electrical work specified in this Section.

B. The requirements of this Section apply to the electrical systems specified in these Specifications and in other Division 26 sections.

C. Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or scheduled on the Drawings and/or in these Specifications, including all labor, supervision, services, permits, fees, and incidentals necessary and required to provide a complete and operable facility with complete systems as shown, specified, and required by applicable codes.

D. The work shall include, but not be limited to, the following systems:

1. Electrical service complete per serving utility company requirements.
2. Electric service and distribution equipment.
3. Connection of electrical equipment furnished under other Divisions of this Specification.
4. Wiring to and connection of electrical equipment or appliances furnished outside of these Specifications and Contract but described on the Electrical Drawings.
5. Special systems as specified herein.
6. Grounding.

E. Advise subcontractor, suppliers, and vendors involved in the work specified in this Section of the applicable requirements.

F. Temporary electrical service, Division 1.

1.2 QUALITY ASSURANCE

A. All work and materials shall conform to all applicable local and state codes and all federal, state and other applicable laws and regulations. All clarifications and modifications which have been cleared with appropriate authorities are listed under the applicable sections. All electrical products shall bear the UL label.

B. Whenever the requirements of the Specifications or Drawings exceed those of the applicable code or standard, the requirements of the Specifications and Drawings shall govern.

C. Codes and Standards: Comply with the provisions of the following referenced codes, standards and specifications:

1. Institute of Electrical and Electronic Engineers (IEEE)
2. Federal Specifications (FS)
3. American National Standards Institute (ANSI)
4. National Electrical Manufacturer's Association (NEMA)

5. National Fire Protection Association (NFPA)
6. Underwriters Laboratories, Inc. (UL)
7. Factory Mutual (FM)
8. International Building Code (IBC) with State and Local Amendments
9. National Electrical Code (NEC) with State and Local Amendments
10. American Society for Testing and Materials (ASTM)
11. Americans with Disabilities Act (ADA)
12. International Fire Code (IFC) with State and Local Amendments
13. National Electrical Contractors Association (NECA)

D. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name. Where two or more units of the same class of equipment are furnished, use product of the same manufacturer; component parts of the entire system need not be products of same manufacturer. Furnish all materials and equipment, new and free from defect and of size, make, type and quality herein specified or approved by the Architect. All materials shall be installed in a neat and professional manner.

E. All apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.

F. All disconnect switches, panelboards, switchboards, motor control centers, and equipment of like nature shall be of the same manufacturer.

G. The Drawings and Specifications are complementary. What is called for by one shall be as though called for by both. If Drawings and Specifications contradict each other, the Contractor shall obtain written clarification prior to the bid. If time constraints are such that this is not possible, then the more stringent of the conflicting requirements shall be included in the bid. The Specifications are not automatically more authoritative than the drawings.

1.3 WORK OF OTHER CONTRACTS

A. Work under this contract shall be conducted in a manner to allow for the future installations of such equipment or items, and include the wiring and/or devices shown on the Drawings or listed in other sections of this Specification. Also see "Equipment Connections."

1.4 WORK OF OTHER DIVISIONS

A. Work under this Division shall be conducted in a manner to cooperate with the installation of such equipment or items as specified in other Divisions.

B. Control devices and control wiring relating to the heating and air conditioning systems are specified under other Sections of these Specifications except for provisions or items specifically noted on the Drawings or specified herein.

C. Consult all Drawings and Specifications in this project and become familiar with all equipment to be installed. Coordinate all aspects of the construction with the other trades on the job to ensure that all work and materials required to provide a complete and operational facility are included in the bid.

D. All sections of Division 26 are interrelated and shall be considered in their entirety when interpreting any material, method, or direction listed in any section of Division 26. Individual sections are not written for specific subcontractors or suppliers but for the general contractor.

1.5 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Submit in accordance with Division 1 full technical and descriptive shop drawing data on proposed materials and equipment as detailed in each section.

B. The Contractor shall verify that all equipment submitted can be delivered and installed within the time constraints of the construction period.

C. Include the manufacturer, type, style, catalog number, complete specification, certified dimensions, and description of physical appearance for each item and option submitted. Reproduction of catalog data sheets shall be clean and legible to show all details, including gauge of metal used.

D. Include only information on exact equipment to be installed, not general catalogs of the manufacturer. Where sheets show proposed equipment as well as other equipment, identify proposed equipment with rubber stamp arrow or similar concise method.

E. Submit with each copy a transmittal letter verifying that all included equipment submittals have been carefully considered for quality, dimensions, function, and have been coordinated with the Drawings and Specifications. Guarantee that proposed materials will meet or exceed the quality and function of those specified.

F. Include wire run and connection diagrams for all signal and/or low voltage systems, including floor plans.

G. Submittal Review: The submittal review process is a means to determine quality control. The action noted to be taken (or where conflicts with the contract documents are not noted) shall not be interpreted by the Contractor as automatic "change orders." Approval of the data for substitution and shop drawings shall not eliminate the contractor’s responsibility for compliance with Drawings or Specifications, nor shall it eliminate the responsibility for freedom from errors of any sort in the data discovered prior to or after the review process. Deviations, discrepancies, and conflicts between the submittals and the Contract Documents shall be called to the Architect's attention in writing at the time of transmittal of the data.

H. Unless otherwise directed by Division 1, submittal data shall be in a 3-ring plastic binder with a clear plastic sleeve and a project identification sheet inserted. Arrange submittals numerically with specification sections identified on divider tabs. All required sections shall be submitted at one time.

1.6 PRODUCT SUBSTITUTION

A. Material other than those specified may be approved for this project providing a written request is submitted to the Architect prior to bid in accordance with Instructions to Bidders. Requests shall include complete specifications, dimensions, manufacturer and catalog number for each item for which approval is desired. If, in the opinion of the Architect, the material is not complete or if it is not an acceptable substitute, he may reject it. The Architect's evaluation will be based solely on the material submitted.

1.7 CHANGE ORDERS

A. All supplemental cost proposals by the Contractor shall be accompanied by a complete itemized breakdown of labor and materials without exception. At the Architect's request, the contractor's estimating sheets for the supplemental cost proposals shall be made available to the Architect. Labor must be separated and allocated for each item of work.

1.8 RECORD DOCUMENTS

A. Maintain a set of record drawings as directed in Division 1.

B. Keep Drawings clean, undamaged, and up to date.

C. Record and accurately indicate the following:

1. Depths, sizes, and locations of all buried and concealed conduits/cables.
2. Changes, additions, and revisions due to change orders, addenda, obstructions, etc. Eradicate extraneous information.

D. Make Drawings available when requested by Architect for review.

E. Submit as part of the required Project Closeout documents as indicated in Division 1.

F. Use standards set in contract documents. Note field modifications, all addenda and change order items on project record drawings. If deficiencies are found in either the quality or the accuracy of the drawings, they will be returned unapproved. Additional review of subsequent submissions shall be at the contractor’s expense.

1.9 OPERATING AND MAINTENANCE DATA

A. Upon completion of Contract and after no further action is noted as being required on catalog data submitted for review, submit multiple sets of Operating and Maintenance Manuals for inclusion in Owner's Maintenance Brochure as specified in Division 1. Operation and maintenance manuals shall include descriptive and technical data, maintenance and operation procedures, wiring diagrams, spare parts lists, service representatives, supplier for replacement parts, etc. Bind each set of Operating and Maintenance Manuals in 3-ring, vinyl or canvas covered, loose leaf binders organized with index and thumb-tab marker for each classification of equipment or data.

1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

A. At the completion of the project, at a time scheduled by the Owner, assemble key mechanics, subcontractors, vendors, factory representatives and similar personnel required to explain all facets of maintenance and operation of the installed system to the Owner's personnel. Instructions shall include actual operation of systems and methods of maintenance.

1.11 ALTERNATE BIDS

A. Refer to Division 1 for possible effect upon Work of this Division.

1.12 WARRANTY

A. Furnish, prior to application for final payment, three copies of written and signed guarantee effective a period of one year from date of completion and acceptance of entire project; agree to correct, repair and/or replace defective materials and/or equipment or the results of defective workmanship without additional expense to the Owner. Where no response satisfactory to the Owner has occurred within three working days from the written report of a warranty covered defect, the contractor shall agree to pay for the cost of repair of the reported defect by a contractor of the Owner's choice.

B. Where the manufacturer's guarantee exceeds one year, the longer guarantee shall govern and include the Contractor's labor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All electrical products installed in this project shall be listed by Underwriters Laboratories, Inc., or be approved in writing by the local inspection authority as required by governing codes and ordinances.

B. All material shall be new and bear manufacturer's name, model number, electrical characteristics and other identification, and shall be the standard product of manufacturer regularly engaged in production of similar material.

C. All materials shall be of manufacturer's latest design, and of the best quality. The materials shall be manufactured in accordance with applicable standards listed under Quality Assurance.

2.2 ACCESS PANELS

A. Provide panels of adequate size for equipment requiring service and installed above plaster or gypsum board ceilings, behind walls or in furring. Furnish complete with correct frame for type of building construction involved. Size, number and location of access panels is not necessarily shown on Drawings. Use no panel smaller than 12" x 12" for simple manual access, nor smaller than 16" x 20" where personnel must pass through. Milcor Style A, K, L, or M panels or equivalent Bilco or Potter-Roemer as required by construction. Access panels shall maintain ceiling fire rating.

2.3 PAINTING

A. The work of this Division includes painting of the electrical items. All exposed conduits, boxes, surface raceways, etc. shall be painted per the Architect's direction. See Division 9 for additional painting requirements.

2.4 FIRE RATINGS

A. Electrical items (light fixtures, boxes, etc.) recessed into fire rated walls or ceilings shall be alcoved in gypboard enclosures or be UL listed to maintain the fire rating.

PART 3 - EXECUTION

3.1 LAYOUT AND COORDINATION

A. The Contractor shall inspect the job site prior to bidding and become familiar with existing conditions which will affect his work. The Drawings are diagrammatic indicating approximate location of outlets, lighting fixtures, electrical equipment, etc. Consult the Architectural, Structural and Mechanical Drawings to avoid conflicts with equipment, structural members, etc. When required, make all deviations from Drawings to make the work conform to the building as constructed, and to related work of others. Minor relocations ordered prior to installation may be made without added cost to the Owner.

B. Obvious omissions from Drawings or Specifications or differences between Drawings and Specifications shall be called to the Architect's attention at least ten (10) days prior to the bid date for clarification. Failure to do so will be construed as the willingness of this Contractor to supply all necessary materials and labor required for the proper completion of this work in a manner approved by the Architect.

C. Call to the attention of the Architect any error, conflict or discrepancy in Drawings and/or Specifications. Do not proceed with any questionable items of work until clarification of same has been made.

D. Supplementary details and plans may be supplied as required and they will become a part of the Contract Documents.

E. Work under this Division shall be conducted in a manner to cooperate with all other trades for proper installation of all items of equipment.

F. Coordination of work with other crafts employed on the project is mandatory. Arrange work to reduce interruption of existing services to minimum. When interruptions are unavoidable, consult Architect and utilities involved and agree in writing, with copy to the Architect, upon a mutually satisfactory time and duration.

G. Verify the physical dimensions of each item of electrical equipment to fit the available space and promptly notify the Architect prior to roughing-in if conflicts appear. Coordination of equipment to fit the available space and the access routes through the construction shall be the Contractor's liability.

H. Locations of items shown on the Drawings as existing are partially based on record and other drawings which may contain errors. The Contractor shall verify the correctness of the information shown prior to rough-in or demolition and notify the Architect of any discrepancies.

I. Coordinate all work and trim with carpet installers. Provide carpet plates on all carpet surfaces, complete as required.

J. Install equipment such that code-required working clearances are maintained, and allow clearances for future maintenance.

K. Coordinate installation of electrical conduit, boxes, fittings, anchors, and miscellaneous items to be concealed in precast concrete assemblies.

3.2 UTILITY COORDINATION

A. Utility Coordination: Coordinate all aspects of the incoming electrical, telephone and other utility services indicated with the city engineer, serving utility, and the off-street improvements contractor. Requirements of the utility company which exceed the provisions made on the Drawings or covered by these Specifications shall take precedence. Provisions made on the Drawings or Specifications in excess of the utility company's requirements shall take precedence. No additional compensation will be allowed the contractor for connection fees or additional work or equipment not covered in the Drawings or Specifications which are a result of policies of the serving utilities.

B. The Contractor shall contact the serving utility representatives and verify if any charges will be rendered against this project. These charges, if any, shall be included within the basic bid figure.

1. The utility representative is ***PacifiCorp, Tom Kikes, #503-280-2708***:

3.3 EXCAVATING AND BACKFILL

A. Provide trenching, backfilling, compaction, repaving or other site restoration as required by the work done in this Division. Minimum trench depth shall be 36" unless otherwise noted. Install 6" wide red vinyl tape with lettering "Caution: Buried Electric Line Below" 18" above all buried electric lines in this contract.

B. Excavating and backfilling required for installation of electrical work shall be performed in accordance with requirements specified in Division 31. Backfill in excavations outside of building may be excavated material from site containing no rocks over 3/4" in diameter.

C. Provide all necessary backfill materials, whether from site excavations or from off-site borrows, to completely fill excavations. Coordinate patching of all asphalt or concrete surfaces disturbed by this work with the Owner.

D. Bored Crossings: Casing shall be smooth steel pipe fabricated in sections for welded joints, of size sufficiently large to provide adequate working space to properly install conduits, continuous butt welded at joints for rigid, watertight encasement, minimum thickness of 0.188” for casing under 14” diameter, and 0.281” for casings 14” and larger diameter.

3.4 PROTECTION OF WORK

A. Protect electrical work, wire and cable, materials and equipment installed under this Division against damage by other trades, weather conditions or any other causes. Equipment found damaged or in other than new condition will be rejected as defective.

B. Switchgear, panels, light fixtures and electrical equipment shall be kept covered or closed to exclude moisture, dust, dirt, plaster, cement, or paint and shall be free of all contamination before acceptance. Enclosures and trims shall be in new condition, free of rust, scratches or other finish defects. Properly refinish in a manner acceptable to the Architect if damaged.

C. Including products of other Sections, clean, repair and touch-up or replace when directed, products which have been soiled, discolored or damaged.

D. Provide for dehumidification of equipment during construction when directed by Architect.

E. Remove debris from project site upon completion or sooner if directed.

3.5 GENERAL INSTALLATION METHODS

A. Provide raceways and conduits for all electrical system wiring as specified herein. Class II or III systems wiring installed per Article 725 of NEC will be required to be installed in raceway unless otherwise indicated. When open wiring is permitted, raceways will be required in insulated walls and in other inaccessible areas. Low voltage wiring installed in return air plenums shall utilize plenum rated cable.

B. The extent of the branch circuiting and control wiring shown shall not be changed.

C. Cross or hash marks on power and lighting conduit runs indicate quantity of No. 12 minimum copper branch circuit conductors unless otherwise noted. Where such marks do not appear, provide conductors as required to provide an operable system, sized per local codes.

D. Repair surfaces damaged during installation to match adjacent undisturbed areas. Surface preparation, including cleaning and priming, shall be in accordance with the paint manufacturer's requirements.

E. Adjacent panelboards, component cabinets, terminal cabinets, trench duct, and wire gutter exposed in finished areas shall have matching trim and finish.

F. In general, the mounting heights shall be as noted on the Drawings or as listed below. Where no heights are indicated, request clarification from the Architect. Consult the Architectural, Structural, and Mechanical Drawings to avoid conflicts prior to roughing in. All dimensions are to the center of the device above finished floor unless specified otherwise. Lighting dimensions are to the bottom of suspended fixtures; mount panelboards 72" to top handle; mount devices above counters, 12" above counter or 4-1/2" above backsplash, whichever is greater; and receptacles in unfinished areas 48".

G. All raceways and wiring shall be concealed where possible. All wiring devices, recessed light fixtures, etc., shall be flush mounted unless otherwise noted.

H. Relays, panels, cabinets and equipment shall be level and plumb and installed parallel with structural building lines. All equipment and enclosures shall be suitable for the environmental conditions in which they will operate.

I. The Drawings do not indicate all items necessary. Provide associated equipment, materials, and labor as required for complete and operable systems.

3.6 CUTTING AND PATCHING

A. Under no conditions are beams, girders, footings or columns to be cut for electrical items unless so shown on Drawings or written approval obtained from the Architect.

B. Cutting, patching and repairing for the proper installation and completion of the work specified, including plastering, gypsum board, masonry work, concrete work, carpentry work and painting shall be performed by workers skilled in their respective trades.

C. Follow requirements specified in Division 1.

3.7 SLEEVES AND CHASES

A. Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls. Seal all openings around conduits against leaks and in a manner to maintain the fire rating of the structure penetrated. Prevent unnecessary cutting in connection with the finished work. Make all repairs and seals in a manner acceptable to the Architect.

3.8 NOISE CONTROL

A. The entire electrical system apparatus shall operate at full capacity without objectionable noise or vibration.

B. Outlet boxes at opposite sides of partitions shall not be placed back-to-back, nor shall straight-through boxes be employed, except where specifically permitted on the Drawings by note, to minimize transmission of noise between occupied spaces.

C. Contactors, transformers, starters, and similar noise-producing devices shall not be placed on walls which are common to occupied spaces unless specifically called for on the Drawings. Where such devices must be mounted on walls common to occupied spaces, they shall be shock mounted or isolated in such a manner as to effectively prevent the transmission of their inherent noise to the occupied space.

D. Ballasts, contactors, starters, transformers, and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.

3.9 EQUIPMENT CONNECTIONS

A. Provide complete electrical connections for all items of equipment requiring such connections, including incidental wiring, materials, devices and labor necessary for a finished working installation.

B. Verify the rough-in and wiring requirements for all equipment provided under other Divisions of the work and requiring electrical connections with equipment supplier and installer prior to rough-in. Check the voltage and phase of each item of equipment before connecting. Motor connections shall be made for the proper direction of rotation. Pump motors shall not be test run until liquid is in the system and proper lubrication to all bearings in unit is checked. Minimum size flex for mechanical equipment shall be 1/2". Exposed motor wiring shall be jacketed metallic flex.

C. Conduit, wire and circuit breaker sizes for mechanical equipment and equipment furnished under other Divisions are based on the equipment ratings of one manufacturer. The equipment actually furnished may be of a different brand with different electrical characteristics. Conduit, wire and circuit breakers shall not be ordered or installed until exact electrical requirements are obtained. Responsibility for this coordination shall rest with the Contractor.

3.10 TESTS

A. Complete each system as shown or specified herein and place in operation except where only roughing-in or partial systems are called for. Each system shall be tested and left in proper operation free of faults, shorts, or unintentional grounds.

B. After the interior wiring system installation is completed, and at such time as the Owner may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of the Specification. The test shall be performed in the presence of the Owner or an authorized representative. The Contractor shall furnish all instruments and personnel required for the tests, and the Owner will furnish the necessary electric power. The Contractor shall submit in writing to the Owner upon completion of the project the measured ground resistance of each ground rod, indicating the location of the rod, the resistance, and the soil conditions at the time the measurements were made.

END OF SECTION 260500

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all conductors, cables, connectors, lugs, cable ties, and terminations for all systems.

1.2 QUALITY ASSURANCE

A. All conductors shall be Underwriters Laboratories, Inc., listed and comply with Fed. Spec. J-C-30B and UL 83. Materials omitted here but necessary to complete the work are to be of comparable quality.

1.3 PRODUCT DELIVERY, STORAGE & HANDLING

A. Deliver conductors and cables in complete coils with UL label and bearing manufacturer's name, wire size, and type of insulation.

B. Store and handle materials so as not to subject them to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation.

C. Deliver conductors No. 10 and smaller in manufacturer's original unopened and undamaged cartons with labels legible and intact.

1.4 SUBMITTAL AND RECORD DOCUMENTATION

A. None required.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Conductors No. 10 AWG and smaller may be soft-drawn, stranded, or solid copper. Conductors larger than No. 10 AWG shall be stranded, soft-drawn copper.

B. Insulation for new conductors installed in raceways shall be "THWN" for conductors No. 8 AWG or smaller, and "THWN" or "THHN" for conductors No. 6 AWG or larger, or as noted.

C. Where adverse conductor exposure exists, code-approved insulation suitable for the conditions encountered shall be used unless shown otherwise on the Drawings.

D. All wire and cable for feeder circuits shall conform to the latest requirements of the current edition of the NEC and shall meet all ASTM Specifications. Wire and cable shall be new and have wire size, grade of insulation, voltage, and manufacturer's name permanently marked on outer covering at regular intervals.

E. Sizes shall not be less than indicated. Branch circuit conductors shall not be smaller than No. 12 AWG. Class I remote control and signal circuit conductors shall not be less than No. 14 AWG. Class 2 low energy remote control and signal circuit conductors shall not be less than No. 18 AWG.

F. All insulation shall be rated 600 volts unless noted otherwise.

G. Acceptable Manufacturers: General Electric, Hatfield, Anaconda, Rome Cable, Essex, Belden, West Penn, or approved.

2.2 SPLICES AND TERMINATIONS

A. All connectors shall be solderless pressure type per Fed. Spec. W-S-610, properly taped. All taped joints shall be with plastic tape, "Scotch 33," applied in half-lap layers without stretching to deform.

B. Splices shall utilize Scotch "Hyflex" or "Ideal" wing nut connector installed properly. Splices for No. 8 and larger wires shall be made with tin or silver plated copper compression sleeves.

C. Splices made in handholes and manholes, or underground splices, shall be made water tight with epoxy resin-type splicing kits.

PART 3 - EXECUTION

3.1 CONDUCTORS

A. Insulation shall be removed with a stripping tool designated specifically for that purpose. All conductors shall be left nick-free.

B. UL listed pulling compounds may be used with the residue cleaned from the conductors and raceway entrances after the pull is made.

C. Raceway shall be complete, clean and free of burrs before pulling conductors.

D. Wire shall not be left extending out of exposed conduit stubs or incomplete raceways where subject to mechanical injury.

E. Pulleys or blocks shall be used for alignment of the conductors when pulling. Pulling shall be in accordance with manufacturer's specifications regarding tensions, bending radii of the cable and compounds.

F. Conductors shall be terminated as required.

G. Conductor sizes for special systems shall be as recommended by the equipment manufacturer except as noted.

H. Stranded conductors shall not be terminated with post and screw unless compression spade/ring lug is utilized.

I. 120-volt homeruns over 80 feet in length shall be minimum #10 conductor.

3.2 LABELING

A. Provide color coding of building wiring consistent throughout the work as listed herein, unless required otherwise by local code authority. Band feeder conductors not available in colors where clearly visible at each termination, tape or splice using two full wraps of 3/4" adhesive vinyl tape or equally visible color marking corresponding to the following table.

Less than 250V between phases	251 to 600V btwn phases
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Orange
Phase C - Blue	Phase C - Yellow
Neutral - White	Neutral - Gray
Ground - Green	Ground - Green

B. Switch legs, travelers, etc., to be consistent with the above phases to which they are connected or may be any other color distinctive from those listed above. Complex control circuits may utilize any combination of colors but the identification shall be by labels throughout. Labeling shall be accomplished by using computer-generated heat shrink labels suitable for the wire size used. In no case will hand lettering or wraparound labels be accepted.

C. Phase color code to be consistent at all feeder terminations, A-B-C left to right or A-B-C top to bottom.

D. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made.

E. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved shop drawings. Hand lettering or marking is not acceptable.

3.3 SPLICES AND TERMINATIONS

A. Splices are to be made up completely promptly after wire installation. Single wire pigtails shall be provided for fixture and device connections. Wire nuts may be used for fixture wire connections to single wire circuit conductor pigtails.

3.4 CONNECTORS

A. Control and special systems wires shall be terminated with a tool- applied, spade-flared lug when terminating at a screw connection.

B. All screw and bolt-type connectors shall be made up tight and be retightened after an eight-hour period.

C. All tool-applied compression connectors shall be applied per manufacturer's recommendations and physically checked for tightness.

D. Check terminations in all panelboards, switchgear, motor control centers, etc., six months after completion of installation. Supply a confirming letter to the Owner at completion of test.

3.5 TESTS

A. Perform insulation resistance tests on all feeders and circuits over 100 A, 480 volt and below, with a 1,000 volt megger. The written test report listing the results of the test to be included in the Operating and Maintenance Manuals. Equipment which may be damaged by this test shall be disconnected prior to the test.

END OF SECTION 260519

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide ground system as specified herein, as shown on the Drawings, and as required by NEC and other rules and regulations pertaining to grounding.

1.2 SUBMITTAL AND RECORD DOCUMENTATION

A. None required.

PART 2 - PRODUCTS

2.1 GROUND CONDUCTORS

A. Equipment or grounding conductors shall be soft drawn copper, stranded per ASTM B8 and, if insulated, shall have green insulation.

2.2 GROUNDING BUSHINGS/WEDGES

A. Sufficient ampacity with grounding conductor set screw connection.

2.3 CONNECTOR

A. Cast, set screw or bolted type.

2.4 GROUND RODS

A. Copper-clad steel, not less than 3/4" in diameter, 8' long, driven full length into the earth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All grounding conductors shall be sized in accordance with Article 250, Tables 250.66 and 250.122 of the NEC.

B. Except where specifically indicated otherwise, all exposed non-current-carrying metallic parts of electrical equipment, metallic raceway systems, and neutral conductor of the wiring system shall be grounded.

C. The ground connection shall be made at the main service equipment and shall be extended to the point of entrance of the metallic water service. Connection to the water pipe shall be made by a suitable ground clamp. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flange connection.

D. Where the metallic water service is used, it shall be grounded as described by Article 250.53 of the NEC.

E. Generally, all supplemental grounding electrodes shall be ground rods.

F. All ground wire connections below finished grade, cast in concrete, or bonding solid wire shall be exothermically welded.

G. Where there is no metallic water service to the building, ground connections shall be made to driven ground rods on the exterior of the building.

H. The maximum resistance measured in accordance with IEEE Standard 142 of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods shall be installed not less than 6' on centers, or if sectional-type rods are used, additional sections may be coupled and driven with the first rod. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Engineer shall be notified immediately.

I. Grounding conductor connectors shall be made up tight and located for future servicing and to ensure low impedance.

J. The Contractor shall submit in writing to the Owner upon completion of the project the measured ground resistance of each ground rod, indicating the location of the rod and the resistance and the soil conditions at the time the measurements were made.

K. Where new circuits are to be served by existing panels with no ground bus, provide supplemental copper ground bus in panel.

END OF SECTION 260526

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all electrical equipment and wiring with adequate supports of specified type required for a complete installation.

1.2 SUBMITTAL AND RECORD DOCUMENTATION

A. Submit shop drawings indicating details of fabricated products and materials.

PART 2 - PRODUCTS

2.1 FASTENERS

A. Fastenings shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring steel tension clamps on steel work; for new concrete installation use cast-in-concrete inserts. Kindorf D-255 or approved.

B. Hammer-driven and trigger-fired anchors may be used only after obtaining specific written authorization from the Architect.

2.2 OUTLET BOX SUPPORTS

A. Wood Stud Walls: Adjustable bar hangers with "C" channel cross section Steel City 6010 series, or approved, or mounted on solid blocking. 4-inch square boxes adjacent to wood studs may be side nailed and back braced with Steel City No. 50 box brace.

B. Light steel construction, bar hangers with 1-inch long studs between metal studs or metal stud "C" brackets snapped on and tab-locked to metal studs.

C. Concrete or masonry walls where boxes are not cast in place. Flush anchors or concrete inserts.

D. Flush Ceiling Outlets: Steel City 6010 series or equal bar hangers.

2.3 CONDUIT SUPPORTS

A. One Hole Malleable Straps: Steel City, Appleton, T&B, Diamond, Raco, or approved.

B. Conduit Clips: Caddy, Raco, or approved.

C. Nail-Up Straps: 1/2" through 1", Raco 2252, 2253, 2254, or approved.

D. Adjustable Hangers for Conduits 1-1/2" and Larger: Steel City C-149 with threaded steel rod of proper size.

E. Adjustable trapeze hangers to support groups of parallel conduits; Steel City B-905 steel channel, H-119 square washer, C-105 strap, threaded rod. Components of Unistrut, Globe Strut, Harvey Alstrut, Kindorf, Thomas & Betts, or approved.

2.4 HANGER ROD ATTACHMENTS

A. Side Beam Connector, Kindorf E-244; 90 degree fitting, Kindorf B-916; clamp type anchor clips Kindorf Type "C," Unistrut P2675 or approved, spot type concrete insert Kindorf B-255 with "Galv-Krom" finish.

2.5 SUPPORT CHANNELS

A. Conduit: Kindorf B-905 with Galv-Krom finish, and C-105 single bolt channel pipe straps.

B. Lighting: Kindorf B-900 with G-969 closure strip and G-977 swing connector.

C. Recessed in Concrete: Kindorf D-980 with D-982 anchored end caps and D-983 joiner clips.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Every fastening device and support for electrical equipment (includes fixtures, panels, outlets, conduits, and cabinets) shall be capable of sustaining not less than four times the ultimate weight of the object or objects. Fasten support to the building or a building structural member.

B. Provide independent supports to the building or building structural member for electrical fixtures, materials, or equipment installed in or on ceiling, walls, or in void spaces and/or over the furred or suspended ceilings. Chain or additional ceiling wires may be used for light fixture supports.

C. Other crafts' fastening devices shall not be used for the supporting means of electrical, equipment, materials, or fixtures.

D. Supports and/or fastening devices shall not be used to support more than one particular item.

E. Vertical support members for equipment and fixtures shall be straight and parallel to building walls.

F. Examine all equipment locations to determine type of supports required.

G. Raceways or pipe straps shall not be welded to steel structures.

H. Holes cut to a depth of more than 1-1/2" in reinforced concrete beams or to a depth of more than 3/4" in concrete joists shall avoid cutting the main reinforcing bars. Holes not used shall be filled.

3.2 BOXES

A. Boxes and pendants for surface-mounted fixtures on suspended ceilings shall be supported independently of the ceiling supports.

B. In open overhead spaces, cast metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers.

C. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved fastener not more than 24" from the box.

3.3 RACEWAYS

A. Support conduits within 18" of outlets, boxes, panels, cabinets, couplings, elbows, and deflections. Maximum distance between supports shall not exceed ten (10) foot spacing.

B. Conduit up to and including 1" EMT may be supported from ceiling fixture wires by conduit clips or other approved devices only with written approval of the installer of the ceiling support system. All other conduit runs shall be secured to the structure by two-hole straps or supported on Kindorf or Unistrut hangers. Wire will not be permitted for supporting conduit. All visible conduit runs will be parallel to the building structural lines.

C. Anchor conduit installed in poured concrete to the steel reinforcing with No. 14 black iron wire.

D. In partitions of light steel construction, sheet metal screws may be used, and bar hangers may be attached with saddle-suspended ceiling construction only. Lighting system branch circuit raceways shall be fastened to the ceiling supports.

E. Support suspended feeder conduits by metal ring or trapeze hangers with threaded steel rods. Wire ties to prevent displacement, using not less than No. 14 iron wire, may be used only for concealed runs in concrete for conduit up to 1-1/4".

F. At main distribution and surface mounted branch panels and cabinets where conduit exits from the top, provide support channels on wall 24" above panel and at 6'-0" intervals from there on for support of conduits.

END OF SECTION 260529

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all raceways, fittings, and boxes of specified type required for complete project. Install all systems in raceways unless specifically noted otherwise. Provide all outlet boxes, junction boxes, pull boxes and special boxes required for pulling of wires, making connections, and mounting of devices or fixtures.

1.2 QUALITY ASSURANCE

A. Underwriters Laboratories, Inc., listed and NEC approved

B. All boxes shall be Underwriters Laboratories, Inc., listed. Where special fabrication is required, the work shall be performed by a listed facility in accordance with UL 50, and all products of manufacture shall bear a label. Outlet and junction boxes shall be sized in accordance with NEC requirements for "THHN" wire or as noted on Drawings.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver raceways with Underwriters Laboratories, Inc., label and bearing manufacturer's name on each length.

B. Deliver fittings in manufacturer's original unopened and undamaged packages with labels legible and intact.

1.4 APPLICATION

A. Areas of use:

Underground	PVC
Within poured Concrete (except slab-on grade) or CMU	GRC, IMC, PVC
Dry concealed locations	GRC, IMC, EMT
Wet or Dry exposed locations, subject to damage	GRC, IMC
Dry exposed locations, not subject to damage	GRC, IMC, EMT
Hazardous Class I or II	GRC, IMC

B. Underground conduit shall be minimum 3/4" trade size. PVC shall not be used inside building. Unless otherwise approved, all conduits shall be installed under reinforcing steel.

C. Where the contractor elects to utilize PVC in lieu of GRC, the contractor shall provide supplemental ground bus in terminating switch and panelboards, and green ground wire in conduit according to code rules.

D. For the purposes of this section, poured concrete slabs on grade and under-the-building slabs are not classified as dry locations.

E. Flexible metal conduit will be permitted only where flexibility is necessary. Exceptions are connections to recessed light fixtures. Flexible metal conduit shall be used for connection to all equipment subject to movement or vibration such as motors, transformers, etc. Liquid-tight flexible metal conduit shall be used when moisture may be present and for exposed motor and equipment connections.

F. Surface raceway may be used only where specifically called for on the Drawings or in the Specifications.

G. Aluminum conduit is not permitted.

1.5 SUBMITTAL AND RECORD DOCUMENTATION

A. Submit product data for surface raceway and wireway.

B. Submit product data for floor boxes. Submit shop drawings for nonstandard boxes, enclosures, and cabinets. Include layout drawings showing components and wiring.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Allied Tube & Conduit, Western Tube & Conduit, Triangle, Bridgeport, AFC, Carlon, Western Plastics, Alflex, or approved substitute. Wiremold, Walker, or approved substitute. Raco, Thomas & Betts, or approved substitute.

2.2 CONDUITS

A. Galvanized Rigid Conduit (GRC) shall be hot-dip zinc, galvanized inside and out, mild steel pipe manufactured in accordance with UL-6 and ANSI C80.1. All threads shall be galvanized after cutting.

B. Electrical Metallic Tubing (EMT) shall be steel only and shall comply with UL-797 and ANSI C80.3. Exterior shall be hot-dip zinc galvanized and interior protected by a corrosion-resistant lubricating coating.

C. Intermediate Metallic Conduit (IMC) shall comply with UL-1242 and ANSI C80.6. Exterior shall be hot-dip zinc galvanized and interior protected by a corrosion-resistant lubricating coating.

D. Rigid non-metallic conduit (PVC) polyvinyl chloride shall be schedule 40 unless otherwise noted, and shall comply with UL-651 and NEMA TC 2.

E. Surface raceway shall utilize snap-in cover and fittings as recommended by the manufacturer and shall comply with UL 5 standard. Material and size shall be as indicated on the Drawings.

F. Flexible metal conduit shall be steel and comply with UL 1 and ANSI standards. Liquid-tight flexible metal conduit shall comply with UL 360 and ANSI standards.

2.3 WIREWAYS

A. Gutters: Steel, painted, square in cross section, preformed knockouts on standard spacing, screw cover, suitable for environment.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

C. Exterior wireways and fittings/accessories shall be stainless steel.

2.4 FITTINGS

A. GRC and IMC shall be coupled and terminated with threaded fittings. Ends shall be bushed with insulating bushings equal to T&B 1220 or 1230 series.

B. Connectors and couplings for EMT shall be steel concrete tight compression type or set screw type with insulated throats on connectors. Indent type connectors shall not be used.

C. Conduits piercing a building waterproof membrane shall be provided with O-Z type FSR fittings.

D. Flexible metal conduit shall utilize screw-in type connectors. Couplings and set-screw type connectors are not permitted.

E. Seal-offs with filler fiber, compound, large removable cover. All components shall be of the same manufacturer.

F. Expansion Couplings:

1. Exposed Conduit Runs: Expansion couplings shall be weatherproof with external bonding jumper, providing at least 4” longitudinal movement with bushed conduit ends.
2. Concealed Conduit Runs: Expansion couplings shall be water tight with an internal bonding jumper and neoprene construction. The fitting shall allow 3/4” movement in any direction or deflection of 30 degrees from normal.

G. Locknuts shall be galvanized steel.

2.5 BOXES

A. Boxes for use with raceway systems shall not be less than 4" square and 1-1/2" deep except where shallower boxes required by structural conditions are approved.

B. Flush and Concealed Outlet Boxes: Galvanized stamped steel with screw ears, knock-out plugs, mounting holes, fixture studs if required.

C. Surface Outlet Boxes: Galvanized stamped steel same as above for use on ceilings and walls above 14 feet.

D. Boxes shall be of the cast-metal hub type when located in normally wet locations and when surface mounted on outside of exterior surfaces.

E. Boxes installed for concealed wiring shall be provided with suitable extension rings or plastic covers as required.

F. Cast-metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed.

G. Provide boxes suitable for the intended environment and sized as required to accommodate the equipment within. Exterior boxes shall be stainless steel.

H. Pull boxes of not less than the minimum size required by the National Electrical Code shall be constructed of code-gauge aluminum or galvanized sheet steel except where cast-metal boxes are required in locations specified above. Boxes shall be furnished with screw-fastener covers. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ends of metal conduits shall be reamed and left free of burrs.

B. Provide pull boxes or vaults where shown or required to limit the number of bends in any conduit to not more than three 90 degree bends, or to ease pulling tension. Use boxes of code-required size with removable covers, installed so that covers will be accessible after work is completed.

C. Conceal all wiring in finished spaces so far as practicable. Exposed conduit shall be used only in unfinished spaces.

D. Exposed raceways shall be parallel or at right angles to structural lines, and shall be neatly offset into boxes. Exposed raceways shall follow existing exposed piping/ductwork/conduit paths as far as practicable.

E. Conduit stubbed from a concrete slab or wall to serve an outlet mounted on a table or to supply a machine shall have a rigid conduit coupling flush with the surface of the slab. Provide plug where conduit is to be used in future.

F. Keep conduit and raceway closed with suitable plugs or caps during construction to prevent entrance of dirt, moisture, concrete or foreign objects. Raceways shall be clean and dry before installation of wire and at the time of acceptance.

G. Remove all foreign matter from raceways and pull mandrel through conduits larger than 1-1/2" prior to installing conductors.

H. Where no conduit size is noted on the Drawings, conduit may be the minimum code permitted size for the quantity of type THHN conductors installed, but in no case smaller than 1/2" trade diameter. Conductor quantities indicated in conduits do not include ground wire unless otherwise noted. Adjust conduit sizes accordingly.

I. Where the contractor elects to combine branch circuit runs shown as separate runs on the Drawings, provide a minimum 3/4" conduit or increase raceway size to provide a minimum of 25 percent spare capacity for future conductors. Feeder runs shall not be combined.

J. All conduits installed in concrete construction, underground, or under the building slab shall be minimum 3/4", unless otherwise noted.

K. Assemble, glue and seal PVC conduit in straight lengths prior to installation in trench.

L. Seal-offs shall be installed in all conduits which route from warm areas into refrigerated areas.

M. Install PVC conduit in accordance with manufacturer's instructions. Cut the conduit ends square and apply an approved solvent to clean the joint. Apply an approved cement and allow to set 24 hours before installing conductors.

N. Conduits shall be fastened to all sheet metal boxes and cabinets with two locknuts where required by the National Electrical Code, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used.

O. A pull wire shall be inserted into each empty raceway in which wiring is to be installed by others. The pull wire shall be of No. 15 AWG zinc-coated steel, or of plastic having not less than 200-pound tensile strength. Not less than 10" of slack shall be left at each end of the pull wire.

P. Raceway shall not be installed under the fire pits of boilers and furnaces and shall be kept 6" away from parallel runs of flues, steam pipes and hot water pipes.

Q. Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed.

R. Expansion fittings complete with grounding jumpers shall be installed where raceways cross expansion joints, construction joints, sawed joints, and where shown.

S. Where conduit is shown stubbed into a telephone, computer or communication terminal area, conduit shall be stubbed up 6" above floor or 12" below ceiling and terminated with insulating bushings.

T. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate head room, working clearance, and access to both boxes and other equipment.

U. The end of a conduit stub shall have an insulated bushing.

V. Pack spaces around conduits with polyethylene backing rods and seal with polyurethane caulking to prevent entrance of moisture where conduits are installed in sleeves or block-outs penetrating partitions.

W. Install intumescent material around ducts, conduits, etc., to prevent spread of smoke or fire where installed in sleeves or block-outs penetrating fire-rated barriers. An alternate method utilizing intumescent materials in caulk and/or putty form may be used.

X. Outlet boxes shall be designed for the intended use. Flush outlet boxes shall be installed flush with finished surface lines.

Y. Outlet boxes on flex connected fixtures shall be installed within five feet of conduit knock-out in fixture.

Z. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate head room, working clearance, and access to both boxes and other equipment.

3.2 INSTALLING CONDUIT BELOW SLAB-ON-GRADE OR IN THE GROUND

A. All electrical wiring below slab-on-grade shall be protected by a conduit system.

B. No conduit system shall be installed horizontally within concrete slab-on-grade. For slab-on-grade construction, horizontal runs of rigid plastic shall be installed below the floor slab.

C. Conduit passing vertically through slab-on-grades shall be coated rigid steel.

D. Slope conduits away from terminal equipment; drain away from the building interior.

E. Rigid steel or IMC conduits, metal boxes, and couplings installed below slab-on-grade or in the earth shall be field-wrapped with 0.010" pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory applied plastic resin, epoxy, or coal-tar coating system. Zinc coating may be omitted from rigid steel conduit, or IMC which has a factory-applied epoxy system. All joints shall be threaded, sealed and wrapped with tape to prevent entry of water. Use 20 mil pipe wrapping tape to cover wrench marks, field cuts, or abrasions to the outer factory installed anti-corrosion covering.

F. Provide duct seal at ends of all underground and under-slab conduits.

END OF SECTION 260533

PART 1 - GENERAL

1.1 DESCRIPTION

A. Clearly and properly label the complete electrical system to indicate the loads served or the function of each item of equipment connected under this work.

1.2 SUBMITTAL AND RECORD DOCUMENTATION

A. None required.

PART 2 - PRODUCTS

2.1 IDENTIFICATION MARKERS

A. Unless otherwise specified, all identification nameplates shall be made of laminated three-ply plastic in accordance with Fed. Spec. L-P-387 equal to "Lamicoid." Nameplates shall be minimum 1/16" thick, with black outer layers and a white core, red outer ply for all emergency applications. Edges shall be chamfered.

B. Provide identification nameplates for starters, switchboards, safety switches, panelboards, motor control centers, transformers, equipment (air handling units, exhaust fans, pumps, etc.), with a minimum of 1/4" high letters.

C. Provide identification nameplates for control power transformers, control devices (relays, contactors, etc.), with a minimum of 1/8" high letters.

D. Where switches control remote lighting, exhaust fans, or power outlets, or where switches in the same gang (two or more) serve different purposes, such as light, power, intercom, etc., or different areas, such as corridor and outlet, furnish engraved cover plates with 1/8" black letters indicating function of each switch or outlet.

PART 3 - EXECUTION

3.1 LABELING

A. Major items of electrical equipment and major components shall be permanently marked with an identification nameplate to identify the equipment by type or function and specific unit number as shown on the Drawings.

B. Provide typewritten branch panel schedules with protective clear, transparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designation on the construction drawings. Minimum panel schedule width shall be 4" with 1/4" height allowed for each circuit line. Panel schedules shall be the type which install in a metal frame or pocket. Panel schedules shall be of the odd/even sequence (1-3-5-7-9... and 2-4-6-8-10...).

C. Identify service entrance and distribution switchboards with engraved nameplate corresponding with the plans, mounted on the face of the switchboard. Identify each feeder, breaker, and switch with engraved nameplate corresponding with the plans.

D. Identify branch panels with engraved nameplate corresponding with the main or subdistribution panel labeling, mounted on the face of the door. No brand labels or other markings shall be on the outside of the panels.

E. Label all disconnect switches, relays, contactors, starters and time switches indicating voltage, amperage, power panel source, circuit number and equipment served with laminated plastic label.

F. Nameplates shall be secured with screws or pop rivets. Adhesive-only fasteners shall not be permitted.

END OF SECTION 260553

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide the secondary service entrance and metering equipment as specified herein and as shown on the Drawings.

1.2 COORDINATION

A. Coordinate all aspects of the incoming electrical utility service with the serving utility representative.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect equipment against damage and moisture. Store materials off ground.

B. Deliver equipment with UL label and bearing manufacturer's name.

1.4 QUALITY ASSURANCE

A. Underwriters Laboratories, Inc., listing/approval.

B. National Electrical Code with state and local amendments.

C. Serving utility requirements and guidelines.

1.5 SUBMITTAL AND RECORD DOCUMENTATION

A. Submit product data for products specified in this Section. Include dimensions, ratings, and data on features and components.

PART 2 - PRODUCTS

2.1 UTILITY METERING EQUIPMENT

A. Fabricated compartment and section meeting utility company's requirements.

B. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company.

2.2 CT RATED METER SOCKET

A. Enclosure and cover to be fabricated from code gauge galvanized steel.

B. Shall have lug range for #14 to #6 copper.

C. Shall have test perch drilled and tapped for test switches.

D. Shall have AWSR sealing ring.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panels, cabinets and equipment level and plumb, parallel with structural building lines. Cover shall fit neatly without gaps, openings or distortion.

B. Install in accordance with the manufacturer's installation instructions.

END OF SECTION 262000

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all wiring devices and finish plates as required unless specifically indicated otherwise.

1.2 QUALITY ASSURANCE

A. Underwriters Laboratories, Inc., listed and NEC approved.

B. Wiring devices shall be specification grade, with special devices as noted on the Drawings. Should the Drawings indicate a device other than those listed herein, such device shall be of same grade and manufacture as specified below.

C. All lighting switches and duplex receptacles installed shall be from the same manufacturer and have identical appearance characteristics.

1.3 SUBMITTAL AND RECORD DOCUMENTATION

A. Submit product data for wiring devices and cover plates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Receptacles: Single and duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounded type, Hubbell HBL5362 Series. Receptacles shall have nylon faces, one-piece brass mounting strap with integral ground contacts and bypass power contacts; color as selected by Architect.

B. Receptacles with ground fault interrupters shall be in accordance with UL 943.

C. Special purpose or heavy duty receptacles shall be of the type and of ratings and number of poles indicated or required for the anticipated purpose. Contact surfaces may be either round or rectangular. One appropriate straight or angle-type plug shall be furnished with each receptacle. Locking facilities, where indicated, shall be accomplished by the rotation of the plug.

D. Receptacles in wet locations shall be in a weatherproof enclosure, the integrity of which is not affected when the receptacle is in use. The enclosure shall be one or two-gang, and shall be securely secured to the receptacle box with tamper-proof fasteners through factory-drilled or field-drilled through factory-prepared drill points.
Bell "Rayntite II", Intermatic WP1000 series, or equal.

2.2 ACCEPTABLE MANUFACTURERS

A. Hubbell, Bryant, P&S, Leviton, and Cooper.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Devices and finish plates to be installed plumb with building lines.

B. Finish plates and devices not to be installed until final painting is complete. Scratched or splattered finish plates and devices will not be accepted.

C. Wall mounted receptacles shall be installed vertically at centerline height shown on the Drawings unless otherwise specified.

D. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16 inch.

E. All outlets shall have a cover plate. Provide blank cover plate to match surrounding area if none other is specified.

3.2 TESTS

A. Test all receptacles for line to line, line to neutral, line to ground, and neutral to ground, opens or shorts, and correct defective wiring.

3.3 LABELING

A. See Section 260553, Identification for Electrical Systems.

END OF SECTION 262726

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Clearing and grubbing.
2. Removing above- and below-grade site improvements.
3. Disconnecting and capping or sealing site utilities.
4. Temporary erosion and sedimentation control measures.
5. Removal of nuisance/invasive plant species.

1.2 MATERIAL OWNERSHIP

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

B. Historic items, relics, and other items of interest or value to the Owner encountered during site clearing shall remain the Owner's property. Carefully remove and salvage in a manner to prevent damage and deliver promptly to Owner.

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 where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located a minimum of 72 hours prior to site clearing.

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

1.4 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter, 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 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

B. Invasive plant species: Existing exterior plants considered invasive or nuisance per the City of Portland, September 2011 Portland Plant List.

1. English Ivy, Hedera helix species, Rank “C” invasive plant

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are 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 EXAMINATION

A. Inspect site and identify all areas within the work limits where English Ivy is growing. Mark and identify for removal.

3.3 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 requirements of authorities having jurisdiction and the sediment and erosion control Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established according to requirements of authorities having jurisdiction.

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

3.4 UTILITIES

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

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

B. 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. Do not proceed with utility interruptions without Owner's written permission.
2. Notify Owner not less than two days in advance of proposed utility interruptions.

C. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

1. Do not remove shrubs, and other vegetation indicated to remain or to be relocated.

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, and compact each layer to a density equal to adjacent original ground.

3.6 INVASIVE/NUISANCE PLANT REMOVAL

A. Remove English Ivy by mechanical or manual methods by pulling, digging and grubbing. Remove all branches stems and roots. Pile removed ivy onto plastic sheets. Do not leave or store on ground. Dispose of properly off site. Do not use chemical herbicides.

3.7 SITE IMPROVEMENTS

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

B. Remove slabs, paving, curbs, and gutters at existing full-depth joints unless indicated otherwise. Neatly saw-cut length of existing pavement to remain with vertical faces prior to removing existing pavement.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, 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.

END OF SECTION 311000

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Base course for concrete walks and pavements.
5. Base course for asphalt paving.
6. Excavating and backfilling for utility trenches.
7. Storm water infiltration facilities

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 off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade 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, tanks, curbs, mechanical and 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 course 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. Drainage Fill: Free draining, open-graded aggregate course used to support pervious pavement or in drainage zones in flow-through planters, vegetated storm water facilities, and infiltration galleries.

M. Growing Media: Non-native soil mixture made up of sand, loam, and compost; used on surface storm water facilities.

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.

B. Site Information: Research public utility records and verify existing utility locations prior to ordering any material. Notify the Engineer immediately if any discrepancies are found in the project survey.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve or use ODOT 1-1/2-inch – 0-inch BASE AGGREGATE.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve or use ODOT 3/4-inch – 0-inch BASE AGGREGATE.

H. Drainage Course: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Backfill and Fill:

1. Satisfactory soil materials.
2. Initial Trench Backfill: Use ODOT 3/4-inch – 0-inch base aggregate.
3. Final Trench Backfill: Relatively clean, granular material, such as sand, sandy gravel, or crushed rock of up to 2” maximum size and with less than 5% passing the No. 200 sieve (washed analysis).

J. Drainage Fill: Angular, granular material with a maximum particle size of 2 inches and shall meet ODOT Standard Specification 00430.11. The material shall be free of roots, organic material, and other unsuitable materials; have less than 2 percent passing the No. 200 sieve (washed analysis); and have at least two mechanically fractured faces.

K. Riprap: Sized as shown on the plans and graded per ODOT Standard Specifications. Filter blanket for riprap support shall be as specified and/or as shown on the plans.

L. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 110 lbf ; ASTM D 4632.
2. Tear Strength: 40 lbf ; ASTM D 4533.
3. Puncture Resistance: 50 lbf ; ASTM D 4833.
4. Water Flow Rate: 150 gpm per sq. ft.; ASTM D 4491.
5. Apparent Opening Size: No. 50 ; ASTM D 4751.

M. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 200 lbf ; ASTM D 4632.
2. Tear Strength: 75 lbf ; ASTM D 4533.
3. Puncture Resistance: 90 lbf ; ASTM D 4833.

4. Water Flow Rate: 4 gpm per sq. ft. ; ASTM D 4491.

N. Growing Media: A loose and friable material blend of loamy soil, sand, and compost that is 30-40% compost (by volume) and meets the following criteria;

1. Partial Gradation: A sieve analysis of the complete blended material shall be conducted per ASTM C117/C136, AASHTO T11/T27, or ASTM D422/D1140 and meet the following gradation.

Sieve Size	Percent Passing
1-Inch	100
#4	75 – 100
#10	40 – 100
#40	15 – 50
#100	5 – 25
#200	5 – 15

The blend shall have a Coefficient of Uniformity (D60/D10) equal to or greater than 6 to ensure it is well grades (has a broad range of particle sizes).

2. Acidity: pH of the blended material shall be tested and be between 6 to 8.

3. Compost: The compost shall be derived from planter material and provided by a member of the US Composting Council Seal of Testing Assurance (STA) program. See www.compostingcouncil.org for a list of local providers.

The compost shall be the result of the biological degradation and transformation of plant-derived materials under conditions designed to promote aerobic decomposition. The material shall be well composted, free of viable weed seeds, and stable with regard to oxygen consumption and carbon dioxide generation. The compost shall have no visible free water and produce no dust when handled. It shall meet the following criteria, as reported by the US Composting Council STA Compost Technical Data Sheet provided by the vendor.

- 100% of the material must pass through a ½-inch screen.
- The pH of the material must be between 6 and 8.
- Manufactured inert material (plastic, concrete, ceramics, metal, etc) shall be less than 1.0% by weight.
- The organic matter content shall be between 30 and 70% (dry weight basis).
- Soluble salt content shall be less than 6.0 mmhos/cm.
- Maturity Indicator shall be greater than 80% for Germination and Vigor.
- Stability shall be ‘Stable’ to ‘Very Stable’.
- Carbon/Nitrogen (C/N) ratio shall be less than 25:1.
- Trace metals test result = “Pass”.

4. Blend: The material shall be well mixed and homogenous. It shall be free of wood pieces, plastics, and other foreign matter. There shall be no visible free water.

5. Infiltration: The blended material shall have a minimum infiltration rate of 4 inches per hour. Contractor shall provide the Engineer with a 2 gallon sample for initial testing. The Contractor shall also perform one one-pit falling head infiltration test within the footprint of each proposed infiltration facility to verify the infiltration rate of the native soils. Pre-soak prior to testing.

6. Submittals: At least 14 working days in advance of construction, submit the following:

   a. Documentation for the two analyses described in section 1 and 2 above (particle gradation with calculated coefficient of uniformity; and pH) shall be performed by an accredited laboratory with certification maintained current. The date of the analyses shall be no more than 90 calendar days prior to the date of the submittal. The report shall include the following information:

      1) Name and address of the laboratory.

      2) Phone contact and email address for the laboratory.

      3) Test data, including the date and name of the test procedure.

   b. A compost technical data sheet from the compost vendor. The analysis and report must conform to the sampling and reporting requirements of the US Composting Council Seal of Testing Assurance (STA) program. The analysis shall be performed and reported by an approved independent STA program laboratory and be no more than 90 calendar days prior to the date of submittal.

   c. Two gallon sized bags of the blended material.

   d. A description of the location, equipment, and method proposed to mix the material.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 5 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

B. Tracer Wire: 12 AWG minimum solid copper insulated High Molecular Weight Polyethylene (HMW PE) tracer wire or approved equal. The tracer wire insulation shall be green for sewer pipe and blue for waterlines. Joints or splices shall be waterproof.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, freezing temperatures or frost, and other hazards created by earthwork operations. Provide protective insulating materials as necessary.

B. 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."

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

D. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

E. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

F. Protect all areas designated to be infiltration facilities from foot or equipment traffic and surface water runoff. Do not use proposed infiltration facilities to dispose of surface water runoff during construction. Under no circumstances should materials and equipment be stored on top of the installation area.

3.2 EXPLOSIVES

A. Explosives: Do not use explosives.

3.3 EXCAVATION

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.4 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.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.6 EXCAVATION FOR UTILITY TRENCHES

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

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

1. Clearance: 12 inches each side of pipe or conduit.

C. 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.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course. Hand excavate for bell of pipes.
2. Excavate utility structures to provide 6 inches clearance (enlarge as needed) to allow for compaction of backfill material.

3.7 EXCAVATION FOR STORM WATER INFILTRATION FACILITIES

A. Excavate facility to the indicated gradients, lines, depths, and elevations. All excavation shall be performed with the lightest practical excavation equipment. All excavation equipment shall be placed outside of the limits of the facility.

B. To help prevent subgrade soil contamination and clogging by sediment, infiltration facility construction should be delayed until all other construction within its drainage area is completed and the drainage area stabilized. Provide additional sediment control measures such as diversion berms around the facility as needed. Additional excavation and backfill required to restore the infiltration rate lost due to clogging or over-compaction during construction shall be performed by the contractor at no cost to the Owner.

3.8 SUBGRADE INSPECTION

A. Proof-roll subgrade before filling or placing aggregate with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

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

3.9 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, may be used when approved by Engineer.

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

3.10 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.

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

3.11 BACKFILLS AND FILLS

A. Backfill: Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Inspecting and testing underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 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 excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

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 initial trench backfill material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial 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.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

H. STORM WATER INFILTRATION FACILITY FILL

I. Growing media shall be placed in loose lifts, not to exceed 8 inches each.

J. Placement of the growing media will not be allowed when the ground is frozen or saturated or when the weather is to wet as determined by the Owner's Representative.

3.13 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.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.
6. Under and around utility structures, use engineered fill.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 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, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 10 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

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 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 10 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

D. Growing media shall be compacted with a water-filled landscape roller. It shall not otherwise be mechanically compacted.

3.16 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 1/2-inch.
3. Pavements: Plus or minus 1/2-inch

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2-inch when tested with a 10-foot straightedge.

3.17 SUBBASE AND BASE COURSES

A. Place subbase and base course on 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.
2. Compact subbase and base course 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 698.

3.18 DRAINAGE COURSE

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

B. On prepared subgrade, 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.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Contractor 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, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

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. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 5000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.20 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.

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

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

D. Weather permitting and as approved, storm water infiltration facility plants shall be installed as soon as possible after placing and grading the growing media in order to minimize erosion and further compaction.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot-mix asphalt patching.
2. Hot-mix asphalt paving.
3. Pavement-marking paint.

B. Related Sections:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
2. Job-Mix Designs: For each job mix proposed for the Work.

B. Material Certificates: For each paving material, from manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or ODOT.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Section 00744 of the 2008 Oregon Standard Specifications for Construction for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F.

2. Asphalt Base Course: Minimum surface temperature of 60 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials and 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Conform to requirements of 00744 of the 2008 Oregon Standard Specifications for Construction.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22 or PG 70-22

B. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt.

2.3 RECLAIMED ASPHALT PAVEMENT (RAP) MATERIAL

A. Use of RAP in the production of new asphalt pavement, as allowed in section 00744 of the 2008 Oregon Standard Specifications for Construction, is encouraged.

2.4 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.

1. Color: As indicated.

C. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.

1. Color: As indicated.

D. Glass Beads: AASHTO M 247, Type 1.

E. Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE or commingled postconsumer and postindustrial recycled rubber or plastic, UV stabilized; 4 inches high by 6 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

F. Thermoplastic Pavement Markings: Provide material and install per section 00850 of the 2008 Oregon Standard Specifications for Construction.

1. Color: White.

2.5 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Provide mixes conforming to section 00744 of the 2008 Oregon Standard Specifications for Construction.
2. Surface Course: Level 2, ½ inch dense, HMAC

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.3 PAVEMENT MARKING REMOVAL

A. General: Remove existing pavement striping on sections of existing pavement that are indicated to remain by using hydroblasting, steel shot blasting, or grinding per ODOT Standard Specifications Section 00851.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Spread mix at minimum temperature of 250 deg F.
2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 WHEEL STOPS

A. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Replace and compact hot-mix asphalt where core tests were taken.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 321216

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete for the following:

1. Curbs
2. Planter Walls
3. Walkways
4. Retaining Walls

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.3 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Include substantiating substantial test data to show compliance with ACI 318 Chapter 5.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. The steel reinforcement detailer shall generator all shop drawing bending and installation details from the contract drawings and specifications. The use of reproductions or photocopies of the contract drawings shall not be permitted.
   1. Provide details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement."

D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Form materials and form-release agents.
6. Curing compounds.
7. Applied finish materials.
8. Bonding agents

9. Epoxy adhesives.
10. Joint fillers.
11. Repair materials.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with the following:
1. ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2.2 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Epoxy-Coated Welded Wire Fabric: ASTM A 884/A 884M, Class A, plain steel.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

D. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

E. Plain Steel Wire: ASTM A 82.

F. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain.

G. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

H. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain steel bars.

I. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

J. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

K. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I

    a. Fly Ash: ASTM C 618, Class C.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
3. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.

C. Anti-Graffiti Sealer: Two (2) coats of "VANDLEGUARD" anti-graffiti coating over a base coat of Rainguard "BLOK-LOK" or approved equal. Install per the Manufacturer's recommendations.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi (walls) or 3300 psi **(all other installations)**
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
3. Slump Limit: 4 inches, plus or minus 1 inch

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content: 6 percent plus or minus 1percent.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 20 percent.

E. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

F. Admixtures: Use admixtures according to manufacturer's written instructions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete operations only after nonconforming conditions have been corrected and subgrade is ready to receive concrete.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Chamfer exterior corners and edges of permanently exposed concrete, unless noted otherwise.

G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.6 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints. Install so strength and appearance of concrete are not impaired.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of pavement strips where indicated.
3. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
6. Place joints perpendicular to main reinforcement.
7. Locate horizontal joints in walls at top of footings.
8. Use a bonding agent or roughen interface to 1/4" amplitude at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.7 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Screed pavement surfaces with a straightedge and strike off.

J. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

K. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

L. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

M. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

N. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

C. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4 inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.9 RETAINING AND PLANTER WALL FINISHING

A. General: Apply the following finishes on all retaining walls and planter walls.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing materials, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete on all exposed faces.
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surface and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than created by the rubbing process.

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Unformed Surfaces: Begin curing immediately after finishing concrete but not before free water has disappeared from concrete surface.

E. Formed Surfaces: Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

F. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

   1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

E. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.12 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch
2. Thickness: Plus 3/8 inch minus 1/4 inch
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches
8. Joint Spacing: 1/2 inch
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.13 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day and at least one composite sample for each 5000 square feet of surface area of slabs or walls.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Owner.

G. Remove and replace concrete where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.15 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Owner, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. 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 as they occur.

END OF SECTION 321313

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid concrete pavers with openings between pavers filled with aggregate.
2. Aggregate setting bed for pavers.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavation and compacted subgrade.
2. Section 321313 "Concrete Paving" for cast-in-place concrete curbs that serve as edge restraints for porous paving.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For materials other than aggregates.

B. Product Data: For the following:

1. Pavers.

C. Sieve Analyses: For aggregate materials, according to ASTM C 136.

D. Samples:

1. Full-size units of each type of unit paver indicated.
2. Aggregate fill.
3. Aggregate setting bed materials.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1. For solid interlocking paving units, include test data for freezing and thawing according to ASTM C 67.

1.6 QUALITY ASSURANCE

A. Mockups: Build 10 ft x 10 ft mockup to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

PART 2 - PRODUCTS

2.1 CONCRETE UNIT PAVERS

A. Source Limitations: Obtain each type of paver from single source that has resources to provide materials and products of consistent quality in appearance and physical properties.

B. Solid Concrete Pavers for Porous Paving: Solid interlocking paving units of shapes that provide openings between units, complying with ASTM C 936, resistant to freezing and thawing when tested according to ASTM C 67, and made from normal-weight aggregates.

1. Products: Subject to compliance with requirements, provide the following:

   a. Eco-priora by Mutual Materials.
   b. Approved Equal.

2. Thickness: 3-1/8 inches.
3. Face Size and Shape: 8”x8”.
4. Color: Grey
5. Finish: Standard
6. Color Pigment Material Standard: Comply with ASTM C 979.

2.2 AGGREGATE SETTING-BED MATERIALS

A. Bedding Course and Joint Filler: Sound crushed stone with 90% fractured faces, LA Abrasion C40 per ASTM C131, minimum CBR of 80% per ASTM D1883, and complying with ASTM D448 for size no. 8 (1/4" clean crushed, open graded). Gradation shall meet the following:

Sieve Size	Percent Passing
1/2 in.	100
3/8 in.	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

B. Base Aggregate: sound crushed stone with 90% fractured faces, LA abrasion C40 per ASTM C131, minimum CBR of 80% per ASTM D1883 and complying with ASTM D448 for size no. 57 (1" clean crushed, open graded). Gradation shall meet the following:

Sieve Size	Percent Passing
1-1/2 in.	100
1 in.	95 to 100
1/2 in	25 to 60
No. 4	0 to 10
No. 8	0 to 5

C. Subbase Aggregate: sound crushed stone with 90% fractured faces, LA abrasion C40 per ASTM C131, minimum CBR of 80% per ASTM D1883 and complying with ASTM D448 for size no. 2 (2"-3" clean crushed, open graded).

Sieve Size	Percent Passing
3 in.	100
2-1/2 in.	90 to 100
2 in	35 to 70
1-1/2 in.	0 to 15
3/4 in.	0 to 5

2.3 FILL MATERIALS

A. Graded Aggregate for Porous Paving Fill: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.

2.4 DRAINAGE GEOTEXTILE

A. Mirafi 160N or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Compaction of the native soil subgrade should be limited in order to prevent a reduction in the permeability of the soil.

3.2 INSTALLATION, GENERAL

A. Mechanical installation of permeable pavers is recommended.

B. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work.

C. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

D. Cut unit pavers with motor-driven masonry saw equipment or a block splitter to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

E. Tolerances:

1. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch unit-to-unit offset from flush.
2. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches and 1/4 inch in 10 feet or a maximum of 1/2 inch.

F. Provide curbs as indicated. Install curbs before placing unit pavers.

3.3 SETTING-BED INSTALLATION

A. Contractor to protect subgrade from over-compaction.

B. Place geotextile on bottom and side of soil subgrades. Secure in place to prevent wrinkling from vehicle tires and tracks.

C. Moisten, spread, and compact the No. 2 subbase in 4 to 6 inch lifts without wrinkling or folding the geotextile. Place subbase to protect geotextile from wrinkling under equipment tires and tracks.

D. For each lift, make at least two passes in the vibratory mode than at least two in the static mode with a minimum of 10 T vibratory roller until these is no visible movement of the No. 2 stone. Do not crush aggregate with the roller.

E. Moisten, spread, and compact the No. 57 base layer in one 4 inch thick lift. Place subbase to protect geotextile from wrinkling under equipment tires and tracks.

F. For each lift, make at least two passes in the vibratory mode than at least two in the static mode with a minimum of 10 T vibratory roller until these is no visible movement of the No. 2 stone. Do not crush aggregate with the roller.

3.4 PAVER INSTALLATION

A. Set unit pavers on leveling course, being careful not to disturb leveling base. If pavers have lugs or spacer bars to control spacing, place pavers hand tight against lugs or spacer bars. If pavers do not have lugs or spacer bars, place pavers with a 1/16-inch- minimum and 1/8-inch-maximum joint width. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size pavers.

1. When installation is performed with mechanical equipment, use only unit pavers with lugs or spacer bars on sides of each unit.

B. Compact pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.

1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.

C. Place graded aggregate fill immediately after vibrating pavers into leveling course. Spread and screed aggregate fill level with tops of pavers.

1. Before ending each day's work, place aggregate fill in installed porous paving except for 42-inch width of unfilled paving adjacent to temporary edges (laying faces).
2. As work progresses to perimeter of installation, place aggregate fill in installed paving that is adjacent to permanent edges unless it is within 42 inches of laying face.
3. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with nonstaining plastic sheets to protect it from rain.

D. As work progresses, remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 321443

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes piping, valves, sprinklers, lawn sprinkler specialties, controls, and wiring.

B. Related Sections include the following:

1. Division 2 Section "Water Distribution" for water supply piping, water meters, and backflow preventers.

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Pressure Piping: Downstream from point of connection to water distribution piping to and including control valves. Piping is under water distribution system pressure.

C. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. NP: Nylon plastic.
3. PE: Polyethylene plastic.
4. PP: Polypropylene plastic.
5. PTFE: Polytetrafluoroethylene plastic.
6. PVC: Polyvinyl chloride plastic.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Water Coverage: 100 percent head to head coverage.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated:

1. Pressure Piping: 200 psig.
2. Circuit Piping: 150 psig.
3. Drain Piping: 100 psig.

1.5 SUBMITTALS

A. Product Data: Include pressure rating, rated capacity, settings, and electrical data of selected models for the following:

1. Valves. Include aboveground and underground; general-duty, manual and automatic control, and quick-coupler types.
2. Valve boxes.
3. Sprinklers.
4. Specialties. Include emitters, drip tubes, and other devices.
5. Controllers. Include wiring diagrams.
6. Piping.
7. Jointing materials

B. Test Reports: As specified in "Field Quality Control" Article in Part 3.

C. Maintenance Data: To include in maintenance manuals specified in Division 1. Include data for the following:

1. Automatic control valves.
2. Sprinklers.
3. Specialties.
4. Controllers.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of lawn sprinkler piping components and are based on specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered but not used without written authorization and approval. Refer to Division 1 Section "Substitutions."

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

C. Comply with requirements of utility supplying water and authorities having jurisdiction for preventing backflow and back siphonage.

D. Comply with ASTM F 645-11, "Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems."

E. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:

1. Do not remove end protectors unless necessary for inspection; then, reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

E. Protect flanges, fittings, and specialties from moisture and dirt.

F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations.

B. Investigate and determine available water supply water pressure and flow characteristics.

C. Site Information: Reports on subsurface condition investigations made during design of Project are available for informational purposes only; data in reports are not intended as warranties of accuracy or continuity of conditions (between soil borings). Owner assumes no responsibility for interpretations or conclusions drawn from this information.

D. Weather Requirements:

1. Do not solvent weld polyvinyl chloride pipe when ambient temperature is below 40 degrees F and falling.
2. Do not solvent weld polyvinyl chloride pipe in wet conditions without adequate cover.

1.9 SEQUENCING AND SCHEDULING

A. Maintain uninterrupted water service to building during normal working hours. Arrange for temporary water shutoff with Owner.

B. Coordinate sprinkler piping with work specified in Division 2 Section "Landscaping."

C. Coordinate sprinkler piping with utility work.

D. Schedule for Installing Pipe Sleeves and Sprinkler Heads:

1. Schedule installation of pipe sleeves below paving and walks prior to installation of paving and walks.

2. Schedule installation of sprinkler heads after final grading.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.

1. Valve Keys: Furnish quantity of tee-handle units equal to 25 percent of amount of each type of key-operated, control valve installed.
2. Quick-Coupler Hose Swivels: Furnish quantity of units equal to 25 percent of amount of each type of quick coupler installed.
3. Quick-Coupler Operating Keys: Furnish quantity of units equal to 25 percent of amount of each type of quick coupler installed.

1.11 DAMAGES

A. Any structures or facilities damaged by work of this project shall be restored to equal or better than original condition at the Contractor's expense and to the satisfaction of the Owner's Representative.

B. The Contractor shall be responsible for all damage caused by leaks or breaks in the equipment and materials furnished or installed in this contract for one year after the date of final acceptance.

1.12 EXISTING UTILITIES

A. The Contractor shall verify, locate, and identify, with visible marking, all existing underground utilities in the areas of work and maintain such markings until all work in those areas is complete.

B. Should uncharted piping or other utilities be encountered during the execution of the work, the Contractor shall notify the Owner's Representative immediately and consult with the utility owner for instructions before proceeding with the work.

C. The Contractor shall cooperate with the Owner and public or private utility companies in keeping their respective services and facilities in operation. If it becomes necessary to temporarily interrupt existing services or facilities, the Contractor must provide temporary utility services to the satisfaction of the Owner's Representative.

1.13 PERMITS AND REGULATIONS

A. All work detailed herein and on the drawings shall be accomplished in strict accordance with the applicable Local, State and Federal codes and regulations. The Contractor shall be responsible for obtaining and paying for all necessary permits to accomplish the work described herein.

B. The irrigation contractor is responsible to obtain an electrical permit before starting work.

1.14 RECORD DRAWINGS

A. The Contractor shall maintain a current record of all pipe, wire, and equipment placement, and shall record all variations or changes approved by the Owner's Representative. Changes in layout of proposed work shall be recorded on the Record Drawing Set in blue pencil or ink. Additions to the proposed scope of work shall be recorded on the Record Drawing Set in green pencil or ink. Deletions either in the proposed scope of work or by a change in layout shall be recorded on the Record Drawing Set in red pencil or ink.

B. Record drawings must be submitted to the Owner's Representative for review and approval on a weekly basis.

C. Complete Record drawings shall be included in the Maintenance Manual.

1.15 SUBSTITUTIONS

A. If materials other than those specified in the Contract Documents are proposed, the Owner's Representative shall determine whether such materials or methods are a suitable or equal substitute. The irrigation system described in the Contract Documents is based on specific GPM output, static and operating pressures. Approved substitutions may require partial or complete redesign of the system at the Contractor's expense. The Owner's Representative's decision will be final.

1.16 WARRANTIES

A. Manufacturer's Warranty:
   1. Provide equipment manufacturer's standard Warranty for automatic controllers, control valves, quick couplers, and heads.

B. Installer's Warranty:
   1. Provide installer's one-year warranty for watertight pipelines to the Owner's Representative at the time of final acceptance, showing the date of completion, which shall be the beginning of the warranty period.
   2. Warranty shall include repair of trench backfill, which settles more than 1/2 inch or of plantings, lawns, paving, and walk materials damaged by settlement of trench backfill soils during the guarantee period.
   3. Warranty shall include adjustment, repair and maintenance of the irrigation system for one year following the date of final acceptance.

PART 2 - PRODUCTS

2.1 PIPE

A. All PVC main line and lateral PVC (Polyvinyl Chloride Plastic) pipe shall be PVC 1220, Type 1, normal impact, I.P.S., N.S.F. approved. Schedule 40 PVC pipe shall conform to ASTM D1784-69, ASTM D1785, and PS22-70. Class 200 PVC pipe shall conform to ASTM D1784-69, ASTM D2241, and PS22-70. All PVC pipe shall be new, defect free, and continuously and permanently marked with the manufacturer's name or trademark, size, schedule and type of pipe. All pipes shall be minimum of 200 PSI rated and with SDR 21 walls.

B. All lateral line "Flex-Pipe" shall be high density 3408 polyethylene and conform to the requirements of ASTM D2239, and be listed by NSF International. All pipe shall be new, defect free, and continuously and permanently marked with the manufacturer's name or trademark, size, schedule and type of pipe. All pipes shall be minimum of 200 PSI rated and with SIDR 7 walls. Approved product is "Eagle High Density" 3408 pipe, SIDR 7.

2.2 PVC PIPE FITTINGS

A. All PVC fittings shall be PVC 1220, schedule 40, type 1, normal impact, I.P.S., N.S.F. approved and meeting the requirements of ASTM D-2466.

B. All PVC nipples shall be standard weight schedule 80, with molded threads.

2.3 PVC CLEANER AND PRIMER

A. "Weld-On P-75" or approved equal. All approved equals for "Weld-On P-75" shall meet the requirements of ASTM F-656.

2.4 PVC SOLVENT CEMENT

A. In all circumstances use "Weld-On 725" or approved equal. All approved equals for "Weld-On 725" shall meet N.S.F. approval for Type I and II PVC through three (3) inch and meeting requirements of ASTM D-2564.

2.5 PVC SLEEVES

A. All sleeves shall be Class 200 PVC and shall be sized to provide sufficient clearance to accommodate all pipes and wire required to pass through the sleeve, plus room for an additional Class 200 PVC pipe of minimum 2.5" diameter, unless otherwise specified on the drawings.

2.6 COPPER AND GALVANIZED STEEL PIPE AND FITTINGS

A. All steel pipes shall be schedule 40, hot-dipped galvanized, conforming to ASTM A120-76. Fittings shall be hot-dipped galvanized, malleable iron. Diameters shall be measured in 1" increments only, starting with a minimum diameter of 1".

B. All copper pipes and fittings shall be Type K, conforming to ASTM B88-09 and ASTM B687-99. Assembly shall conform to ASTM B828-02. Diameters shall be measured in 1" increments only, starting with a minimum diameter of 1".

C.

2.7 IRRIGATION HEADS

A. As shown on drawings

2.8 VALVES

A. Control Valves:

1. Automatic Control Valves: Toro P220-27-00 electric remote control valves with pressure regulator as indicated on drawings. Size as indicated on plans.
2. Manual Control Valves: Heavy duty Brass body control valves, straight or angle configuration, 150 PSI min. rating for valves less than 1-1/2" 200 PSI rating for valves 1-1/2" or larger, conforming to ASTM B-62, with 'cross' or 'hub' style handle. Size as indicated on plans.

B. Isolation Valves:
1. Mainline isolation valves; As shown on drawings; or approved equal.
2. Zone isolation valves; shall be Brass Gate valves as indicated on plans, 150-PSI min., rated, with standard seat and threaded ports. Valve shall be same size as line on which it is installed, unless otherwise indicated on drawings. Valves shall have brass or stainless steel wheel or cross style handle.

D. Quick-Coupling valves; As show on drawings (with 'non-potable' lid); or approved equal.

F. Backflow Prevention Valve: As shown on drawings. To be installed by Contractor.

2.9 VALVE BOXES AND VALVE COVERS

A. Valve Boxes for Control, Isolation, Pressure Relief and Ball Valves; for single valves, "Oldcastle Model #1419", NDS “Pro Series” rectangular, or approved equal, with locking top and with six (6") inch extensions as needed to facilitate required installation. Where multiple valves are placed, the boxes shall be no closer than four (4') feet on center. Boxes shall be "Oldcastle" or NDS “PRO SERIES” brands, molded of a single piece of high density polyethylene or approved equal. Locking lids and extensions shall be of same manufacture as box.

B. Backflow Prevention/ Point of Connection Assembly Vault concrete vault with locking, diamond plate cover. Vault shall be sized to allow installation of backflow prevention device, master valve, isolation valve, sub-meter, and secondary backflow device where required. (See P.O.C. schematic) Contractor shall maintain a minimum clearance zone, on all sides, between any device and vault sides or other device or pipe. This zone shall extend from the center of any device to a distance equal to either the height or width of the device, whichever is greater, plus one inch. Minimum acceptable vault for Backflow assemblies 2" or smaller is "Oldcastle. model #25-TA", or approved equal. Minimum acceptable vault for Backflow assemblies greater than 2" is "Utility Vault Co. model #644-LA w/#64-352 locking steel cover", or approved equal.

C. Bolts for Locking Valve Box Lids: where locking or bolt-down lids are required the contractor shall provide stainless steel "penta" bolts (five-sided) and stainless steel washers. Bolts shall be of appropriate size and length for the specified valve box lid.

2.10 SWING JOINT ASSEMBLIES

A. Prefabricated assemblies are allowed. "Dura" model number 1-A2-3-1-10 or approved equal, with ten (10") inch lay length, for irrigation heads only, MIPT by spigot, schedule 80, or approved equal: for Quick-Coupling Valve swing joint assemblies use "Dura" 1-A2-3-1 fittings with appropriate 'lay length' as required by details. Pre-fabricated swing-joint assemblies must be a minimum one (1") inch size and properly sized for associated irrigation heads and not increase water velocity through fittings above five (5) feet per second allowable industry standard.

B. Polyethylene pipe swing joint assemblies: Where "poly-pipe" swing joint assemblies are indicated on plans and in details the "poly" pipe shall be flexible black tubing constructed of virgin linear low density polyethylene material. The tubing shall have a wall thickness of 0.090 inches (+/- 0.010 inches). It shall have an inside diameter of 0.490 inches (+/- 0.010 inches) for use with 'spiral barb' fittings without the necessity of glue or clamps. The model number and logo of the manufacturer shall be printed at no less than 12" intervals along the length of the pipe. Each section of pipe used shall be capable of pressure testing at the rate of 100 pounds per square inch (PSI) to a minimum burst pressure of 475 PSI. All pipes must have an operating pressure rating of 80 PSI at 110° F.

C. Spiral barb fittings for polyethylene swing joint assemblies: All fittings shall be constructed specifically for use in constructing "poly-pipe" swing assemblies. The fittings shall have a maximum operating water pressure of 80 PSI. All fittings shall be constructed of UV resistant, thermoplastic material and be so designed to permit 'twist-in' insertion eliminating the need for glue and/or clamps.

2.11 IRRIGATION CONTROLLER, MONITORING AND SENSING DEVICES

A. Controller: Toro Model TIS-12-ID controller, 12 station indoor controller for commercial use. Controller shall be mounted to wall inside restroom mechanical room. Coordinate location of mounting with Owners Rep. and install per manufactures recommendations and specifications. Coordinate installation with other trades to ensure access, conduit, electrical connections, conduit or any other required operation is installed or coordinated for proper installation and operation of controller.

2.12 WIRE AND ELECTRICAL CONNECTORS

A. Irrigation control wire shall be single strand insulated copper wire designed for 24 volts or greater, Type UF, UL approved for direct burial in NEC Class II circuits. Size of wire shall be in accordance with manufacturer's recommendation, but in no case smaller than number fourteen (14) gauge. Common wire shall be white and control wires shall be red. If more than one Common wire is required, additional Common wires shall be yellow.

B. Electrical Connectors: watertight electrical connectors "3-M DBY/DBR", "RainBird Snap-Tite", "Pen-tite PVC Socket and Sealing Plus", or approved equal.

C. Locator Wire; all water lines must be marked with continuous #14 gauge, single strand locator wire, with light blue color coating.

2.13 OTHER MATERIALS

D. Pipe Joint Tape; pipe joint tape shall be a minimum of one-half inch (1/2") Teflon tape intended for use in wrapping threaded PVC and/or galvanized pipe fittings and joints, as required.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not allow any work to be covered or enclosed until it has been inspected, pressure tested, and approved by the Owner's Representative.

B. Installation of all materials and equipment shall be in strict accordance with the manufacturer's written specifications and recommendations and with local and state codes whether indicated on the drawings or not. The Contractor is responsible for calling to the immediate attention of the Owner's Representative any conflicts between the manufacturer's written specifications and recommendations; local and state codes; and the Contract Documents. The Owner's Representative may require the Contractor, at no additional cost, to correct to the Owner's satisfaction any work installed that results in such conflicts.

C. The location of pipe, sprinkler heads, valves, and other equipment shall be as shown on the plans and shall be the size and type indicated. No changes shall be made without prior approval by the Owner's Representative. Minor changes necessary to conform to ground conditions may be made by the Contractor without the Owner's Representative's prior consent in order to ensure the smooth progress of the work. However, all such changes are subject to approval by the Owner's Representative and must be recorded on Record Drawings.

D. Permission to shut off any water lines must be obtained in writing from the Owner's Representative prior to the beginning of any work. Disruptions in service shall be kept to a minimum.

E. The Contractor shall be responsible for maintaining the system and protecting it from all damage, including damage caused by vandalism or adverse weather conditions, until date of final acceptance. The Contractor shall be responsible for repairing such damage at no additional cost to the Owner.

F. The Contractor shall maintain at the site a clean copy of the drawings for recording all changes to the project in accordance with the Records Drawings Procedure. All changes shall be recorded within twenty-four (24) hours of occurrence.

3.2 TRENCHING

A. A minimum depth of cover to the top of irrigation piping shall be as follows:
   1. All lateral lines shall be a minimum of sixteen inches (16") deep.
   2. All mainline shall be a minimum of twenty inches (20") deep.
   3. All communication and/or phone line wire runs shall be a minimum of twenty inches (20") deep.
   4. Where multiple pipes are laid in common trench the contractor must maintain a minimum separation of 2" in any direction between all pipes.
   5. Cover all pipe with a minimum depth of four inches (4") of specified sand, measured from the top of the pipe.

B. Backfill in the cool part of the day whenever possible to minimize expansion and contraction of the PVC pipe.

C. Remove all lumber, rubbish, and rocks from irrigation trenches. Irrigation lines shall have a firm, uniform bearing surface for the entire length of each line. Wedging or blocking of pipe is not permitted.

D. Before back-filling trenches, all pipe shall be flushed clear and clean of all dirt and foreign material.

E. Backfill trenches in layers of not more than six inches (6") in depth and compact each layer. Fill trenches to finish grade with native or imported topsoil keeping the top three inches (3") free of rock. Restore surface to original or better than original condition.

F. Any materials or equipment damaged or destroyed while back filling shall be repaired or replaced by the Contractor at no additional cost to the Owner.

G. "Pulling" of pipe with a vibratory plow may be accepted as an alternate installation method for specific portions of the work. The Contractor shall request in writing of the Owner's Representative permission to use this method of installation. Requests shall include a complete description of the type of equipment to be used, the experience of the equipment operator and the areas in which pipe will be pulled.

3.3 PIPE

A. Exercise care in handling and storing all pipe and fittings. Store materials under cover before using. Transport materials in a vehicle of adequate size and capacity to prevent bending or the concentration of an external load at any point on the materials. Any materials or portions of materials that show such damage shall be discarded and replaced.

B. Remove all foreign matter and dirt from inside pipe or fittings before lowering into the trench.

C. Install all pipe and fittings per the manufacturer's specifications. Use the specified primer and cement on all glue joints. Use Teflon tape on all threaded joints.

D. Install the specified locator wire on the topside of all pipes. Tape locator wire to the all pipe at no less than twenty-foot (20') intervals. All sections of locator wire shall be spliced together with watertight splice connectors, to provide a continuous run.

E. Snake pipe in trenches to allow for expansion and contraction as recommended by the manufacturer.

F. At all installed joints cut pipe ends square and remove all burrs.

3.4 CONTROL VALVES

A. Install complete with isolation valve, valve box and extension(s) and as detailed. All valve boxes shall be installed so that the top of the box is flush with finish paving grade or 1" above planting area grade.

B. Verify locations with Owner's Representative prior to installation.

3.5 QUICK-COUPLING VALVES

A. Install complete with fittings and covers as detailed.

3.6 ISOLATION/MANUAL VALVES

A. Install complete with fittings, valve boxes and extension(s), as detailed.

3.7 IRRIGATION HEADS

A. Install irrigation heads of types, sizes and coverage called for in the Irrigation Legend/Key at the locations shown on the drawings. Minor changes in head location may be necessary to achieve the required coverage at no additional expense to the Owner. Notify the Owner's Representative for approval prior to making any changes. Document all changes on project record drawings as they occur.

B. Locate no head closer than three inches (3") from any adjacent walk (gravel, concrete, or otherwise).

3.8 IRRIGATION SLEEVES

A. Install sleeves for irrigation lines and/or control wire under pavement prior to placing pavement materials. Extend sleeves beyond pavement edge a minimum of twelve inches (12"). All sleeves shall be installed with a minimum depth of cover to the top of the pipe of twenty inches (20"). If length of required sleeve is greater than the length of the unit of pipe, solvent weld all joints required. Otherwise all sleeves shall be of one continuous length of pipe.

B. Tape ends of sleeve closed to keep soil out of the sleeve until irrigation lines and/or control wire are installed.

C. Permanently attach a single length of fourteen-(14) gauge trace wire above the entire length of the sleeve.

D. Stake both ends of sleeves with a readily visible stake extending twelve inches (12") above grade and below grade to the bottom of the sleeve. Mark the above grade portion of the stake with the words "Irrig. Sleeve". Remove stakes after sleeves are recorded on as-built drawings and after irrigation lines and/or control wires are installed and inspected.

E. Place a minimum of four inches (4") of sand backfill over the top of all sleeves, in areas of new paving, before back filling with soil or other sub-grade materials.

3.9 IRRIGATION CONTROL

A. Lay control wires in trench under mainline and/or lateral lines whenever they occur in the same trench. Place control wires in sleeves/conduit under all paving and when not in common trench with mainline and/or lateral lines.

B. Make all wire splices moisture proof using specified electrical connectors. Splices shall only be made in valve boxes. Provide a minimum of one-foot (1') of coiled slack between all wire splices.

C. Control wires shall be bundled together and wrapped with electrical tape at intervals of no more than ten (10) feet. Wires shall be placed below mainline and/or laterals when in same trench.

D. Clearly mark both ends of all wiring, on a permanent tag, with the number of the corresponding valve and controller station. Locate one tag at each control valve and one tag per wire in the controller.

E. Install separate common wire for each controller.

F. Sharp bends or kinks in the wiring shall not be permitted. Wires shall be carefully placed along the bottom of the trench. Wire shall not be unreeled and pulled into trench from one end.

G. Where any wiring is run in trench without irrigation piping the appropriate warning tape shall be placed in trench six inches (6") above the wiring.

H. Trace wire shall be laid on top of all mainline and lateral lines and taped to the top of the pipe with electrical tape wrapping the entire circumference of pipe. Trace Wire shall be taped at intervals of no less than 20' and at all Tee's and turns in the pipe. A min. of 2' of trace wire shall be looped in each valve box unless otherwise directed by the Owner's Representative. Loop mainline trace wire into box. Have lateral trace wire come in from down streamside of box.

3.10 IRRIGATION CONTROLLERS

A. The Contractor is responsible for providing a power source to the specified controller location in accordance with the manufacture’s standard specifications, recommendations and all applicable local and state codes.

3.11 BACKFLOW PREVENTION DEVICE

A. Install complete with fittings and materials as specified (see drawings). Follow all applicable state and local codes and requirements for installation and testing.

3.12 FLUSHING AND TESTING

A. Thoroughly flush all piping before testing and installation of irrigation heads and before backfilling any trenches.

B. The Contractor shall not allow or cause any work to be covered before it has been inspected and approved. Work covered before approval shall be uncovered at the Contractor's expense.

C. Soil may be placed in trenches between fittings to insure the stability of the line under pressure. In all cases, fittings and couplings must be open for visual inspection for full period of test. No testing shall be done until the last solvent welded joint has had a minimum of twenty-four (24) hours to set and cure.

D. Before testing, fill pipes with water and expel all air from pipes.

E. In system with concrete thrust blocks, the test shall not be made until at least five (5) days have passed after all concrete thrust blocks are installed. If higher early strength cement is used in the concrete thrust block, the test shall not be made until at least two (2) days have elapsed.

F. Test lateral piping at full pressure. Minimum pressure test on mainline, valves, joints and fittings, shall be one-hundred (100) pounds per square inch without losing more than three (3) pounds per square inch for a period of one (1) hour. The Contractor shall first perform the test for himself and repair any leaks or defects. The Contractor shall then notify the Owner's Representative at least twenty-four (24) hours in advance and complete another test in the presence of the Owner's

Representative for approval. All testing shall be done with a certified pressure gauge supplied by the Contractor. Submit written certification of the gauges' accuracy prior to testing.

G. The Contractor shall adjust and balance the irrigation system to provide uniform coverage. The Contractor shall change or adjust heads and/or nozzles as required providing uniform coverage and matching final grades. Upon completion of all systems and coverage tests performed by and for the Contractor, the Contractor shall notify the Owner's Representative at least twenty-four (24) hours in advance, and perform another coverage test in the presence of the Owner's Representative for approval.

H. Where inspected work does not comply with specified requirements or if pressure tests fail, replace the rejected work until reinspected by the Owner's Representative and found to be acceptable.

I. All locator wires must be tested and approved by the Owner's Representative prior to Final Payment.

3.13 CLEAN-UP

A. Upon completion of the work, clean up all boxes, wrappings, excess materials, and other rubbish resulting for this work and leave the site in original or better condition.

3.14 FINAL SUBMITTAL

A. The Contractor shall comply with "Record Drawing Procedures" specified in Section 01700 PROJECT CLOSEOUT and shall include all approved variations or changes, indicating all main and lateral line locations, valves, quick-couplers, drains, wire runs, pump(s), and irrigation heads, located by field dimensions to the nearest permanent landmark approved by the Owner's Representative.

B. The Contractor shall provide an Irrigation Valve Schedule, laminated on both sides with plastic, for placement inside the appropriate controller cabinet.

C. The Contractor shall provide a clean, legible print of the final Project Record Drawing with all zones clearly color-coded. The Contractor shall laminate both sides with plastic. Submit to Owner's Representative for approval.

D. The Contractor shall provide three (3) copies of all equipment operation instructions, parts lists, service manuals, specification sheets, warranty information, winterization instructions, precipitation rates for irrigation heads, and circuit operating time for each zone; properly collated, punched and bound in a three (3) ring binder. Each binder shall be clearly marked with the following information:

PROJECT MANUAL
"Project Name" (from Contract Documents)
Date of Project Completion
Contractor's Name and Address

Submit project manuals to Owner's Representative for review and approval.

E. The Contractor shall be responsible for providing up to eight (8) hours of training and orientation covering the adjustment and maintenance of the irrigation system. The Contractor shall be responsible for one full winterization and one spring activation of the irrigation system, following completion of the work, and shall conduct these operations as part of the Owner's training and orientation procedures.

END OF SECTION 328400

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Seeding.

B. Related Sections include the following:

1. Division 2 Section "Site Clearing" for topsoil stripping and stockpiling.
2. Division 2 Section "Earthwork" for excavation, filling and backfilling, and rough grading.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.4 SUBMITTALS

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

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture identifying source, including name and telephone number of supplier.

C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

D. Qualification Data: For landscape Installer.

E. Material Test Reports: For existing surface soil and imported topsoil.

F. Planting Schedule: Indicating anticipated planting dates for each type of planting.

G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1.7 SCHEDULING

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: After April 15
2. Fall Planting: Before September 15

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 SEEDED AREA MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable stand of grass is established, but for not less than the following periods:

1. Seeded Areas: 60 days from date of Substantial Completion.

a. When full maintenance period has not elapsed before end of planting season, or if seed is not fully established, continue maintenance during next planting season.

B. Maintain and establish seeded areas by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Re-grade and re-plant bare or eroded areas and re-mulch to produce a uniformly smooth lawn.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.

C. Watering: Provide and maintain temporary piping, hoses, and watering equipment to convey water from sources and to keep seeded area uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water seeded areas at a minimum rate of 1/2 inch per week..

PART 2 - PRODUCTS

2.1 SEED

A. Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances and the Dept. of Agriculture for the State of Oregon. Seed that is moldy, wet or otherwise damaged shall not be accepted.

B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. 25% Creeping Red Fescue
2. 25% Chewing’s Fescue
3. 25% Hard Fescue
4. 25% Blue Fescue

C. Seed Rate: 200 bulk lbs per acre

2.2 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 6 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

    a. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep but a maximum of 12 inches deep; do not obtain from bogs or marshes.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
2. Class: Class O, with a minimum 95 percent passing through No. 8 sieve and a minimum 55 percent passing through No. 60 sieve.
3. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch (19-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.

2.5 PLANTING ACCESSORIES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.6 FERTILIZER

A. Commercial chemical-type fertilizer, uniform in composition, dry, free-flowing, conforming to state and federal laws, and minimum percentage of nutrients by weight. Apply no fertilizer on watersides or waterways.
   1. 22 percent nitrogen, 10 percent phosphoric acid, 10 percent potash, slow release.

2.7 MULCHES

A. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

   1. Organic Matter Content: 50 to 60 percent of dry weight.
   2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Hydroseed Mulch: Chopped grass straw, grass straw, wood cellulose free of noxious weed seed, mold, decay or other conditions which would impair or be detrimental as mulch.

2.8 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

2.9 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with soil amendments per recommendations of required soil report.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding over spray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 2000-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.
3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at a minimum rate of 1000-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb/acre.

3.4 SATISFACTORY SEEDING

A. Satisfactory Seeded Areas: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches.

B. Reestablish seeded areas that do not comply with requirements and continue maintenance until seeded areas are satisfactory.

3.5 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after seed/grass is established.

C. Remove erosion-control measures after grass establishment period.

END OF SECTION 329200

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Trees.
2. Shrubs.
3. Ground cover.

B. Related Sections include the following:

1. Division 2 Section "Site Clearing" for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.
2. Division 2 Section "Earthwork" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
3. Division 2 Section "Subdrainage" for below-grade drainage of landscaped areas, paved areas, and wall perimeters.

1.3 DEFINITIONS

A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than sizes indicated; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

B. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated.

C. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for kind and size of exterior plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

E. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.

F. Finish Grade: Elevation of finished surface of planting soil.

G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

H. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

I. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.4 SUBMITTALS

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

B. Submit a certified confirmation of plant orders within five days after Notice to Proceed including information on quantity ordered and location, phone number, and address of grower who has agreed to provide plant material.

C. Submit photographs of trees and shrubs with enough detail to clearly show size and character.

D. Samples for Verification: For each of the following:

1. Tree accessories.

E. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:

1. Manufacturer's certified analysis for standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

F. Qualification Data: For landscape Installer.

G. Material Test Reports: For existing surface soil and imported topsoil.

H. Planting Schedule: Indicating anticipated planting dates for exterior plants.

I. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when exterior planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

F. Observation: Owner’s Representative may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Owner’s Representative retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Owner’s Representative of sources of planting materials seven days in advance of delivery to site.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

1. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

B. Do not prune trees and shrubs before delivery, except as approved by Owner’s Representative. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots in water for two hours if dried out.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.7 COORDINATION

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: After March 15
2. Fall Planting: Before October 15

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Owner’s Representative.

1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.8 WARRANTY

A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.

1. Warranty Period for Trees, Shrubs, Grasses Ground Cover and other Plants: One year from date of Final Acceptance.
2. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
3. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
4. A limit of one replacement of each exterior plant will be required, except for losses or replacements due to failure to comply with requirements.

1.9 MAINTENANCE

A. Trees, Shrubs, Grasses Ground Cover and other Plants: Maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers,

tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.

1. Maintenance Period: One Year from date of Substantial Final Acceptance.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Owner's Representative, with a proportionate increase in size of roots or balls.

C. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.

D. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

E. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.2 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

B. Small Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1.

2.3 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

2.4 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

2.5 BROADLEAF EVERGREENS

A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

2.6 GROUND COVER PLANTS

A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.7 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

    a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

2.8 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
2. Class: Class O, with a minimum 95 percent passing through No. 8 sieve and a minimum 55 percent passing through No. 60 sieve.
3. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.9 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.10 FERTILIZER

A. Fertilizer for trees shall be plant tablets 20-10-5, 21-gram size.

B. Fertilizer for ground cover shall be plant tablets 20-10-5, 10-gram size.

2.11 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Fine grind shredded fir bark.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

2.12 STAKES AND GUYS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches by length indicated, pointed at one end.

B. Guy and Tie Wire: ASTM A 641/A 641M, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch in diameter.

C. Guy Cable: 5-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.

D. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch in diameter, black, cut to lengths required to protect tree trunks from damage.

E. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.13 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

2.14 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with soil amendments per recommendations of required soil report.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner’s Representative acceptance of layout before planting. Make minor adjustments as required.

D. Lay out exterior plants at locations directed by Owner's Representative. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

3.3 PLANTING BED ESTABLISHMENT

A. Loosen subgrade of planting beds to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply fertilizer directly to subgrade before loosening.
2. Spread topsoil**,** apply soil amendments including composted mulch and fertilizer on surface, and thoroughly blend planting soil mix.

a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil mix to a depth sufficient to equal 4" following consolidation/and compaction but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil mix

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.4 TREE AND SHRUB EXCAVATION

A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for tree and shrub stock.
2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. If drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.

B. Subsoil removed from excavations may be used as backfill.

C. Obstructions: Notify Owner's Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch-diameter holes into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Owner's Representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE AND SHRUB PLANTING

A. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.

1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

B. Set container-grown stock plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.

1. Carefully remove root ball from container without damaging root ball or plant.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

C. Set fabric bag-grown stock plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.

1. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

D. Set and support bare-root stock in center of pit or trench with root collar or trunk flare flush with adjacent finish grade. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots. Tamp final layer of backfill. Remove injured roots by cutting cleanly; do not break.

E. Organic Mulching: Apply 2-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 3 inches of trunks or stems.

F. Wrap trees of 2-inch caliper and larger with trunk-wrap tape. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling. Inspect tree trunks for injury, improper pruning, and insect infestation; take corrective measures required before wrapping.

3.6 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as directed by Owner's Representative.

B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Owner's Representative, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.

3.7 GUYING AND STAKING

A. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses. Support trees with two strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Use the number of stakes as follows:

1. Use 2 stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; 3 stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.

B. Guying and Staking: Guy and stake trees exceeding 14 feet in height and more than 3 inches in caliper, unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches long, driven to grade.
1. Attach flags to each guy wire, 30 inches above finish grade.
2. Paint turnbuckles with luminescent white paint.

3.8 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants as indicated.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING BED MULCHING

A. Mulch backfilled surfaces of planting beds and other areas indicated. Do not mulch seeded areas.

1. Organic Mulch: Apply 2-inch average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.10 CLEANUP AND PROTECTION

A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.11 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 329300

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

1. Cleanouts.
2. Inlets.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

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

1. Backwater valves.
2. Cleanouts.
3. Inlets.
4. Pipe
5. Fittings.
6. Drains.

B. Coordination Drawings: Show pipe sizes, locations, and elevations.

C. Field quality-control test reports. Product Data: For each type of product indicated.

1.4 PROJECT CONDITIONS

A. Site Information: Research public utility records, and verify existing utility locations prior to ordering any materials. Notify Architect immediately if any discrepancies are found in the project survey.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252, Type S, with smooth waterway for coupling joints.

1. Soiltight Couplings: AASHTO M 252, corrugated, matching tube and fittings.
2. Corrugated PE Pipe and Fittings NPS 12 and Larger: AASHTO M 294, Type S, with smooth waterway for coupling joints.
3. Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings.

2.4 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.6 CLEANOUTS

A. At grade clean outs shall have an adjustable sleeve-type housing, a threaded brass plug with counter sunk slot, and a cast iron frame and cover.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.7 TRENCH DRAINS

A. Trench drains as manufactured by Polydrain by ABT, Inc. Load Class D with 0.6 percent bottom slope, or approved equal.

2.8 STORMWATER AREA DRAINS

A. Area Drains: Made of materials and dimensions as shown on the Drawings.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, backfilling, and identification materials and their installation are specified in Section 312000 "Earthmoving." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

1. Use detectable warning tape over all piping and over edges of underground structures.

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 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.

D. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping with 36-inch minimum cover.
3. Install piping below frost line.
4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

E. 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, nonpressure drainage piping according to the following:
   1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
   2. Join dissimilar pipe materials with nonpressure-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, as indicated in plans. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.5 AREA DRAIN INSTALLATION

A. Set frames and grates to elevations indicated.

3.6 TRENCH DRAIN INSTALLATION

A. Install per Manufacturer’s recommendation.

3.7 CONNECTIONS

A. Connect nonpressure, 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 overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    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.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

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 334100