



INVITATION TO BID #2018-17
Wichita Park Construction
ADDENDUM NUMBER 1
March 29, 2018

On March 22, 2018, Clackamas County, on behalf of the North Clackamas Parks and Recreation District ("County") published Invitation to Bid #2018-17 ("BID"). The County has found that it is in its interest to amend the BID through the issuance of this Addendum #1. Except as expressly amended below, all other terms and conditions of the original BID shall remain unchanged.

1. The following changes have been made to the Project Information, Plans, Specifications and Drawings:

- Remove in its entirety the Wichita Park Permit Set Specifications, dated March 1, 2018, and replace with the new specifications titled Wichita Park Bid Set Specifications, Addendum #1, dated March 27, 2018, hereby attached and incorporated by reference.

Attachments: Wichita Park Bid Set Specifications, Addendum #1, dated March 27, 2018

End of Addendum #1

Wichita Park

Bid Set Specifications

Addendum #1

March 27, 2018

Client:

North Clackamas Parks and Recreation District
150 Beaver Creek Road
Oregon City, OR 97045

Prepared by:

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SECTION 01 10 00

SUMMARY OF WORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Specifications, and general provisions of the Contract, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project includes but not limited to: Clearing and grubbing, grading, installation of pavement, play equipment, fencing, drainage system, signs and site furnishings, irrigation and planting, right-of-way improvements, and utility upgrades.
- B. Architect Identification: The Contract Documents, dated March 1, 2018 were prepared by: Lango Hansen Landscape Architects.

1.3 CONTRACT

- A. Contract Type: Stipulated Price as described in the Bid Proposal Form Section B-5.
- B. Work of the Project includes construction of the Wichita Park. The proposed development is located at 5908 SE Monroe Street Milwaukie, Oregon 97222.
- C. Off-site Work includes: Roadway improvements along the north face of Wichita Park from the ROW to the centerline of Monroe Street.
- D. The Owner has applied for and paid for the following permits: Tree Removal, Grading, and right-of-way permits.
- E. Contractor is responsible for procuring and paying for all project trade permits.
 - 1. The Contractor is responsible to comply with all project permits.
- F. Perform Work of Contract under a Lump Sum contract with Owner in accordance with Conditions of Contract.
- G. It is not anticipated that the Owner will perform any Work on the site.
- H. Contract Duration:
 - 1. COMMENCEMENT DATE: Upon Issuance of Notice to Proceed ("NTP")
 - 2. SUBSTANTIAL COMPLETION DATE: September 15, 2018 (Except for seeding and plant establishment)
 - 3. FINAL COMPLETION DATE: October 1, 2018

1.4 USE OF PREMISES

- A. Construction staging, activities and schedules for this Project will be coordinated with the Owner's Representative.
- B. Work limits are restricted to limits that have been shown on Contract Documents and approve by the Owner's Representative.

1.5 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 7 a.m. to 7 p.m., Monday through Friday, except as otherwise indicated.
 - 1. Weekend Hours: Only as allowed by local jurisdictions AND by special arrangement with the Owner's Representative.
- B. Existing Utility Interruptions: 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 below:
 - 1. Schedule for and notify Owner's Representative of facility after hours utility shut downs a minimum of five (5) days in advance of proposed utility interruptions.
 - 2. Quick utility disconnect and reconnects, hot taps, done during a time acceptable by the Owner's Representative are allowed but must be scheduled and approved two (2) weeks in advance. Contractor to provide all necessary warning signs and/or watch-staff to coordinate utility changeovers as approved.
 - 3. Do not proceed with utility interruptions without Owner's written permission.

1.6 WORK SEQUENCE

- A. Provide construction facilities and temporary controls during mobilization. Contractor shall secure site access, construction staging, and project site.
- B. Contractor will provide temporary signage stating the closure and/or limited access for this project as required by the Owner's Representative.

1.7 OWNER'S REPRESENTATION

- A. Owner: North Clackamas Park and Recreation District.
- B. Owner's Representative: the District's Project Manager, unless otherwise determined.
- C. Landscape Architect: Landscape Architect of Record or other contracted Consultants as identified.
- D. Special Inspectors: As identified to perform special inspections related to the Work of the Project.

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preconstruction meeting.
- B. Pre-Installation Conference.
- C. Progress meetings.
- D. Request For Information (RFI).
- E. Product Data/Submittals.
- F. Layout of work.
- G. Permits
- H. Field Engineering

1.2 DEFINITIONS

- A. Product Data: Printed information, such as manufacture's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
- B. Samples: Partial sections of manufactured or fabricated components, cuts or containers of material, color range sets a, and swatches showing color, texture, and pattern.
 - 1. Samples used to establish standard by which Work will be judged.
- C. Mockups:
 - 1. Full-sized assemblies for review of construction, coordination, testing, or operation; they are not Samples.
 - 2. Approved mockups will be used to establish standard by which Work will be judged and maybe allowed to remain as part of the permanent Work.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 PRECONSTRUCTION MEETING

- A. Owner's Representative will schedule a meeting at the project site, no later than fifteen (15) days after Notice of Award.

- B. Attendance Required:
1. Owner's Representative
 2. Owner
 3. Landscape Architect
 4. Contractor Project Manager and Superintendent
 5. Subcontractors deemed necessary by Contractor and/or Owner's Representative.
 6. Manufacturers deemed necessary by Contractor and/ or Owner's Representative.
- C. Agenda:
1. Execution of Owner-Contractor Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Submission of: list of subcontractors, schedule of values, and preliminary construction schedule.
 4. Designation of personnel representing the parties to Contract.
 - a. Emergency off-hour contacts.
 5. Routing of correspondence.
 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 7. Scheduling:
 - a. Critical work sequencing.
 - b. Special inspections.
 8. Use of premises by Owner and Contractor.
 9. Temporary Utilities provided by Owner.
 10. Survey and site layout by Contractor.
 11. Security and housekeeping procedures.
 - a. Site access, traffic, and parking rules.
 - b. Office, work, and storage areas.
 - c. Working hours.
 12. Application for payment procedures.
 13. Procedures for Special Inspections.
 14. Procedures for maintaining record documents.
 15. As-built record keeping.
- D. Record minutes and distribute copies within two (2) working days after meeting to all participants, and those affected by decisions made.

3.2 PRE-INSTALLATION CONFERENCES

- A. Conduct pre-Installation Conference before each activity that requires coordination with other construction activities. Specification Sections requiring pre-Installation Conferences include but not limited to;
1. Play Area
 2. Irrigation and Planting
 3. Right of Way work
 4. Other construction activities as appropriate
- B. Attendance required:
1. Owner's Representative.
 2. Owner

3. Landscape Architect
4. Contractor.
5. Manufacturer's representative, if required by manufacturer or these specifications.
6. Code enforcement personnel, if required by local codes.

C. Notifications:

1. Notify attendees of scheduled Conference a minimum of seven (7) calendar days in advance of the conference.

3.3 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout construction progress of the work at minimum weekly intervals or as determined by Owner's Representative.
- B. Make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
- C. Attendance required: Contractor's project manager, Job, major Subcontractors and suppliers, Owner's Representative, Owner, as appropriate to agenda topics for each meeting.
- D. Record attendance and meeting minutes will be provided by Landscape Architect.
 1. Meeting minute items will be numbered sequentially using meeting number and item number.
 2. Meeting minutes will track all items until noted as resolved in the meeting minutes.

3.4 REQUEST FOR INFORMATION

- A. When field conditions or contents of Contract Documents require clarification of verification by Architect, following procedure is required.
 1. Present item or items requiring clarification/verification at Progress meeting for discussion. (For critical or emergency items, contact Owner's Representative immediately).
 2. If it is determined by the **Owner's Representative or Architect/Engineer** that item or items do not require written RFI submittals, then clarification/verification shall be in Progress Meeting Report.
 3. If it is determined by the **Landscape Architect or Owner's Representative** that item or items do require written RFI submittals, prepare each RFI on a form approved by Architect.
 4. Number RFI sequentially from "001".
 5. Record each RFI in a log, identifying each by RFI-#, subject, date submitted, date of response, and disposition. Update and distribute log at project meetings.
 6. Provide a proposed solution to the RFI.
 7. Landscape Architect shall respond to submitted RFI's within seven calendar days in space provided on RFI form.
 8. If a potential cost impact is indicated on RFI, then include a change order request for the proposed work.
- B. Route and copy RFI's in same manner as correspondence.

- C. If an Agreement regarding clarification/verification for RFI's cannot be reached by the parties, see General Conditions and Supplementary Conditions for procedures to resolve conflict.

3.5 PRODUCT DATA/SUBMITTALS

- A. Collect Product Data/Submittals into a single submittal for each element of construction or system.
- B. Mark each copy to show applicable choices and options. Where printed Product Data/Submittals includes information on several products that are not required or proposed for Work, clearly mark copies to indicate applicable information.
- C. Include following information:
 - 1. Manufacturers' printed recommendations.
 - 2. Compliance with trade association standards.
 - 3. Compliance with recognized testing agency standards.
 - 4. Performance characteristics and capacities.
 - 5. Notation of dimensions verified by field measurement.**
 - 6. Required clearances, wiring and piping diagrams, and controls.
 - 7. Manufacturer's standard schematic drawings and diagrams, modified as required to suit Project requirements.
 - 8. Notation of coordination requirements.
- D. Colors and Patterns: Except where specific color and pattern is indicated in Contract Documents, and whenever a choice of color or pattern is available in specified products, submit two (2) color and pattern charts to Architect/Engineer for selection.
- E. Submit following for each required submittal:
 - 1. Digital copy for Landscape Architect's Review.
- F. Landscape Architect will return submittal marked with action taken and corrections or modifications required, to Contractor for distribution.

3.6 SAMPLES

- A. Submit Samples for review of size, kind, color, pattern, and texture, and to illustrate functional and aesthetic characteristics of Product.
- B. Where variation in color, pattern, or texture, or other characteristics is inherent in material or product represented, submit at least 3 multiple units that show approximate limits of variations, or number of units indicated in individual specification Sections.
- C. Field Samples: Full-sized examples erected on-site to illustrate finishes, coatings, or finish materials and to establish Project standard.

3.7 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual Sections, submit them at project closeout:
 - 1. Project record documents.
 - 2. Operation and maintenance data.

3. Warranties.
4. Bonds.
5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

3.8 LAYOUT OF WORK

- A. Survey and verify conditions of the Project Site.
- B. Record existing conditions prior to construction for comparison with Contract Documents.
1. Report conflicts to Architect/Engineer prior to start of Work.
 2. Architect will provide revisions to Contract Documents or issue instructions to deal with conflicts.
 3. Be responsible for remedying conflicts, which could have been prevented by timely reviews of existing conditions.
 4. Remedies, which vary from Contract Documents shall be approved by Architect/Engineer and Owner's Representative.

3.9 PERMITS

- A. The following permits have been obtained by the Owner:
1. Planning and Right-of-Way Permit
 2. Grading Permit
 3. Tree Removal Permit
 4. Erosion Control Permit
- B. The Contractor is responsible for obtaining and paying the following permits:
1. Plumbing Permit (Owner to pay for Meter only)
 2. Electrical Permit. See Design Build Requirements for work done to date.
 3. Any other trade permits deemed necessary to complete construction.

3.10 FIELD ENGINEERING

- A. Engineering Services:
1. Provide field engineering services as required for construction.
 2. Locate and maintain and accurate benchmark on or near suite which has been established by a Registered Surveyor.
 - a. Relate subsequent elevations of finish grades and building elements to this benchmark.
- B. Existing Control Points:
1. Protect control points prior to starting Work, and preserve permanent reference points during construction.
 2. Make no changes or relocations of control points without written notice to Architect's/Engineer's Representative.
 3. Report to Architect's/Engineer's Representative when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- C. Instrument layout:

1. Using site benchmarks and existing elevation control points, establish lines and levels, located and layed out by survey instrumentation.
 2. Locate water supply, storm and sanitary sewer lines.
 3. Locate edge and level of paving, curbs, walks, and sloping landscape.
 4. Locate building foundations, columns locations, and floor levels.
 5. Locate controlling lines and levels required for plumbing, mechanical and electrical Work within five (5) feet of building perimeter.
- D. Corrections:
1. Record changes in elevations or location of Work on project record Documents.
 2. Report errors in horizontal and vertical dimensions and grades prior to starting Work.
- E. Verification:
1. Verify dimensions of new and existing Work.
 - a. If field measurements differ slightly from Drawings, modify to accommodate. If field measurements differ significantly from Drawings, notify Architect/Engineer prior to commencing Work.
 2. Coordinate locations of openings through floors, roofs and walls with Architectural, Mechanical and Electrical Drawings.
- F. Documentation:
1. Submit documentation to verify accuracy of field engineering Work when requested by Architect/Engineer or Owner.

END OF SECTION

SECTION 01 30 50
DESIGN BUILD REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Certain components of the Work under this project are Design Build. It is the Contractor's responsibility to coordinate and assume or assign to subcontractors the complete responsibility for the design, calculations, submittals, fabrication, transportation, and installation of the Design Build portions or components as required in this Section. The Applicant is responsible for submitting to the governing jurisdiction all Design Build documents required for the separate approval for each Design Build item. There are no exceptions. Design Build components of this Work are defined as complete, operation systems, provided for their intended use.
- B. The Owner's Representative's review of Design Build submittals shall be for design intent and shall not lessen nor shift the responsibility from the Applicant or the assigned subcontractor to the Owner nor the design professional. The Owner shall not be responsible for paying for any delays, additional products, additional hours of work or overtime, restocking or rework required due to failure by the Applicant or the subcontractor to coordinate their Work with the Work of other trades on the project or to provide the Design Build portion or component in a timely manner to meet the schedule of the project.
- C. Design Build components include all electrical design and installation required as indicated in the specifications and Drawings.

1.2 SUBMITTALS

- A. Comply with pertinent provisions of Division 1.
- B. Design Build submittals are required to show complete criteria, design assumptions, details, calculations, submittals, instructions for fabrication, assemble, installation and interface with other trades, unless noted otherwise in the specific Specification Section.
 - 1. Include product data for all components.

1.3 PERMITTING

- A. Contractor to provide all information necessary for complete permit application.
- B. Contractor to acquire all necessary permits before the commencement of any work.

1.4 REGULATORY REQUIREMENTS

- A. Conform with current provisions of the following codes, standards, and specifications:

1. Federal Specifications
 2. American National Standards Institute
 3. National Electrical Manufacturer's Association
 4. National Electrical Code
 5. National Fire Protection Association
 6. National Electric Safety Code
 7. Uniform Building Code
- B. Where conflicts exist between any of the above standards, the standard which is most stringent shall take precedence.
- C. Contractor to be selected from PGE approved list.

1.5 COORDINATION

- A. Work under this division shall be conducted in a manner to cooperate with other trades and contracts involved with this project.
- B. Consult all drawings and specifications for the project and verify the requirements of all equipment by other divisions, the Owner or by other contracts prior to installation and connection.
- C. Consult the drawings of all other divisions to avoid conflicts with cabinets, equipment, structural members, etc.

1.6 WARRANTY

- A. Provide evidence of guarantees against defect for factory-assembled equipment and devices on which the manufacturers furnish standard published guarantees as regular trade practice; this guarantee shall not be less than one year after acceptance. The complete installation including workmanship shall be guaranteed against defect for one year after final acceptance. The Contractor shall agree to correct, repair or replace defective materials/equipment at no additional cost to the Owner. The results of defective workmanship shall also be corrected at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Like items such as switches, receptacles, fixture types, panels, etc. shall be from one manufacturer.

- B. All material shall be new and bear manufacturer's name, model number, electrical characteristics, UL label and other standard manufacturer identification.

2.2 ELECTRICAL WORK

A. Electrical Connection:

1. Contractor to provide electrical connection from existing onsite electrical pole. Obtain all necessary trade permits for this work. Work includes:
 - a. Excavate utility trench from existing utility pole to location shown on drawings
 - b. Install electrical conduit in trench
 - c. Install electrical meter and connect to power line. Power line from utility pole to meter to be installed by PGE.

B. Circuits:

1. Complete wiring to all panels, breakers, switches, outlets, lighting and other electrical equipment as specified and as indicated in the Drawings.

C. Meter:

1. Contractor to install meter in location as shown on Drawings. Meter shall meet all applicable City, County, and State Codes.
2. Provide all other circuit breakers and panels necessary for functioning system.

D. Irrigation Controller

1. Provide 117 VAC, 60 Hz. See Irrigation specifications and product literature for additional information.
2. Provide (4) 110-volt plug outlets inside control cabinet for non-controller use.

PART 3 EXECUTION

3.1 GENERAL

- A. Contractor to supply all necessary equipment, tools, and products necessary to install system as shown on Drawings and as specified.

3.2 DIVISION OF LABOR

- A. Existing power line serving onsite utility pole to be disconnected and removed by PGE.
- B. Contractor to remove and dispose of onsite utility pole and light.

- C. PGE to relocate existing guy wire support for pole located in ROW on south side of SE Monroe St.
- D. PGE to install new power line and provide power drop at existing pole located in ROW on south side of SE Monroe St. PGE to install conduit and power line down to base of pole.
- E. Contractor (approved by PGE) to excavate trench and install conduit from pole to onsite location of meter, as shown on drawings.
- F. PGE to install power line from pole to meter located onsite.
- G. Contractor to connect power line to meter.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. References and Standards.
- B. Quality assurance submittals.
- C. Control of Installation.
- D. Testing and inspection services.
 - 1. Inspection and testing services required to verify compliance with requirements specified or indicated as provided by the Owner.

1.2 REFERENCES

- A. ASTM C 1021-08 – Standard Practice for Laboratories Engaged in Testing of Building Sealants.
- B. ASTM C1077-10d- Standard Practice for Laboratories Testing Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.
- C. ASTM C 1093-09 – Standard Practice for Accreditation of Testing Agencies for Unit Masonry.
- D. ASTM D 3740 -10- Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction.
- E. ASTM E 329-09 – Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- F. ASTM E 543-09 – Standard Practice for Agencies Performing Nondestructive Testing.

1.3 QUALITY ASSURANCE

- A. Qualifications for Inspection and Testing Agencies: For Contractors information only
 - 1. Owner will engage inspection and testing service agencies that are prequalified as complying with American Council of Independent laboratories’ “Recommended Requirements for Independent Laboratory Qualification” and that specialize in types of inspections and test to be performed.
 - 2. Each independent inspection and testing agency engaged on Project to be authorized by authorities having jurisdiction to operate in State where Project is located.
- B. Duties of Testing Agency:

1. Testing agency shall cooperate with Architect/Engineer and Contractor in performing its duties.
2. Agency to provide qualified personnel to perform inspections and test.
3. Agency to **immediately** notify Architect/Engineer and Contractor of irregularities or deficiencies observed in Work during performance of its services.
4. Except as otherwise specified, testing laboratory to secure, handle, and store samples and specimens for testing.

1.4 SUBMITTALS

- A. For Contractors information only: Test Reports: After each test / inspection, promptly submit one copy of report to Architect/Engineer, Owner's Representative and Contractor.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specification section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Result of test/inspection.
 - j. Conformance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 2. Test reports are submitted for Architect and Owner's Representative's knowledge as contract administrators for the Owner, for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the contract documents.
- B. Certificates: When specified in individual sections, submit certification by manufacturer and Contractor or installation/application subcontractor to Landscape Architect, in quantities specified for Product Data.
 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- C. Manufacturer's Instructions: When specified in individual specifications sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Architect's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.5 TESTING AND INSPECTION AGENCIES

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing; and inspections.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Landscape Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 TESTING AND INSPECTION

- A. See individual specification sections for testing; and inspection required and Quality Control Inspections listed above.
- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Landscape Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. **Immediately** notify Landscape Architect and Contractor of observed irregularities or non-conformance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Attend preconstruction meetings and progress meetings.
 - 8. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.

3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used, which require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide location for storage and curing of test samples.
 4. Notify Architect and Testing agency 24-hours prior to expected time for operations requiring testing/inspection services
 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.
- F. Inspections and testing costs required by defective Work or improperly timed notices shall be paid by Contractor.
- G. Utilization of testing laboratory services in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

3.3 REPAIR AND PROTECTION

- A. Upon completion of inspection, testing, and sample taking, repair damaged construction.
1. Restore substrates and finished
 2. Comply with Section 01 70 00 - Cutting and Patching.
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection are Contractor's responsibility, regardless of assignment of responsibility for inspection and testing.

3.4 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Landscape Architect, it is not practical to remove and replace the Work, Landscape Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Temporary fencing, barricades, and guards to protect trees which are to remain from damage above and below grade.
 - 1. Erect as shown on plans.
- B. Protection of root systems from smothering, compaction and damage.
- C. Protection of plant growth, including root systems of trees and plants, from dumping of refuse or chemically injurious material or liquids, and continual puddling of running water.
- D. Specification shall be applied concurrently and in conjunction with other plant material protection measures herein described and specified.

1.2 GENERAL REQUIREMENTS

- A. Preservation, protection, and pruning of existing trees and shrubs, and other vegetation indicated to remain.
- B. Meet local jurisdiction requirements for protection of existing trees and vegetation.
- C. Provide temporary fencing, barricades and guards as required to protect trees and other plants to remain from all damage.
- D. Protect all trees to remain from stockpiling, material storage, vehicle parking and driving within the Tree Protection Zone.
 - 1. Do not store construction materials or permit vehicles to drive or park within Tree Protection Zone of any tree to remain.
- E. Owner to provide Certified Arborist for review of conditions that arise in the field. Contractor to provide a Certified Arborist to perform the work as needed.

1.3 DEFINITIONS

- A. Certified Arborist: Certified by The International Society of Arboriculture (ISA).
- B. Drip line: The area defined by the outermost perimeter of a tree's or shrub's vegetated canopy.
- C. Tree Protection Zone (TPZ): Area defined by, at a minimum, the *drip line* of a single designated tree or the outermost perimeter of the combined *drip line areas* of a designated group of trees, but more specifically reflecting the *Critical Root Zone (CRZ)* of each tree and

plant species to be protected. This area may be established or extended as deemed necessary by the Owner's Representative.

1.4 SITE VERIFICATION OF CONDITIONS

- A. Meet with Owner's Representative to conduct on-site inspection of tree and plant materials to remain and Tree Protection Plan prior to start of Work.
- B. Notify Owner's Representative 48-hours prior to starting construction work around trees to be saved and prior to tree work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. As indicated and required elsewhere in this Specification Section, and as recommended by Owner's Representative.
- B. Fencing: Owner's Representative field reviews and approves all tree protection locations, methods and measures. See Drawings for fencing material.
- C. Pruning Equipment:
 - 1. Roots and Branches Larger than 1-inch in diameter: Sharp saw.
 - 2. Roots and Branches 1-inch or less in diameter: Pruning shears.

PART 3 EXECUTION

3.1 INSPECTION

- A. Inspect trees shown on plans to be protected, prior to start of construction.
 - 1. Document and photograph unusual conditions.
 - 2. Submit digital copies of documentation to Owner's Representative prior to beginning work.
 - 3. Verify conditions regarding tree protection prior to site disturbance.
- B. Owner's Representative must be present during demolition of existing conditions within drip line of trees to remain.
- C. Notify Owner's Representative within 24-hours prior to inspection and/or tagging of protected trees.

3.2 GENERAL

- A. Install fencing/barricades around all tree protection zones of trees designated to remain prior to commencement of any construction activities including but not limited to clearing and demolition work.
 - 1. Once erected, plant protection fencing will be maintained throughout the duration of the work.

2. All ingress is prohibited without prior approval from the Owner's Representative.
 3. Designate protected trees to be clear of any material storage, personnel, or vehicular movement.
- B. Protect all plant growth including root systems of trees and plants to remain from:
1. Construction activities including but not limited to: material storage, staging, all work activities and parking.
 2. Dumping of construction related refuse.
 3. Damage due to noxious materials in solution caused by runoff and/or spillage during mixing and placement of construction materials, and drainage from stored materials.
 4. Chemically injurious materials and liquids used in construction process.
 5. Flooding, erosion, or excessive wetting resulting from dewatering operations, compaction, water flow or traffic.
 6. Unauthorized cutting, breaking, or skinning roots and branches, skinning, and bruising of bark.
- C. Where cutting seems necessary, review conditions with Owner's Representative before proceeding, and comply with directives.
- D. Fires on project site are not allowed.
- E. Engage the Owner's Representative to direct removal of branches from trees and large shrubs to remain, if required to clear new construction and where indicated; and to direct tree root pruning and relocation work.
- F. Where directed by the Owner's Representative, extend pruning operations to restore natural shape of trees and other plants impacted by construction activities.
- G. Cut branches and roots with sharp pruning instruments, as specified. Do not break, chip or mutilate.
- H. Water trees and other vegetation to remain as necessary to maintain their health during the course of the work.
1. Maintain a watering schedule and log of watering operations.
- I. Restrict vehicular and foot traffic of all construction crews, to prevent compaction of soil over root systems and within tree protection zones.

3.3 PRE-CONSTRUCTION CARE

- A. All trees designated to be retained within the project limits shall be pruned to ANSI A-300 Pruning Standards with selective low limb removal, as directed and approved by the Owner's Representative, where required for construction clearance.
- B. Structural support (cabling) in accordance with National Arborist Association Standards will be required on specific trees within the project limits and where required for construction clearance, as identified by the Owner's Representative.

3.4 EXCAVATION AROUND TREES

- A. Excavate within the tree protection zone of trees only where indicated and approved by the Owner's Representative.
 - 1. Excavate around tree roots within tree protection zone only under the direction of the Owner's Representative.
- B. Where excavating for new construction is required within root protection zones of trees:
 - 1. Hand excavate to minimize damage to root systems;
 - a. Use narrow tine spading forks and comb soil to expose roots.
 - b. Reposition roots in backfill areas whenever possible.
 - 2. Specialized equipment/machinery may be used only as approved by the Owner's Representative and permitting agency. Machinery shall be:
 - a. Equipped with rubber tracks, not metal tracks;
 - b. Designed to perform the task it is being used for;
 - c. Appropriate and capable for each task in order to minimize damage to root systems and avoid disturbance to adjacent surface and subsurface conditions;
 - d. Appropriate in size for the specific conditions of the project in order to minimize site impacts to the greatest extent possible;
 - e. Operated only by trained and experienced personnel; and,
 - f. Operated only within approved, designated locations and, in strict adherence, shall not be allowed to enter, cross, maneuver, park, or otherwise access any areas other than those approved and designated for the work.
- C. Where trenching for utilities (including but not limited to sewer, storm, electrical, water service and irrigation) is required within tree protection zones:
 - 1. Owner's Representative needs to approve trenching routes.
 - 2. Tunnel under or around roots by hand digging or boring.
 - 3. Trench toward trunk of tree and tunnel under central root mass to avoid severing lateral roots on sides of trench.
 - 4. Do not cut main lateral roots or tap roots over 1-inch diameter. If roots larger than 1-inch diameter are damaged or need to be cut, a root inspection by Owner's Representative is required. Cut smaller roots using sharp pruning tools as specified.
 - 5. Roots greater than 1-inch in diameter exposed during excavation must be cut squarely at the edge of the excavation with a sharp saw or appropriate pruning tool as specified.
 - 6. Temporarily support and protect roots from damage until permanently covered with approved backfill.
- D. Utility trenching routes may need field adjustment or areas of manual excavation to avoid tree roots for both inside and outside of tree protection zones.
- E. Do not allow exposed roots to dry out before permanent backfill is placed. Provide temporary earth or burlap cover; pack with wet compost or four layers of wet untreated burlap.
 - 1. Backfill roots after inspection approval by Owner's Representative.

2. Backfill around root excavations only with clean import topsoil free from materials deleterious to root growth.
 3. Backfill to eliminate voids, compact only by means of manual tamping at root areas.
 4. Water sufficiently to settle backfill and to eliminate voids and air pockets around roots.
 5. Water roots daily when exposed and maintain in a moist condition.
 6. Allow for natural settlement of soil surface, and furnish and apply topsoil sufficient to bring to original finish grade after backfill settlement.
- F. Notify Owner's Representative immediately upon discovery of conditions that threaten survivability of protected tree or that affect vitality, stability or integrity of root system.
- G. All pruning shall be performed to ANSI A-300 Pruning standards and accepted by the Owner's Representative. Other therapeutic care work shall be performed to National Arborist Association standards.

3.5 GRADING AND FILLING AROUND TREES

- A. Maintain existing grade within tree protection zones unless otherwise indicated on Drawings or approved by the Owner's Representative.
- B. Lowering Grades: Where existing grade is above new finished grade shown around trees, under direction of the Owner's Representative, carefully hand excavate within root zones to new grade. Cut roots exposed by excavation, as specified, to approximately 3-inches below elevation of new finished grade.
- C. Raising Grades: Permitted only as acceptable to the Owner's Representative.

3.6 REPAIR AND REMOVAL OF TREES AND PLANTS

- A. Engage the Owner's Representative to perform tree and plant repair work.
1. Repair trees and plants damaged by construction operations in a manner acceptable to the Owner's Representative.
 2. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees and plants.
- B. Remove and replace dead and damaged trees and plants determined by the Owner's Representative to be incapable of restoration to normal growth pattern.
1. Provide new shrubs of same size and species as those replaced or as other wise acceptable to the Owner.
 2. Plant and maintain according to specifications provided.
- C. Trees designated by Owner for complete removal for construction.
1. Prevent damage to trees to be saved and minimize conflicts between trees and people or property. Activities under trees should strive to minimize impact to trees or root zones. Contractors are responsible for tree damage incurred during construction.
 2. Qualifications: The General Contractor must be on site during tree removal. All persons and sub-contractor(s) performing tree work must be licensed Certified Arborists through the International Society of Arboriculture; and must be familiar

with natural area preservation principles. All climbers and sawyers will be licensed Certified Arborists with a minimum of five years of experience doing similar type and scale of work. The Arborists shall be able to fall, block or otherwise remove a tree as required without damage to structures or other trees.

- a. The General Contractor shall provide qualifications and references to the Owner's Representative for approval prior to start of work.
3. Work: Trees shall be felled or blocked in the best manner feasible to avoid damage to adjacent trees, plants, root zones, natural resources, utilities and properties. Trees may only be felled or blocked within the designated construction area and, in strict adherence, shall not be placed or allowed to fall outside of the designated construction area or within a tree protection zone. The arborist performing the work shall determine the best method possible for removing each tree and shall develop a strategic plan for tree removal for approval by the Owner's Representative prior to beginning any tree removal work.
4. Stumps: Stumps and roots inside the area of cut and fill are to be removed after initial felling unless otherwise directed. Void from removed stump shall be backfilled with specification material. Stumps outside the area of cut and fill may be cut clean and flush to the ground and left in place with the approval of the Owner's Representative.
5. Diseased Trees: Trees infected with a disease or insect such as Sudden Oak Death or Asian Longhorned Beetle may need to be disposed by following the guidelines of the Oregon Department of Agriculture (ODA). The ODA, the Natural Resources Supervisor and Owner's Representative will need to be notified of suspected trees.
6. Snag Trees: Trees identified on the Tree Plan to be snagged shall be retained in place and cut to the height as approved. Removed woody materials will be utilized as downed wood as approved or removed from the site. Care should be taken to avoid damage to adjacent trees and plants when cutting snags.
7. Safety: The tree removal operation shall be discussed in the Safety Plan. The trees shall be removed without hazard to people and structures. The Safety Plan shall address trees to be felled in a specific direction and be completed by the arborist or trained personnel under the direct supervision of the arborist. The arborist shall review the site ahead of submitting the Safety Plan; and determine if there are additional hazard trees that should be removed as a matter of safety. These trees shall be discussed as a possible change order.
8. When performing tree removal work, at a minimum:
 - a. Remove people not involved in the work from the area.
 - b. Identify the hazard area with red danger tape.
 - c. Prohibit unauthorized individuals from entering into the work area.
 - d. Evaluate removal options.
9. All heavy machinery shall be limited to areas outside the drip line of trees to be saved, except as approved by Owner's Representative. Any approved work within the drip line of trees to be saved, shall be done with machinery having rubber tracks, not metal tracks. To minimize compaction, a 12-inch thick layer of wood chips may be placed within the drip line of trees to be saved. Plywood sheets may also be placed over the layer of wood chips to further lessen compaction. The plywood sheets and layer of wood chips shall be removed once the tree removal operation is complete.

10. The Contractor shall fall the trees in a manner to provide usable wood for other projects. Verify specific project requirements with Owner's Representative.
 11. Fallen trees blocking a trail need to be cut four feet back from either side of a trail. Tree stumps or visible cuts are to be disguised by muddying up the stump with some surrounding soil and adding pieces of moss if available. If possible, flush cuts on stumps near trails are preferred.
 12. Roots are to be cut with sharp tools designed for the purpose. It is advisable not to cut any root larger than 1" in diameter. When unavoidable, roots shall be cut, not chopped or scraped. Where needed, tunnel under or around roots by hand digging or boring. Pruning of limbs and branches shall be done to ANSI A300 arboriculture standards.
- D. In the event that any trees or plants are damaged, destroyed, or removed as a result of Contractor's, or it's agents' or employees', acts or omissions, damages shall be assessed against the Contractor in accordance with the formulas and standards set forth in the "Council of Tree and Landscape Appraisers" Guide For Plant Appraisal, as it may be revised. In the event that a tree or plant is damaged, but not to the extent that it must be removed, then damages will be calculated as a percentage of the total value of the damaged tree or plant, as estimated by a Plant Professional authorized by the Owner. Contractor will also pay as damages, the costs associated with the District's appraisal of tree and plant damage and lost value, as well as all costs associated with any repairs to the trees and plants that are needed, as determined solely by the Owner's Representative.

3.7 HARDSCAPE INSTALLATION WITHIN TREE PROTECTION ZONES

- A. Only as indicated on Drawings and as approved and/or directed by Owner's Representative.
- B. Electrical conduit and irrigation main lines should be run under walkways, within stone or concrete sub-base, and should not cut into native soil within the Tree Protection Zone. Drip irrigation may be installed within the Tree Protection Zone as directed and approved. Lateral electrical lines to individual lights should be installed as close to the soil surface as possible with short runs from the main conduit.
- C. Electrical fixtures, housing and irrigation valves must be installed with care to avoid cutting roots. Digging must be minimal with excess dirt removed from the tree protection zone.
- D. Utility locations and installation shall conform to all applicable codes and requirements.
- E. Roots exposed during excavation shall be treated as specified herein.
- F. Install walkways as close to grade as possible to minimize excavation into the soil where large roots and areas of high root density exist. Backfill with loose dirt to the minimum depth necessary to achieve a natural look. Mulch if appropriate, as directed by the Owner's Representative.

3.8 PROTECTION

- A. Maintain protective measures throughout construction process.
 1. Repair any alteration to protection measures throughout construction process.

2. Repair or reinstall protective measures upon alteration.
3. Monitor protective measures daily.
4. Pruning and/or repairs must be approved in advance and at completion.
5. Contractor is responsible for cost of repair caused by his actions or by actions of his/her subcontractors.

3.9 CLEANING

- A. Remove fencing, barricades, and guards. See Section 01 70 00 – Execution and Closeout Requirements.
- B. Remove debris and dispose of in a legal manner. See Section 01 74 19 – Construction Waste Management and Disposal.

END OF SECTION 01 56 39

SECTION 01 57 13

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Performance bond.
- E. Compensation to Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.2 REFERENCE STANDARDS

- A. ASTM D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus; 2007.
- B. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Re-approved 2004).
- C. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2004.
- D. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2008.
- E. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2004.
- F. ASTM D 4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002.
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; current edition.

1.3 PERFORMANCE REQUIREMENTS

- A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the 2003 Construction General Permit (CGP), whether the project is required by law to comply or not.

- B. Also comply with all more stringent requirements of State of Oregon Erosion and Sedimentation Control Manual and Clackamas County Erosion Prevention and Sedimentation Control Manual.
- C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit weekly inspection reports.
- D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
- E. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- F. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- G. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- H. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - 1. Prevent windblown soil from leaving the project site.
 - 2. Prevent tracking of mud onto public roads outside site.
 - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- I. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures pump dry and remove deposited sediment after each storm.
- J. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to **Owner**; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - K. Open Water: Prevent standing water that could become stagnant.
 - L. Maintenance: Maintain temporary preventive measures until permanent measures have been established.
- 1.4 SUBMITTALS
- A. Erosion and Sedimentation Control Plan has been approved by the City of Milwaukie.
 - B. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
 - C. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.1 MATERIALS

- A. See Drawings for materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.2 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.3 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Soil Stockpiles: Protect using one of the following measures:
 1. Cover with polyethylene film, secured by placing soil on outer edges.
 2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves; or, 6 inches of straw or hay;
- C. Temporary Seeding: Use where temporary vegetated cover is required.

3.4 INSTALLATION

- A. As shown on Drawings.

3.5 MAINTENANCE

- A. Inspect preventive measures routinely (daily), within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Silt Fences:
 - 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 - 2. Remove silt deposits that exceed one-third of the height of the fence.
 - 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Straw Bale Rows:
 - 1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
 - 2. Remove silt deposits that exceed one-half of the height of the bales.
 - 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures weekly and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.

3.6 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Owners Representative.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 57 13

SUBSTITUTION REQUEST

*The Construction Specifications Institute
Northwest Region*

TO: _____

PROJECT: _____

SPECIFIED ITEM: _____

<u>Section No.</u>	<u>Page</u>	<u>Paragraph</u>	<u>Description</u>
--------------------	-------------	------------------	--------------------

PROPOSED SUBSTITUTION: _____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of request including identifying applicable portions.

Attached data also includes description of changes to Contract Documents that proposed substitution requires for proper installation.

Undersigned certifies that the following items, unless modified by attachments, are correct:

1. Proposed substitution does not affect dimensions shown on Drawings.
2. Undersigned pays for changes to building design, including engineering design, detailing and construction costs caused by proposed substitution.
3. Proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
4. Maintenance and service parts are available locally or are readily obtainable for proposed substitution.

Undersigned further certifies that function, appearance, and quality of proposed substitution are equivalent or superior to specified item.

Undersigned agrees that, if this page is reproduced, terms and conditions for substitutions found in Bidding Documents apply to this proposed substitution.

Submitted by

Name (Print)_____
Signature_____
Firm Name_____
Noted_____
Late
Address_____
City, State, Zip_____
Date_____
Telephone_____
Fax_____
General Contractor (if after award of Contract)

For use by A/E:

____ Approved

____ Approved as

____ Not Approved

____ Received Too

By_____
Date_____
Remarks**Attachments**

1999 Edition

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds

1.2 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect/Engineer with claim for final Application for Payment.
 - 1. Upon acceptance by Architect/Engineer, submit Record Documents to Owner's Representative with transmittal letter containing date, project title, Contractor's name and address, list of documents, and signature of Contractor.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or purposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operation by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one (1) copy of completed documents fifteen (15) days prior to final inspection. This copy will be reviewed and returned with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within ten (10) days after final inspection.
- C. Warranties and Bonds:
 - 1. Submit final warranties prior to final application for payment.
 - 2. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten (10) days after acceptance.
 - 3. Make other submittals within ten (10) days after Date of Substantial Completion, prior to Final Application for Payment.
 - 4. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance as the beginning of the warranty period.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 SUBSTANTIAL COMPLETION

- A. Prior to requesting inspection for certification of Substantial Completion, complete following.
 - 1. In Application for Payment that coincides with, or first follows, date of Substantial Completion is claimed, show 100 percent completion for portion of Work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated in these Contract Documents.
 - b. If 100 percent cannot be shown, include a list of incomplete items, value of incomplete construction, and reason Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases enabling Owner unrestricted use of Work and access to services and utilities.
 - a. Include occupancy permits.
 - 5. Submit:
 - a. Record Drawings
 - b. Record Specifications
 - c. Maintenance Manuals
 - d. Final project photographs
 - e. Damage or settlement surveys
 - f. Property surveys
 - g. Other final record information
 - 6. Deliver tools, spare parts, extra stock, and similar items.
 - 7. Make final changeover of permanent locks and transmit keys to owner.
 - a. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems and instructions to owner's operation and maintenance personnel.
 - 9. Discontinue and remove temporary facilities from site, along with mockups, construction tools, and similar elements.
 - 10. Complete final cleanup requirement Per section 01 70 00
 - 11. Touch up and otherwise repair and restore marred, exposed finishes, including touchup painting.
- B. Inspection Procedures: See section 01 70 00 Execution and Closeout Requirements.

3.2 PROJECT RECORD DOCUMENTS

- A. Architect/Engineer and Contractor will review the record drawings weekly during or after each weekly progress meeting.

- B. Maintain on site one set of the following record documents: record actual revisions to the Work and identify as RECORD DRAWINGS – PROJECT SET:
1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other modification to the Contract.
 5. Reviewed shop drawings, product data, and samples.
 6. Manufacturer’s instruction for assembly, installation and adjusting.
- C. Mark Drawings to show actual installation and construction where construction varies substantially from Work as shown.
1. Using an erasable colored pencil (not ink or indelible pencil) clearly describe change by graphic line and note.
 2. Date Entries, and notes related Change order numbers where applicable.
 3. Call attention to entries by a “Cloud” drawn around areas affected.
 4. Where overlapping changes occur, mark with different colors.
- D. Conversion of Schematic Layouts:
1. Design of future modifications of facility may require accurate information as to final physical layout of items which as shown schematically on Drawings.
 2. Show on Project set of Record Drawings, by dimension accurate to within one inch centerline of each run of items shown schematically on Drawings. Clearly identify item by accurate note such as “cast iron drain”, “galv. Water”, and like. Show by symbol or note, vertical location of item (“under slab”, in ceiling plenum”, “exposed”, and like). Relate by identification descriptive to Specifications.
- E. Ensure entries are complete and accurate, enabling future reference by Owner.
- F. Store record documents separate from documents used for construction.
- G. Record information concurrent with construction progress.
- H. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer’s name and product model and number.
 2. Show changes in actual Work performed in comparison with Specification text.
 3. Product substitutions or alternates utilized.
 4. Changes made by Addenda and modifications, such as Change Orders and modifications issued during construction.
- I. Record Drawings and Shop drawings legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 4. Field changes of dimension and detail.
 5. Details not on original contract drawings.

- J. Record Document Project Manual:
1. Maintain one copy of Project Manual, including addenda, Change Orders, and similar modifications.
 2. Mark up variations occurring in the actual work.
 3. Record substitutions and selection of options.
 4. Cross reference with other documents.
- K. Record Product Data:
1. Maintain one copy of Project Data Sample.
 2. Mark up significant variations in the actual work, Include:
 - a. Variations in product as delivered to site.
 - b. Variations from manufacturer's instructions and recommendations for installation.
 3. Cross-referenced with Change Orders and mark up Record Drawings and Specifications.
- L. Record sample submittal: Immediately prior to Date(s) of Substantial Completion, Architect/Engineer will meet with the Contractor at site, and determine which, if any, samples to be transmitted to Owner.
1. Comply with Architect's/Engineer's instructions for packaging, identification marking, and delivery to Owner's sample storage place.
 2. Dispose of other samples
- M. Miscellaneous record submittals:
1. Refer to other sections of these specifications for requirements of miscellaneous record keeping and submittal in connections with performance of the work.
 2. Prior to Date of Completion:
 - a. Complete miscellaneous records and place in good order.
 - b. Identify and bind or file.
 - c. Make ready for continued use and reference.
- N. Inspection reports:
1. Submit certificates from applicable local governmental agencies that the construction has been inspected as required by laws or ordinances and that the building is approved for occupancy.
- O. Keys:
1. Deliver at Completion Date or such earlier date as the Owner's Representative may designate for earlier occupancy by the Owner.
 2. Tag each key to indicate lock which key operates.
 3. Accompany keys with final hardware schedule, as specified in Finish Hardware Schedule.
- P. Final Record Documents: Prior to request for Substantial Completion, submit two complete sets of bond and electronic copies of Contract As-Built Drawings.
1. Clearly indicate at each affected detail and other drawings a full description of changes made during construction, and actual location of items.
 2. Show final locations of electrical junction in concealed locations.
 3. Call attention to entries by a "cloud" drawn around areas affected.

4. Make changes neatly, consistently, and with proper media to assure longevity and clear reproduction.

Q. Record Drawings electronic files:

1. Delivery Medium: Compact Disk
2. Provide record drawings in PDF format.
3. File Naming: Include project identification and sheet identification.

3.3 OPERATION AND MAINTENANCE DATA

- A. For each product or System: list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of components parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.4 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For each Product, Applied Material, and Finish:
 1. Product data, with catalog number, size, composition, and color and texture designations.
 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion data.

3.5 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For each Item of Equipment and Each System:
 1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristic, and limiting conditions.
 3. Include performance curves, with engineering data and test.
 4. Complete nomenclature and model number of replacement parts.

- B. Panel board Circuit Directories: Provide electrical service characteristics, controls, and communications; typed by label machine.
- C. Include color-coded wiring diagrams as installed.
- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instruction. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's part list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide control diagrams by controls manufacturer as installed.
- K. Provide Contractors coordination drawings, with color-coded piping diagrams as installed.
- L. Provide charts of valve tag numbers, with locations and function of each valve, keyed to flow and control diagrams.
- M. Provide list of original manufacturer's spare parts, and recommended quantities to be maintained in storage.
- N. Include test and balancing reports.
- O. Additional Requirements: As specified in individual product specification sections.

3.6 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experience in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 x 11 inch, three ring binders with durable plastic; covers, 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; Identify title of Project; Identify subject matter of contents and date of creation.

- E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: Manufacturer's printed data, or typewritten data bond paper.
- G. Drawings: Provide with reinforced punched binder tab. Bind in with text; Fold larger drawings to size of text pages.
- H. Arrange content by systems and sequenced of Table of Contents of this Project Manual.
- I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arrange by specification section. For each category, identify names, addresses and telephone numbers of Subcontractors and suppliers, Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.
- J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion data.
- K. Table of Contents: Provide title of Projects; names, addresses; and telephone numbers of Architect/Engineer, Consultants and Contractor with name of responsible parties; schedules of products and systems, indexed to content of the volume.

3.7 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work. Except for items put into use with Owner permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.
- B. Verify that documents are in proper form and acceptable to Owner, contain full information, and are notarized.
 - 1. Manufacturer shall countersign warranty.
 - 2. Subcontractor and installer shall countersign warranty where specified.
 - a. Provide required warranties for waterproofing and roofing systems countersigned by subcontractor and installer.

- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.
- F. Warranties are intended to protect owner against failure of work and against deficient, defective and faulty materials and workmanship, regardless of source.
- G. Limitations: Warranties are not intended to cover failures that result from:
 - 1. Unusual or abnormal phenomena of the elements.
 - 2. Owner's misuse, maltreatment or improper maintenance of work.
 - 3. Vandalism after substantial completion.
 - 4. Insurrection or acts of aggression including war.
- H. Related Damages and Losses: remove and replace work which is damaged as a result of failure, or which must be removed and replaced to provide access for correction of warranted work.
- I. Warranty Reinstatement: After correction of warranted work, reinstate warranty for corrected work to date of original warranty expiration, but not less than half original warranty period.
- J. Replacement cost: Replace or restore failing warranted items without regard to anticipated useful service lives.
- K. Rejection of Warranties: Owner reserves the right to reject unsolicited and coincidental product warranties that detract from or confuse interpretations of Contract Documents.
- L. Manual / Binders: Commercial quality, 8-1/2 x 11 inch, three ring binders with durable plastic; covers.
- M. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS; with title of Projects; names, addresses; and telephone numbers of Contractor and equipment suppliers, name of responsible company principal and date.
- N. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- O. Separate each warranty or bond with index tab sheets keyed to the table of contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preparing subgrades
 - 2. Base course for concrete walks.
 - 3. Base course for asphalt paving.
 - 4. Excavating and backfilling for utility trenches.
 - 5. Drainage fill for infiltration facilities.

1.2 SUBMITTALS

- A. Product Data.
- B. Aggregate Sieve Analysis.
- C. Infiltration test results.

1.3 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, or subgrade, and concrete, or 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 Landscape Architect]. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Landscape Architect. Unauthorized excavation, as well as remedial work directed by Landscape Architect, 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 cement concrete.
 - J. Subgrade: Surface or elevation remaining after completing excavation, or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, 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 stormwater facilities and infiltration galleries.
 - M. Unified Soil Classification System:
 1. GW: Well-graded gravels; gravel/sand mixtures with little or no fines.
 2. GP: Poorly-graded gravels; gravel/sand mixtures with little or no fines.
 3. GM: Silty gravels; poorly-graded gravel/sand/silt mixtures.
 4. GC: Clayey gravels; poorly-graded gravel/sand/clay mixtures.
 5. SW: Well-graded sands; gravelly sands with little or no fines.
 6. SP: Poorly-graded sands; gravelly sands with little or no fines.
 7. SM: Silty sands; poorly, graded- sand/gravel/silt mixtures.
 8. SC: Clayey sands; poorly-graded sand/gravel/clay mixtures.
 9. ML: Inorganic silts; sandy, gravelly, or clayey silts.
 10. CL: Lean clays; inorganic, gravelly, sandy, or silty, low to medium-plasticity clays.
 11. OL: Organic, low-plasticity clays and silts.
 12. MH: Inorganic, elastic silts; sandy, gravelly or clayey elastic silts
 13. CH: Fat clays; high-plasticity, inorganic clays.
 14. OH: Organic, medium to high-plasticity clays and silts
 15. PT: Peat, humus, hydric soils with high organic content.

1.4 PROJECT CONDITIONS

- A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Landscape Architect and then only after arranging to provide temporary utility services according to requirements indicated.
- C. Site Information: Research public utility records and verify existing utility locations prior to ordering any material. Notify the Landscape Architect 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: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, 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. 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 Oregon Standard Specifications for Construction 3/4-inch-0" BASE AGGREGATE.
- E. 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 3-inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. 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 Oregon Standard Specifications for Construction 3/4-inch—0-inch BASE AGGREGATE.
- G. Drainage Course: Narrowly graded mixture of washed 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.
- H. Backfill and Fill:
 - 1. Satisfactory soil materials
 - 2. Initial trench backfill: Use OREGON STANDARD SPECIFICATIONS FOR CONSTRUCTION (3/4-inch – 0-inch) base aggregate.

- I. Drainage Fill: Angular, granular material with a maximum particle size of 2 inches and shall meet Oregon 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.
- J. Drywell Filter Material: Refer to Section 33 41 00 "Storm Utility Drainage Piping."

2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 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 to comply with local practice or requirements of authorities having jurisdiction or 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 and be a minimum of 45 mil. thick. Joints or splices shall be waterproof. The wire shall be rated for 30 Volt.
- C. 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 Strength: 220 lbf; ASTM D 4833.
 - 4. Apparent Opening Size: No. 40; ASTM D 4751.
 - 5. Permativity (minimum): .5 sec⁻¹; ASTM D 4491.
- D. Separation Fabric: Woven geotextile, specifically manufactured 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: 180 lbf; ASTM D 4632.
 - 2. Tear Strength: 68 lbf; ASTM D 4533.
 - 3. Puncture Strength: 371 lbf; ASTM D 4833.
 - 4. Apparent opening size: No. 30; ASTM D 4751.

PART 3 EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving 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 earth moving 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 and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- F. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
- G. 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 shall material and equipment be stored on top of the installation area. Contractor shall not backfill facility until Engineer or Landscape Architect has inspected it and signed off.
- H. Protect all areas designated to receive pervious pavers or pervious pavement from excessive compaction.

3.2 EXPLOSIVES

- 1. 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. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions without prior approval by the Landscape Architect.
 - 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.

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: 6 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 and bedding course 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 STORMWATER INFILTRATION FACILITIES

- A. Excavate facilities to the indicated gradients, lines, depths, and elevations. All excavations shall be performed with the lightest practical excavation equipment. Excavation equipment shall not be operated within the limits of the facility.
- B. To help prevent subgrade soil contamination and clogging by sediment, facility construction shall be delayed until all other construction within its drainage basin 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 any 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 INFILTRATION TESTING

A. The contractor shall perform one open-pit falling head infiltration test within each proposed infiltration facility to verify the infiltration rate of the native soils. Pre-soak prior to testing.

1. Open Pit Falling Head Procedure:

- a. Excavate a hole with bottom dimensions of approximately 2 feet by 2 feet into the native soil to the elevation of the proposed facility bottom. If smooth auguring tools or a smooth excavation bucket is used, scratch the sides and bottom of the hole with a sharp pointed instrument, and remove the loose material from the bottom of the test hole.
- b. Fill the hole with clean water a minimum of 1 foot above the soil to be tested, and maintain this depth of water for at least 4 hours (or overnight if clay soils are present) to presoak the native material. In sandy soils with little or no clay or silt, soaking is not necessary. If after filling the hole twice with 12 inches of water, the water seeps completely away in less than 10 minutes, the test can proceed immediately.
- c. The measurements should be made with reference to a fixed point. A lath placed in the test pit prior to filling or a sturdy beam across the top of the pit are convenient reference points. The tester and excavator should conduct all testing in accordance with OSHA regulations.
- d. After the presaturation period, refill the hole with water to 12 inches above the soil and record the time. Alternative water head heights may be used for testing provided the presaturation height is adjusted accordingly and the water head height used in infiltration testing is 50 percent or less than the water head height in the proposed stormwater system during the design storm event. Measure the water level to the nearest 0.01 foot (1/8 inch) at 10-minute intervals for a total period of 1 hour (or 20-minute intervals for 2 hours in slower soils) or until all of the water has drained. In faster draining soils (sands and gravels), it may be necessary to shorten the measurement interval in order to obtain a well-defined infiltration rate curve.
- e. Repeat the test. Successive trials should be run until the percent change in measured infiltration rate between two successive trials is minimal. The trial should be discounted if the infiltration rate between successive trials increases. At least three trials must be conducted. After each trial, the water level shall be readjusted to the 12 inch level.
- f. The average infiltration rate over the last trial should be used to calculate the un-factored infiltration rate. The final rate must be reported in inches per hour.
- g. Upon completion of the testing, the excavation must be backfilled.
- h. For very rapidly draining soils, it may not be possible to maintain a water head above the bottom of the test pit. If the infiltration rate meets or exceeds the flow of water into the test pit, conduct the test in the following manner:

- 1) Approximate the area over which the water is infiltrating.

- 2) Using a water meter, bucket, or other device, measure the rate of water discharging into the test pit.
 - 3) Calculate the infiltration rate by dividing the rate of discharge (cubic inches per hour) by the area over which it is infiltrating (square inches).
- i. Provide all test results to the Engineer/Landscape Architect.

3.9 SUBGRADE INSPECTION

- A. Proof-roll subgrade with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Do not proof-roll subgrade in infiltration facilities.
- B. Soft pockets and areas of excess yielding that have been identified shall be scarified and moistened or aerated, or removed and replaced with suitable soil materials to the depth required. Re-compact and retest until specified compaction is obtained.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Landscape Architect, without additional compensation.

3.10 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 Landscape Architect.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Landscape Architect.

3.11 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.

3.12 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.

3.13 UTILITY TRENCH BEDDING

- A. Place bedding 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.

3.14 UTILITY TRENCH BACKFILL

- A. 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 pipe or conduit.
 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- B. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- C. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
- D. Install tracer wire in a continuous fashion above the utility in such a manner as to be able to properly trace utility lines without loss or deterioration of signal or without the transmitted signal migrating off the tracer wire. Bring tracer wire to the surface at every box, vault, drainage structure, or manhole.

3.15 DRAINAGE FILL

- A. Compaction of the native soil subgrade should be limited in order to prevent a reduction in the permeability of the soil.
 1. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and underlying soils scarified to a minimum depth of 3 inches with a York rake or equivalent and light tractor.
 2. Where subgrade has been compacted due to construction traffic, subgrade shall be scarified or removed to a depth sufficient to match the naturally occurring insitu state. Add additional base course material to meet design grades at no cost to the owner.
 3. Bring subgrade of base course to line, grade, and elevations indicated. Fill and lightly re-grade any areas damaged by erosion, ponding, or traffic compaction before the placing of stone.
- B. Place drainage geotextile over prepared subgrade, overlapping ends and edges at least 12 inches. Secure in place to prevent wrinkling.

- C. Place drainage fill and compact by tamping with a plate vibrator, and screed to depth indicated. For drainage fill that exceeds 8 inches in compacted thickness, place fill in layers of equal thickness, with no compacted layer more than 8 inches or less than 4 inches thick.
- D. Place drainage geotextile over compacted drainage fill, overlapping ends and edges at least 12 inches.

3.16 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 footings and foundations, use engineered fill.
 - 4. Under and around utility structures, use engineered fill.

3.17 STORMWATER INFILTRATION FACILITY FILL

- A. Growing media shall be placed in loose lifts, not to exceed 8 inches each.
- B. Placement of the growing media will not be allowed when the weather is too wet as determined by the owner's representative.

3.18 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, 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.

3.19 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 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 12 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 turf 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.

3.20 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 Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Turf or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1/2 inch.
 3. Pavements: Plus or minus 1/2 inch.

3.21 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course base course under pavements and walks as follows:
1. Shape base course to required crown elevations and cross-slope grades.
 2. Place base 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.
 3. Compact 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.

3.22 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

- C. Testing Agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area, but in no case fewer than three tests.
 - 2. 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.
- D. With the approval of the Engineer, proof-roll testing of subgrade and/or aggregate base may be substituted for other compaction testing.
- 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 materials to depth required; recompact and retest until specified compaction is obtained.

3.23 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, stormwater 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.

3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hot-mix asphalt patching.
 - 2. Pavement-marking paint.
 - 3. Pavement-marking thermoplastic material.
- B. Related Requirements:
 - 1. Section 31 20 00 "Earth Moving" for subgrade preparation, fill material, aggregate subbase and base courses, and aggregate pavement shoulders.
 - 2. City of Milwaukie Public Works standards.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements Section 0744 of the 2015 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.
 - 2. Comply with City of Milwaukie Public Works standards.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expect before time required for adequate cure, or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
 - 2. Asphalt Base and Surface Course:

Dense Graded Mixes
Less than 2 inches (51 mm)

Surface Temperature
60 degrees F (15.55 degrees C)

2 inches – 2 1/2 inches (51 mm – 63.5 mm)

50 degrees F (10 degrees C)

Greater than 2 1/2 inches (63.55 mm)

40 degrees F (4.44 degrees C)

3. If placing asphalt between March 15 and September 30, temperature may be lowered 5 degrees F.
 4. Do not use field burners or other devices to heat the pavement to the specified minimum temperature.
- 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.
- C. Thermoplastic Pavement-Markings: Proceed with pavement markings only on clean, dry surfaces, minimum ambient or surface temperature shall be 50 deg F.

PART 2 PRODUCTS

2.1 AGGREGATES

- A. Conform to the requirements of City of Milwaukie Public Works standards.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.
- B. Tack Coat: [STM D 977 or AASHTO M 140 emulsified asphalt.

2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles, or glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
- B. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
1. Color: As Indicated.
- C. Glass Beads: AASHTO M 247, Type 1.

2.4 MIXES

- A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent or more than 30 percent by weight.
1. Surface Course Limit: Recycled content no more than 30 percent by weight.
- B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes [approved by authorities having jurisdiction] and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Provide mixes conforming to section 00744 of the 2015 Oregon Standard Specifications for Construction.
3. Base Course: Level 3 1/2 inch dense, HMAC.
4. Surface Course: Level 3 1/2 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. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply tack coat uniformly to vertical asphalt surfaces. Apply 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.
- C. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- D. Asphalt and sand seal edges where new asphalt concrete meets existing pavement.

3.3 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. 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.
- 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.

3.4 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in 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 a 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.

3.5 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."

3.6 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 or 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.

3.7 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.
 4. Difference between adjacent panels: 1/8 inch.

3.8 PAVEMENT MARKING

- A. Do not apply pavement-marking paint or thermoplastic material until layout, colors and placement have been verified with architect.
- 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.
- E. Install thermoplastic pavement markings as indicated on the drawings per the requirements of section 00850 and 00867 of the 2015 Oregon Standard Specifications for Construction.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor 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.

3.10 WASTE HANDLING

- 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 32 12 16

SECTION 32 13 43

PERVIOUS CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Subgrade preparation.
 - 2. Installation of Pervious Concrete Sidewalk.

1.2 RELATED SECTIONS

- A. Section 31 20 00 "Earth Moving."

1.3 REFERENCES

- A. ACI 522.1-08 "Specification for Pervious Concrete Pavement."
- B. When working within the public right-of-way, comply with governing Public Agency Specifications if more restrictive than specified herein.
- C. EPR Criteria for consultants, installers, concrete suppliers and testing labs.
- D. ACI 306R "Cold Weather Concreting" (with specific exceptions pertaining to pervious concrete).

1.4 SUBMITTALS

- A. Design mixtures: For each paving mixture.
 - 1. Indicate where the mix and similar project mix variation have been successfully used on other recent pervious projects.
- B. Certificates of qualifications for:
 - 1. Pervious concrete installer.
 - 2. Pervious concrete supplier.
- C. Sample test panel for proposed mix. Sample Test Panel placed on site will be the basis for meeting project criteria, and shall be in conformance with Section 1.6.C "Test Panels".
- D. One (1) permeability test of the compacted base aggregate
- E. One (1) permeability test result for the proposed mix in inches per hour as determined by ASTM C 1701 or approved equal.
- F. Jointing and spacing plan.

- G. An owner's manual for cleaning, repair, and maintenance for installed pervious pavement.
- H. One-Year Limited Warranty for installed pervious pavement.

1.5 QUALITY ASSURANCE

- A. Perform work in this section in accordance with minimum qualifications for consultants, concrete suppliers, installation contractor, and testing companies, unless otherwise authorized by the design professional of record. Note much of this document is based on ACI 522.1-08 Specifications for Pervious Concrete Pavements. Important note: some sections of this specification are specifically referring to qualifications that are intentionally contrary to ACI 522.1-08. If the two specifications conflict, this specification takes precedence. Use of ASTM C140 is not allowed to compare fresh voids to hardened voids.
- B. When placing concrete during cold weather, follow recommendations of ACI 306R (Except sections within 306R related to Heated Water, Slump, Compressive Strength, Walls, Maturity meters, cement content, and Accelerators which do not apply to pervious concrete.

1.6 QUALIFICATIONS

- A. All consultants, installers, and product suppliers must meet criteria listed below unless otherwise authorized by the Architect.
 - 1. The Pervious Portland Cement Concrete Installation Contractor shall meet one of the following criteria:
 - a. One (1) National Ready Mixed Concrete Association (NRMCA) Certified Pervious Concrete Craftsman must be onsite, overseeing each placement crew during all pervious concrete placements, or
 - b. Three (3) NRMCA Certified Pervious Concrete Installers must be onsite, working as members of the placement crew during all pervious concrete placements, or
 - c. Three (3) NRMCA Certified Pervious Concrete Technicians and one (1) NRMCA Certified Pervious Concrete Installer shall be on site working as members of the placement crew during all concrete placements, or
 - d. If the concrete installer has insufficient experience with pervious concrete pavements (less than three (3) successful jobs and/or does not hold the appropriate NRMCA Pervious Concrete certifications), or if the installer has not installed pervious concrete within the previous six (6) months, the concrete installer may retain (at their expense) an authorized Pervious Concrete supervisor who meets the certification requirements. The supervisor must be onsite, overseeing each placement crew during all pervious concrete placements, or
 - e. Verification of current NRMCA certification and evidence of three (3) successful pervious concrete pavement jobs with a combined minimum of 5,000 square feet of pervious concrete pavement, and the contract information and addresses for three (3) of those projects.

2. The Pervious Portland Cement Concrete Supplier shall meet all of the following criteria
 - a. Have at least one NRCMA Certified Pervious Concrete Technician on the job with authority over the loading, dispatching and transportation of the pervious concrete.
 - b. Have completed a minimum of five (5) successful pervious concrete projects with at least one of those occurring within the previous six months.
 - c. Verification of current NRMCA certification and evidence of five (5) successful pervious concrete projects, and the contract information and addresses for those projects.
 - d. If the concrete supplier has insufficient experience with pervious concrete pavements (less than five (5) successful jobs and/or does not hold the appropriate NRMCA Pervious Concrete Technician certifications), or if the supplier has not supplied pervious concrete within the previous six (6) months, the concrete supplier may retain, at their expense, an authorized pervious concrete supervisor to monitor preparations, batching, and transporting operations. This authorized supervisor shall be present for all pours including the sample panel.
- B. The installer shall use an adequate number of skilled pervious crew workers with pervious concrete experience who are thoroughly trained and experienced in the necessary craft and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this section.
- C. Test Panels:
 1. Contractor is to place, joint, and cure one test panel each to be a minimum of 225 square feet at the required project thickness to demonstrate to the Owner's Representative's satisfaction that in-place unit weights can be achieved and a satisfactory pavement can be installed at the site location.
 2. Test panels may be placed at any of the specified Portland cement pervious locations. Contractor will engage a qualified independent testing agency to perform thickness testing of the test panels in accordance with ASTM C 42; void structure in accordance with ASTM C 138; and for core unit weight in accordance with ASTM C 140, paragraph 9.3.
 3. Satisfactory performance of the test panels, based on the average of three cores of each test panel, will be based on the following criteria. The project engineer has final authority to determine compliance.
 - a. Average thickness within no less than ¼-inch of specified thickness, with no single core exceeding ½-inch less than the specified thickness; nor shall the average compacted thickness be more than 1-1/2-inch more than the specified thickness.
 - b. Unit weight plus or minus 5 pcf of the design unit weight.
 - c. Void Structure: 15% minimum; 25% maximum.
 4. If the test panel is outside one or more of the above mentioned limits, the test panel shall be removed at the contractor's expense and disposed of in an approved landfill and replaced at the contractor's expense.

5. If the test panel meets the above-mentioned requirements, it may be left in-place and included in the completed work.

1.7 PROJECT CONDITIONS

- A. Protection of existing improvements:
 1. Protect adjacent work from splashing of paving materials. Remove all stains from exposed surfaces of paving, structures, and grounds. Remove all waste and spillage.
 2. Do not damage or disturb existing improvements or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.
 3. Restore damaged improvements, including existing paving on or adjacent to the site that has been damaged as a result of construction work, to their original condition or repair as directed and to the satisfaction of the design professional of record.
- B. Safety and traffic control:
 1. Notify and cooperate with local authorities and other organizations having jurisdiction when construction work will interfere with existing roads and traffic.
 2. Provide temporary barriers, signs, warning lights, flagmen, and other protections as required to assure the safety of persons and vehicles around the construction area and to organize the smooth flow of traffic.
- C. Weather limitations:
 1. Do not place pervious concrete pavement when the ambient temperature is below 40 degrees F or above 80 degrees F, unless otherwise permitted in writing by the design professional of record.
 2. Do not place pervious concrete pavement when the wind, heat, or humidity does not allow enough time to place, properly joint, compact, edge, finish and cure before the surface dries and is no longer workable without damaging the surface.

PART 2 - PRODUCTS

2.1 CONCRETE MIXTURES

- A. The mix design shall include:
 1. Mix identification name or number.
 2. Cementitious materials by amount and type per cubic yard.
 3. Water/cement ratio.
 4. Aggregate amounts by weight per cubic yard.
 - a. Aggregate void content as determined by ASTM C29.
 5. Admixtures type by product name and per cubic yard used.
 6. Unit weight of the mix as determined in accordance with ASTM C1688.
 7. Target finished voids (by percent) of the pervious mix as determined by ASTM C 1688.
 8. Integral color, if used, shall include brand, color, and dosage rate.

2.2 CONCRETE MATERIALS

- A. Cementitious material: use the following cementitious materials, of same type, brand, and source throughout the project:
 - 1. Portland cement Type I or II conforming to ASTM C 150.
 - 2. Portland cement Type IP or IS conforming to ASTM C 595.
- B. Fly Ash Type C or F at 25% maximum replacement for Portland cement.
- C. Slag at 30% maximum replacement for Portland cement.
- D. Aggregate:
 - 1. Aggregate source must meet minimum hardness standards to comply with State Highway Department requirements, or other local jurisdictional requirements, whichever is greater.
 - 2. Use an aggregate that will provide a smooth enough finish such that surface uniformity shall be satisfactory to the owner for the use of wheeled carts such as a shopping cart through the placement. Surface must still provide sufficient porosity to allow for it to readily and uniformly infiltrate stormwater.
 - 3. The aggregate must be a crushed rock, washed, clean and free of other contaminants.
 - 4. Aggregate must contain a minimum void content of 38% as determined by ASTM C 29.
 - 5. Nominal maximum aggregate size shall not exceed 1/3 of the specified pavement thickness.
- E. Admixtures:
 - 1. Admixtures must comply with ASTM C 494 and be approved by the design professional of record.
 - 2. All admixtures shall be used per manufacturer's recommendations.
- F. Water: clean, potable water shall be used per ASTM C 1602.
- G. Proportions:
 - 1. Total cement material not to exceed 564 lbs. per cubic yard, unless approved by the design professional of record, as a result of aggregate void content.
 - 2. Mix design shall be based upon the percent of voids of the coarse aggregate in order to determine the proper amount of cement or cementitious materials used to achieve proper coating of coarse aggregate particles and surfaces to meet specified void contents of the pervious mix.
 - 3. Slag cement (25%) or Fly Ash (25%) may be used to replace Portland cement unless otherwise authorized and approved by the engineer.
 - 4. The volume of aggregate, cement, water, and admixture per cubic yard calculated as a function of the unit weight as determined by ASTM C 1688 Standard Test for Density and Voids Content of Freshly Mixed Pervious Concrete must result in a yield of 27 cubic feet per cubic yard.
 - 5. The unit weight per cubic yard of the concrete shall be plus or minus 5 lbs. of the design unit weight

6. The water/cement ratio shall be such that the cement paste displays a wet metallic sheen when floated with a magnesium hand float without causing the paste to flow from the aggregate or seal the surface.
7. Voids: 15% to 25% complying with ASTM C 1688.
8. Fibers: the use of fibers in pervious concrete mixtures is permitted when approved by the engineer.
- H. Isolation joint material: comply with ASTM D 994, D 1751, or D1752.
- I. Make forms with steel, wood, or other materials that are sufficiently rigid to maintain specified tolerances, and capable of supporting concrete and mechanical concrete placing equipment. Forms shall be clean and free of debris of any kind.

2.3 TRANSPORTATION METHODS

- A. Standard Ready Mix Concrete Trucks:
 1. Unless authorized in writing by the pervious consultant or a certified installer, truck mixers shall load using only enough revolutions per minute to load the truck.
 2. After loading, mix for 10 minutes before leaving the plant.
 3. Hot water (defined as temperatures in excess of water out of a well or municipal source) is not to be used in the mix or in the side tanks on the mixers, even in cold weather.
- B. Hauling and delivery:
 1. Pervious concrete delivered via ready mix truck must be treated with hydration stabilizing admixture to allow for two hours of working time after loading, unless otherwise authorized by the design professional of record, and the concrete temperature shall not exceed 90 degrees F.
 2. Trucks used to transport pervious concrete shall rinse and dump all contents including rinse water before loading and re-loading pervious concrete mix.
- C. Discharge:
 1. Prior to discharge of each load, installer shall inspect each load for appearance and conformity to specifications.
 2. Water may be added at the job site to obtain the required mix consistency. Any water adjustments made at the job site shall be made by the certified pervious concrete installer. Document any water adjustments by time and location of placement prior to discharge.
 3. Loads that cannot be adjusted on-site to meet specifications shall be rejected.
 4. Concrete shall be deposited as close to its final position as practicable such that fresh concrete enters the mass of previously placed concrete.
 5. Minimize the practice of discharging onto sub-grade and pulling or shoveling to final placement.
- D. Volumetric (Truck Mounted Mobile Mixers) may be used for delivery and mixing pervious concrete provided:
 1. The truck must be calibrated to the design mix specified.

2. The certified pervious installer is allowed to adjust the mix design to meet moisture requirements of the specification.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Notification Requirements:

1. The design professional of record shall be notified forty eight (48) business hours in advance of subgrade preparation, recharge bed installation, and all pervious concrete pours (including ample time for travel to reach the site) to inspect or send a representative to inspect subgrade preparation, recharge bed installation, and all pervious concrete pours.
2. A pre-paving conference shall be scheduled and held prior to installation of the sample panel. Two weeks notice is preferred by shorter notice allowed if approved by the design professional of record. The following individuals are required to attend:
 - a. Concrete supplier.
 - b. Pervious Concrete contractor
 - c. Site work contractor.
 - d. Project foreman.
 - e. Design professional of record or authorized representative of design professional of record.
 - f. Testing lab representative certified by NMRCA or familiar with pervious pavement test standards.

B. Subgrade preparation:

1. It is essential that the permeability of the underlying native soils be preserved. DO NOT OVER COMPACT. Uniform compaction of cuts and fills are required. Verify percolation rates in accordance with ASTM D 3385 prior to placement of storage aggregate to verify porosity. Protect pervious pavement areas from excessive construction equipment to prevent over compaction.
2. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and the underlying soils scarified to a minimum depth of 3 inches with a York rake or equivalent and light tractor.
3. Where subgrade has been compacted due to construction traffic, subgrade shall be scarified or removed to a depth sufficient to match the naturally occurring insitu state. Add additional base course material to meet design grades at no cost to the owner.
4. Bring subgrade of base course to line, grade, and elevations indicated. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing of stone.

C. Pervious Base Aggregate:

1. Base Aggregate Material:

- a. Base material shall be composed of uniform sized aggregate with a minimum size number five (1 inch – ½ inch). The aggregate should have at least 40% voids unless otherwise specified by civil or geotechnical contract documents. Use of local aggregates outside of the noted size range that provide 40% voids may be approved by the engineer.
2. Before placement of the pervious concrete begins, the pervious concrete contractor shall inspect the in-place base aggregate for compliance to the plans and specifications as follows:
 - a. Drainage fabric is properly secured at least sixteen (16) inches outside of bed, or per the design documents, whichever is greater, as recommended by fabric manufacturer.
 - b. When the pervious concrete abuts a building face or interfaced with asphaltic concrete pavement, an impervious barrier shall be installed to prevent water from seeping from the re-charge bed into adjacent base materials or structures. Approved barriers may include:
 - 1) An impermeable pond liner properly installed to prevent flow from the aggregate base.
 - 2) Flush curbs place onto impermeable soil or used in conjunction with a waterproof liner.
 - 3) Any barrier chosen by the design professional of record to isolate the adjacent structure.
 - c. The base must be compacted to an acceptable level as approved by the design professional of record.
 - d. Test the base aggregate for permeability after compaction by double ring infiltrometer or other suitable test of subgrade soil permeability.
 - e. Base rock temperature and moisture control:
 - 1) Two to twelve hours prior to placing concrete, and immediately prior to the pour, the re-charge bed shall be soaked with water to minimize effect of dry or hot aggregate from drawing moisture out of the plastic concrete. The design professional of record may waive this requirement in wet conditions.
 - f. Contractor to review all plans to determine placement of all other elements of the design (i.e. conduits, drainage pipes, utilities, irrigation sleeves, etc.) prior to placing concrete.
 - g. All joints are to be clearly marked on the forms or base rock prior to placement. Radius joint between forms shall be painted on the base rock before placement begins.
 - h. Contractor must follow the submitted and approved “jointing plan” unless approved in writing by the design professional of record.
 - i. Joints should not exceed fifteen (15) feet in either direction with the larger dimension of a panel not exceeding 125% of the smaller panel.

D. Pervious Concrete Placing Equipment:

1. A motorized “Spinning Screed” like a Bunyan or approved equal, may be used to screed the pervious pavement. No riser strip is required providing the concrete mix is still at grade after compaction using an approved pervious cross roller. If the mix finished below grade, a riser of sufficient thickness to shim the screed to grade after compaction will be required.

2. A hand operated straight edge or motor powered Truss Screed may be used but both require the use of riser strips and static rolling prior to cross rolling. Thickness must be adequate to maintain finished grade after compaction. Typically the riser strip thickness of ¼-inch to 3/8-inch is required.
- E. Approved Hand Tools:
1. The pavement must be compacted using a riser strip unless the screed used provides enough compaction that no loss of elevation occurs after secondary “cross rolling”.
 2. An approved pervious concrete “Cross” roller capable of applying a minimum weight of 40 lbs/LF.
 3. A steel “Static” roller weighing a minimum of 40 lbs/LF, fitted with handles on each end, capable of spanning the full width of the fresh placement is allowed but only if riser strips are used to strike off the freshly placed mix higher than finished grade and compacted back to final grade immediately after the riser strips are removed.
 4. Use of asphalt rollers or plate compactors are not allowed, unless it can be demonstrated that they will not seal the voids, prevent raveling and do not result in uneven surfaces. Use of such tools must be approved in writing by the design professional of record.
 5. A weighted steel or Magnesium float may be used in conjunction with other hand tools to remove roller marks and improve the appearance of the pavement surface provided it does not seal the surface or reduce the permeability below acceptable rates of infiltration.
 6. Hand floats and other tools typical to concrete finishing may be used but only if they do not seal the surface, reduce permeability below acceptable rates of infiltration, or result in a slippery surface texture.
 7. Walking edgers, deep jointers, and hand edgers with specified radius. If no radius is specified the installer may use either a ½-inch or 5/8-inch radius as long as all edgers used on the job match.
 8. Deep jointers, Pervious “Pizza” Style Cutters may be used as long as the joint radius leaved no torn or ragged edges. Deep groove jointers should not be used to “finish” the joint radius, since deep groovers often leave ragged or torn edges. Touch up may be necessary to dress the edge after deep grooving with steel groovers or hand tools.
 9. Groover, a steel tool with a groove cast or attached, may be used to touch up edges after deep jointing. USE OF ALUMINUM GROOVERS IS NOT RECOMMENDED UNLESS THE INSTALLER CAN DEMONSTRATE THE TOOL DOES NOT RESULT IN TORN SURFACES OR RADIUS EDGES.
- F. Placing, Compaction, Jointing, and Finishing Process:
1. Pervious concrete sidewalk shall be constructed using side forms. Slip form paving will not be allowed. Forms shall be made of steel or wood and shall be in good condition, clean, and be capable of being anchored in place so they will be true to grade, line, and slope. Forms that are bent, warped or unclean shall not be used.
 2. Pervious materials shall be placed on the ground as close as possible to its final location. Avoid piling and dragging into place when possible.

3. Take care to accurately strike off the surface using a “riser strip” that allows for compaction to final grade.
4. Immediately after initial strike off, remove the riser strip and compact to grade using a static roller and/or an approved pervious cross roller.
 - a. Control (contraction) joints shall be installed at intervals of a maximum of 15 feet or as indicated by plans. They shall be installed at a depth of $\frac{1}{4}$ the thickness of the pavement.
 - b. The larger horizontal dimension of a slab panel shall not exceed 125% of the small dimension.
 - c. The angle between two intersecting joints shall be between 80 and 100 degrees.
 - d. Align joints of adjacent pavement panels.
 - e. Joints shall intersect pavement free edges at 90-degree angles and shall extend straight for a minimum of 1-1/2 feet from the pavement edge where possible.
 - f. Transverse construction joints shall be installed whenever placing is suspended a sufficient length of time that concrete may begin to harden. If contractor attempts to “blend” a fresh pour into an earlier pour “RAVELING” will occur. Minimize the time between loads to reduce this “accidental cold joint”.
 - g. Isolation (expansion) joints will not be used except when pavement is abutting slabs or other adjoining structures. Extend the isolation joints through the full depth of the pavement. Fill the entire isolation joint with isolation joint material.
 - h. If transverse or isolation joints are used, or where pervious concrete meets impervious pavement, extra compaction may be necessary.
5. Deep groove contraction joints must be installed immediately after compaction, unless the installer chooses to wet cut the contraction joints in three steps:
 - a. Deep groove immediately after screeding.
 - b. Compact with static roller.
 - c. Touch up radius with steel groover after compaction to dress the radius.
6. All wet cut joints and edges shall be tooled into the pavement without delay. Time is of the essence. Jointing without delay aids in the ease of installation and the durability of the tooled edge.
7. All wet cut edges and cold joint edges must have an approved $\frac{1}{2}$ -inch or 5/8-inch radius edger unless otherwise specified. A radius edge is also required next to curbs and next to sawn joints.
8. If the surface or edges are “torn” or not otherwise uniform, immediately add fresh material to correct the appearance. Do not add material after the “sheen” has left the surface. Working with partially set paste (matte appearance as opposed to wet metallic) or un-compacted surface material will weaken the bond and increase the chance of raveling.
9. After cross rolling the surface a weighted finishing tool may be used to remove roller marks (if any) and to touch up the surface.
10. Avoid over-finishing of the surface to protect surface permeability. If material needs to be added or removed, make changes immediately and re-screed as needed.
11. Cold joints should be avoided if possible.

- a. If a delay occurs that lasts long enough that the concrete is no longer workable (metallic sheen is lost), install a header and create a transverse construction joint, compact the edge of the new joint.
- b. If the mix is cut back to a scheduled joint, excess concrete must be removed to allow at least three (3) inches of fresh mix on the surface. Use a straight edge and edging tool to make a tooled radius edges at the new joint.
- c. During short delays, cover the pavement, including the face of the new edge, with plastic until fresh concrete arrives.
- d. Use of a surface stabilizing agent is encouraged during delays. Stabilizers may be reapplied as long as the paste is not damaged.

12. Tolerances:

- a. Construct pavement to comply with the following tolerances:
 - 1) Elevation: +1/4 inch
 - 2) Thickness: +1/2 inch
 - 3) Contraction Joint Depth: +1/4 inch – 0 inch
 - 4) Surface: In any direction, the gap below a 10-foot unlevel straightedge shall not exceed 1/4-inch.

G. Curing Materials and Procedures:

- 1. Proper curing procedures require that fresh pervious concrete curing must begin within twenty (20) minutes after placement. In dry or windy conditions, curing must be started sooner and placing should be suspended if the wet metallic sheen cannot be maintained long enough to complete finishing operations.
- 2. The pavement surface must be covered with six millimeter polyethylene plastic sheeting or thicker or as approved by the design professional of record.
- 3. Black or clear sheeting may be used, but maintain the same type throughout the project.
- 4. The sheeting shall overlap all exposed edges at least 15-inches and shall be secured, without using dirt or stones smaller than the aggregate in the mix, to securely anchor the plastic for all weather conditions.
- 5. Sheeting with unrepaired holes or rips will not be allowed.
- 6. A fog or light mist may be sprayed using a low or medium solid hydration-stabilizing agent. Apply with a pressure sprayer above the surface as needed during high temperature, high wind, and low humidity.
- 7. Liquid curing compounds are not allowed as a replacement for curing plastic. Surface treatments for curing or other approved purposes are allowed in conjunction with curing plastic.
- 8. Internally cured mixed, if approved and used, must still be covered with plastic sheeting for a minimum number of hours as directed by the mix design. If the mix design does not specifically state that it is internally cured, assume that it is not.
- 9. Prevention of “Tiger Striping” (uneven surface discoloration from uneven curing caused by wrinkles and folds in the plastic or efflorescence during the curing process).
 - a. Plastic shall be properly secured and in direct contact with pervious surface (wrinkly free) as much as practical.

- b. To reduce “Tiger Striping” during hot weather, remove the plastic after 24 hours and thoroughly flush the surface with clean potable water. Replace and carefully re-secure the plastic after flushing.
 - c. Carefully inspect daily for air bubbles, blown or areas of loose plastic. Re-anchor securely. Re-hydrate areas where moisture has been lost due to blown, loose or otherwise compromised curing during the first seven days.
- H. Cure Time:
 - 1. If temperature remains at or above 55 degrees F for the duration of the cure:
 - a. Pedestrian traffic may be allowed in 24 hours.
 - 2. At temperatures below 55 degrees F, curing time must be extended before opening to traffic. The extra time needed before opening to traffic is to be approved by the design professional of record.

3.2 PAVEMENT PROTECTION: DURING CONSTRUCTION/BEFORE ACCEPTANCE

- A. The general contractor must ensure all trades, especially landscapers, do not dump fine materials such as dirt or bark on the pervious concrete.
 - 1. The general contractor must protect the pavement from other trades who use the pavement for staging, storage, or other reasons.
 - 2. Protect the pavement surface from abrasion, discoloration, or sediments by covering with a geotechnical fabric. This fabric must be properly anchored and maintained in place starting when the curing plastic is removed and remaining until completion of any construction or landscaping activity that may expose the pavement to hazards.
 - 3. It is the general contractor’s responsibility to remove and pay for replacement costs of surface damage for causes out of the control of the installer.
- B. At the completion of the job, loose construction “crumbs” left on the surface of the pavement shall be flushed off the surface of the pavement just prior to substantial completion by the general contractor unless otherwise specified within the contract.
 - 1. A water truck to flush the loose material, using a high volume, low pressure water flow, is the preferred method to clean the pavement.
- C. The general contractor shall be responsible to clean, repair and touch-up, or replace when directed, pavement which has been soiled, discolored, or damaged by other trades prior to substantial completion.

3.3 REPAIRS

- A. Remove and replace pavement sections that fail to meet standards established and approved by the Owner. Unless otherwise authorized by the design professional of record, remove the entire section at no expense to Owner at the nearest joint.
- B. Patching small areas may be allowed if the installer uses the exact mix design with the same ingredients and cement supplier and can demonstrate the patch will match the appearance and performance of the existing pavement after the replacement pavement

has cured. Minor color differences are to be expected and are not a basis for rejecting patching.

- C. If the pavement has been clogged with construction debris or other sediment, clean the pavement and retest. If the pavement is slow draining because of improper mix design or installation techniques, remove and replace the section of pavement that is not compliant with the specifications at the nearest joint at no cost to the owner.

3.4 MAINTENANCE/CLEANING AFTER CONSTRUCTION AND ACCEPTANCE OF WORK

- A. The Owner is responsible for all maintenance after construction and project work acceptance. The contractor must supply the Owner with a copy of the pervious concrete Owner's Manual and Maintenance Guide.

3.5 TESTING

- A. Laboratory testing shall be completed by an accredited laboratory or as approved by the design professional. Contractor shall provide all third party testing.
- B. Fresh Pervious Concrete:
 - 1. A unit weight test using ASTM C 1688 shall be taken from the first load of the project to verify the mix design used is accurate. At the discretion of the design professional of record, additional tests for each day's placement of pervious concrete in accordance with ASTM C 1688 to verify unit weight may be conducted. Note: Comparison of ASTM C 1688 and ASTM C 140 tested voids won't match.
 - 2. If the unit weight is out of compliance with specifications, the testing laboratory shall notify the installer immediately after discovery. The installer must correct the deficiency before work can continue and the testing laboratory must confirm the correction has been made and conforms to design standards.
 - 3. A representative sample of the fresh mix shall be taken from the sample load and the first load of the project. This sample must immediately be flushed of cement slurry to visually confirm the aggregate reasonably meets size or fracture requirements. If the aggregate is in question, the pour shall be suspended until the mix can be confirmed as meeting the specification.
- C. Hardened Pervious Concrete:
 - 1. Permeability shall be tested using ASTM C 1701 or an approved equal.
 - a. Must be tested on clean, level pervious pavement upon removal of the curing plastic and accepted before opening the pavement to traffic.
 - b. Permeability shall be tested at least 100 inches per hour immediately after curing plastic is removed.
 - c. If less than six (6) inches of open graded base rock is used under the pavement the permeability rate will not be valid and the permeability rate shall not be used for criteria for acceptance or rejection of the pavement.
 - d. The design professional of record is authorized to determine permeability on slopes.

2. Core Testing:

- a. The design professional of record may specify the need for core samples of the hardened concrete. No cores may be taken in the first seven days after placement.
- b. If cores are required the cores shall be measured for thickness only. Untrimmed, hardened core samples may be used to determine placement thickness. The average of all cores shall not be less than the specified thickness with any individual core being more than ½ inch less than the specified thickness.

3.6 ACCEPTANCE

- A. Completed work that meets the standards approved in the sample panel shall be approved.

END OF SECTION 32 13 43

SECTION 32 15 40
CRUSHED STONE PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Work included in this Section: Furnish labor, material and equipment required to install crushed stone paving as shown on Drawings and specified herein

1.2 SUBMITTALS

- A. Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
1. Base Course: one-half cubic foot.
 2. Surface Course: one-half cubic foot.

1.3 ENVIRONMENTAL CONDITIONS

- A. Do not install crushed stone paving during rainy conditions.

PART 2 - PRODUCTS

2.1 CRUSHED STONE

- A. Surface Course: ¼ - inch minus crushed rock, conforming to the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
¼-inch	98-100
#4	95-100
#30	30-50
#200	5-15

1. ½-inch minus material will not be approved.
- B. Approved Products and Manufacturers:
1. Surface Course Base Bid: ¼ - inch minus crushed rock
 2. Base Course: Natural crushed rock conforming to State of Oregon Highway Department Standard Specification Base Aggregate for ¾"-0 crushed rock.
 3. Filter Fabric: nonwoven permeable, per the requirements of Section 31 20 00 Earth Moving.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the subgrade under which the crushed gravel is to be installed. Notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Lines and Levels: Finished grades are shown on Drawings are to be the top of surface course. Slope uniformly between given spot elevations unless otherwise indicated.
 - 1. Surfaces shall be true to within ¼-inch when tested in any direction with a 10-foot straightedge.
 - 2. There shall be no pools of water standing on the surface after a rain.
 - 3. Transition between changes in vertical gradient of walks and paving shall be smooth and gradual with no abrupt or sharp changes greater than ¼-inch.
 - 4. Horizontal layout shall not vary more than 1-inch from dimensions indicated on the Drawings.

3.2 INSTALLATION

- A. Placement and Compaction: Install filter fabric and uniformly spread acceptable material courses and compact to grades and lines shown. Compaction shall be made by power rollers to 95% at optimum moisture content. Each lift shall be compacted separately immediately after placement.
- B. Finish of Surface Course: Finish surface of crushed gravel walkways shall be uniform in appearance as to texture and color, and shall have a firm stable consistency and shall be resistant to erosion.
- C. Repairs and Protection: remove and replace crushed gravel paving that is damaged, defective or does not meet the requirements of this section.
- D. Clean-up: remove all surplus material, debris and rubbish resulting from work from the site.

END OF SECTION

SECTION 32 16 00

CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Curbs.
 - 2. Sidewalks.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials.
 - 2. Admixtures
 - 3. Curing compounds
 - 4. Applied finish materials.
 - 5. Bonding agent or epoxy adhesive.
 - 6. Joint fillers.

1.3 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that 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. ACI Publications: Comply with ACI 301 unless otherwise indicated.

1.4 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. 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.

2.2 STEEL REINFORCEMENT

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185 fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497 flat sheet.
- D. Reinforcing Bars: ASTM A 615 Grade 60; deformed.
- E. Plain-Steel Wire: ASTM A 82 as drawn.
- F. Deformed-Steel Wire: ASTM A 496.
- G. Tie bars: ASTM A 615 Grade 60, deformed.
- H. 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 specified.
 - 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.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C 150, gray portland cement Type I
 - a. Fly Ash: ASTM C 618, Class C.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4M, 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: Potable and complying with ASTM C 94.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: 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, Type A.
 2. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. 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. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.
- B. Detectable warnings: ADA truncated domes aligned in a square or radial grid pattern complying with current ADAAG guidelines. Detectable warnings shall be either precast pavers plastic cast-in-place pavers or plastic adhesive surface applied tile.
1. Color: Yellow
 2. Size: Nominal 12 inch x 12 inch
 3. Thickness: [2 inch (51mm)] [other].
 4. Manufacturers: [Tile Tech], [Armor Tile], [ADA Solutions], [other] or approved equal.
- C. 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 requirements.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
 - 1. Compressive Strength (28 Days): 3000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
- B. Chemical 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. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading and elevation tolerances. See Section 31 20 00 "Earth Moving."
- B. Remove loose material from compacted subbase surface immediately before placing concrete.
- C. Proceed with concrete operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms 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.

3.3 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges 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 structures, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of the concrete structure and at locations where concrete operations are stopped for more than one-half hour unless the structure terminates at isolation joints.
 1. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Expansion Joints:
 1. Construct expansion joints of the preformed filler type in concrete structures as shown and the following:
 - a. Not less than ½ inch wide, except where abutting or underlying concrete joints are larger, then the width shall match those joints.
 - b. At right angles to the structure alignment and normal to the structure surface.
 - c. Which completely separate the concrete segments.
 - d. Placed flush or no more than 1/8 inch below the concrete surface.
 2. Curbs, Islands, and Traffic Separators: provide expansion joints:
 - a. Opposite abutting expansion joints in abutting concrete.
 - b. Over existing expansion joints in concrete underlying the new concrete structure.
 - c. At each point of tangency in the structure alignment.
 - d. Not over 200 foot spacing.
 3. Walks, Monolithic Curbs and Sidewalks, and Surfacing. Provide expansion joints:
 - a. Between driveways and concrete pavement.
 - b. Transversely in walks opposite expansion joints in adjoining curbs and elsewhere so the distance between joints does not exceed 45 feet.
 - c. Transversely in walks at a distance of 16 feet to 8 feet from ends of walks which abut curbs.
 - d. Around poles, posts, boxes, and other fixtures which protrude through or against the structures.
- D. Contraction Joints. Construct transverse contraction joints of the weakened plane or dummy type in the exposed surfaces of the concrete structures as shown and the following:
 1. Locations. Locate contraction joints:
 - a. Over contraction joints in concrete underlying the new concrete structure.
 - b. Opposite contraction joints in abutting concrete.
 - c. At locations to confine joint spacing to a maximum of 15 feet.
 2. Methods. Construct contraction joints by:
 - a. Inserting and removing plates, or other devices.
 - b. Inserting and leaving in place preformed expansion joint filler even and flush with the concrete surface.
 - c. Sawing as soon as practical after concrete placement but before any uncontrolled cracking occurs.
 - d. Tooling.

- e. Other approved methods.
- 3. Requirements. Contraction Joints shall:
 - a. Be not less than 1/8 inch or more than ¼ inch wide.
 - b. Be a depth of one-third the thickness of the concrete.
 - c. Have clean, unfilled grooves (if preformed expansion joint filler is not used).

3.4 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation 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, placing, and consolidating 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. 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 joint devices.
- H. 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.
- I. Screed paving surface 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. Remove forms after the concrete has taken its initial set and while the concrete is still green. Repair minor defects with mortar containing one part Portland cement and two parts sand. Plastering will not be permitted on the faces and exposed surfaces. Honeycombed and other structurally defective concrete shall be removed and replaced at no added cost to the Owner. While the concrete is still green, the exposed surfaces shall be finished by rubbing down high spots and form marks, by rubbing the moistened surfaces with a suitable device to provide a uniform texture and smooth surface, or by applying and rubbing a thin cement grout to produce a uniform color.
- 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, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F 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 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.

3.5 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 ¼ inch (6mm) radius. Repeat tooling of edges after applying surface finished. Eliminate tool marks on concrete surfaces.

3.6 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.
- 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 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. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. 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.

3.7 CONCRETE TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: ¼ inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot-long, unlevelled straightedge not to exceed 1/4 inch.
 - 4. Joint Spacing: 1/2 inch.
 - 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 6. Joint Width: Plus 1/8 inch, no minus.

3.8 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Protect concrete structures from damage. Exclude traffic from structures for at least 14 days after placement. When construction traffic is permitted, maintain structures as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete structures free of stains, discoloration, dirt, and other foreign material. Sweep sidewalk not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 16 00

SECTION 32 31 00

FENCING AND GATES

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, material, equipment and services required for the installation of fencing, posts and fence hardware as indicated on the drawings and/or specified herein. Work shall include any incidentals required to complete installation.
 - 1. Include all rails, braces, fittings, and concrete footings necessary for the complete installation.
- B. General: Like items of materials provided hereafter shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance and replacement.
- C. Delivery, Storage and Handling: Deliver material to the site new and in an undamaged condition. Carefully store material off the ground to provide proper protection against oxidation caused by ground moisture. In the event of damage, immediately make repairs or replace as necessary to the approval of the Owner and at no additional cost to the Owner.

1.2 REFERENCES

- A. Standard Specifications: All work shall conform to all applicable requirements of the following Standard Specifications, whether specifically referred to or not, except as specifically modified herein.
 - 1. Comply with the requirements of the American Society for Testing and Materials (ASTM) especially the ASTM Committee F-14 Standards on Fences (latest edition).

1.3 SUBMITTALS

- A. Submit shop drawings for approval, prior to manufacturing, describing and detailing typical details of fence construction, fence height, post spacing, including sizes of posts, rails, accessories, finishes, and concrete footing details.
- B. Product Data: Provide manufacturer's catalog cuts with printed specifications. Manufacturer shall provide certification of compliance with material specifications, manufacturing date and lot number for all materials used on site. Actual samples of the material shall be requested.

- C. Acceptable Installers: All installation work shall be performed by a fence and gate installation company with at least five years' experience in projects of similar scale and scope. Contractor shall provide three representative fence and gate projects for Owner's review.

1.4 WARRANTY

- A. Provide/submit to Owner's Representative the manufacturer's warranty for each product/item supplied by Contractor. Contractor shall warrant each product/item for one year minimum.

1.5 PROJECT CONDITIONS

- A. Existing Conditions: Examine the site to determine existing conditions, extent of work and clearing operations required. Locate all underground utilities and modify work, as approved by Owner's Representative, if necessary to avoid conflicts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Wood Fencing:
 - 1. Solid Stock: Kiln-dried, S4S; softwood complying with American Softwood Lumber PS 20, and referenced grading rules. Nominal sizes are indicated, except as shown by detailed dimensions. Provide actual sizes as required by PS 20, unless otherwise indicated.
 - a. Moisture content: Limited to values required by referenced grading rules, and woodworking standard.
 - 2. Woodworking Standard: Architectural Woodwork Institute (AWI) Quality Standards: Custom.
 - 3. Exterior Finish Carpentry, Typical:
 - a. Wood Posts: Western Red Cedar, No. 1 and better, free of heart center, Forest Stewardship Council (FSC) certified.
 - 1) Nominal sizes: as indicated.
 - b. Wood Fence Slats: Western Red Cedar, clear, free of heart center, Forest Stewardship Council (FSC) certified.
 - 1) Nominal sizes: as indicated.
 - 4. Miscellaneous materials:
 - a. Fasteners and anchorages: staples of type, size, material and finish required for application indicated; ASTM A 153 galvanized where exposed to exterior conditions.
 - 1) 2" Hot dipped galvanized #304 stainless steel nails at 1" thick fence boards.
 - 2) 2½" Hot Dipped Galvanized #304 screws at fence top rail.
 - b. Provide special fasteners, moldings, adhesives and accessories as necessary for each installation.

- c. Sealant: Ready Seal Stain and Sealant (888) 782-4648. Apply as directed by manufacturer:
 - 1) Color: Natural Cedar
 - 5. Source Quality Control, Lumber: Factory-mark identify grade, mill and grading agency; submit mill certificate in lieu of marking surfaces for materials which will be exposed to view. Do not stamp or mark surfaces which will be exposed to view in completed Work.
- B. Pole and Post Fence
- 1. Solid Stock: Kiln-dried ; softwood complying with American Softwood Lumber PS 20, and referenced grading rules. Nominal sizes are indicated, except as shown by detailed dimensions. Provide actual sizes as required by PS 20, unless otherwise indicated.
 - a. Moisture content: Limited to values required by referenced grading rules, and woodworking standard.
 - 2. Woodworking Standard: Architectural Woodwork Institute (AWI) Quality Standards: Custom.
 - 3. Exterior Finish Carpentry, Typical:
 - a. Wood Posts: Lodgepole Pine, No. 1 and better, free of heart center, Forest Stewardship Council (FSC) certified.
 - 1) Nominal sizes: as indicated.
 - b. Wood Poles: Lodgepole Pine, No. 2 and better, free of heart center, Forest Stewardship Council (FSC) certified.
 - 1) Nominal sizes: as indicated.
 - 4. Sealant: Ready Seal Stain and Sealant (888) 782-4648. Apply as directed by manufacturer:
 - 1) Color: Natural Cedar
- C. Other materials:
- 1. 3/4-inch-minus aggregate and poured-in-place concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to beginning construction, Contractor shall hold pre-installation meeting on site with Owner's Representative. Contractor shall examine conditions where Fencing is to be erected or repaired. Notify Owner's Representative of any conditions detrimental to the proper and timely completion of the work. Do not proceed with installation until unnecessary conditions have been corrected and are acceptable to the installer.

3.2 INSTALLATION, WOOD FENCING

- A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are defective manufacture with respect to surfaces, sizes or patterns.
- B. Install the work plumb, true, level and straight.
- C. Apply sealant, including UV topcoat, according to manufacturer's recommendations.
- D. Adjust joinery for uniform appearance. Repair damaged and defective Work. Replace Work which cannot be satisfactorily repaired.
- E. Prevent damage and deterioration of installed Work.

3.3 FOOTINGS

- A. Unless specified otherwise by manufacturer, comply with the following:
 - 1. Excavate for concrete footing to neat, clean lines in undisturbed soil. Provide forms in unstable soil conditions.
 - 2. Top of footing in unpaved areas: 1-inch above finish grade. Slope toward edge of footing to prevent water pooling.

3.4 CLEAN-UP

- A. Job site shall be cleared of all excess materials (concrete, wire, rails, pipe, etc.). All areas impacted by construction shall be leveled with import topsoil soil and graded flush with finish grade, be free of all debris and rocks, and restored to as good as or better than the original condition, as approved by Owner's Representative.
- B. Leave in a neat and tidy condition daily.

END OF SECTION

SECTION 32 84 00

IRRIGATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. The Contractor shall furnish all labor, supervision, and materials to install a complete irrigation system as described by and implied in the Contract Documents.
 - 2. The Contractor shall repair any settling of backfilled trenches that may occur during the guarantee period, and completely restore and repair all plantings, lawn, paving, and other site improvements disturbed by this construction.
- B. Coordinate work with installation of other site work.

1.2 SUBMITTALS

- A. The Contractor shall make all submittals in accordance with Section 01330 – Submittal Procedures.
- B. Product Submittals:
 - 1. Products used shall not deviate from those indicated on Contract Drawings, specified herein or approved through the substitution request process. Product submittals are required for all irrigation items.
- C. Quality Assurance Submittals:
 - 1. Submit copies of manufacturer's installation instructions for irrigation equipment.
 - 2. Submit documentation that the installer is a licensed and bonded landscape or irrigation contracting firm that specializes in and has experience in the successful installation of similar systems that include installation of centralized irrigation systems.
- D. Contract Closeout Submittals:
 - 1. The Contractor shall submit PDF format Record Drawings and shall include all approved variations or changes, indicating all sleeve, main line, lateral line, valve, wire runs, irrigation head, and other irrigation component locations to be located by field dimensions to the nearest permanent landmark, as approved by the Owner's Representative.
 - 2. The Contractor shall submit a letter of certification from the controller system manufacturer's representative stating that the controller system has been installed correctly.

1.3 SITE CONDITIONS

- A. Weather Requirements:
 - 1. Do not solvent weld polyvinyl chloride pipe (PVC) when ambient temperature is below 40° F and falling.

2. Do not solvent weld polyvinyl chloride pipe in wet conditions, without adequate cover.
- B. Schedule for Installing Pipe Sleeves, Conduits and Sprinkler Heads:
 1. Coordinate with other trades as required to schedule installation of pipe sleeves and conduits below paving and walks prior to installation of paving and walks.
 2. Schedule installation of sprinkler heads after final grading.

1.4 DAMAGES

- A. Any structures or facilities damaged by work on 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 1 year after the date of final acceptance.

1.5 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. If utilities are to remain in place, the Contractor shall provide adequate means of protection during excavation operations.
- 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.

1.6 PERMITS AND REGULATIONS

- A. The Contractor shall obtain all necessary permits and inspections as applicable and required for the project. All work detailed and specified herein shall be accomplished in strict accordance with the applicable local, state, and federal codes and regulations.

1.7 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.

1.8 SUBSTITUTIONS

- A. Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements".
- B. 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.

1.9 WARRANTIES

- A. Manufacturer's Warranty: Provide equipment manufacturer's standard warranty for control valves, and heads.
- B. Installer's Guarantee:
 - 1. Provide installer's 1-year guarantee for entire system to the Owner's Representative at the time of final acceptance, showing the date of completion, which shall be the beginning of the guarantee period.
 - 2. Guarantee shall include repair of trench backfill that settles more than ½" or of plantings, paving, and walk materials damaged by settlement of trench backfill soils during the guarantee period.

PART 2 PRODUCTS

2.1 PIPE

- A. All main line PVC (Polyvinyl Chloride Plastic) pipe shall be PVC 1220, Type 1, normal impact, I.P.S., N.S.F. approved and shall conform to ASTM D1784-69, ASTM D1785, and PS22-70. All main line pipe size 3" and smaller shall be Schedule 40 PVC. All main line pipe size 4" and larger shall be Class 315 PVC.
- B. All PVC lateral line pipe shall be Schedule 40 PVC pipe and shall conform to ASTM D1784-69, ASTM D1785, 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. Minimum pipe size shall be 3/4-inch.

2.2 PIPE FITTINGS and unions

- 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.
- C. All PVC fittings for electrical conduits shall be sweep fittings.
- E. Unions shall be Spears 897 series grey Schedule 80 PVC, line size.

2.3 PVC CLEANER AND PRIMER

- A. "Weld-On P-75". All 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". All equals for "Weld-On 725" shall meet N.S.F. approval for Type I and II PVC through 3" and meeting requirements of ASTM D-2564.

2.5 PVC SLEEVES AND CONDUITS

- A. All sleeves for irrigation main and lateral lines shall be Schedule 40 PVC and shall be sized as detailed.
- B. All electrical conduit for control wires shall be Schedule 40 PVC, gray in color.

2.6 BACKFLOW DEVICE

- A. See Civil Drawings.

2.7 IRRIGATION HEADS

- A. As shown on Drawings.

2.8 VALVES

- A. Automatic Control Valves: For spray zones: Rain Bird PEB automatic remote control valves where indicated. Size as shown on drawings. See plumbing for installation details. For drip zones: See Drip Irrigation, below.
- B. Master Valve: Rain Bird PEB Valve, 1 ½" size, normally-closed type.
- C. Quick-Coupling Valves: Rain Bird Model 44-RC quick-coupling valves. Provide 2 keys and swivels.

2.9 VALVE BOXES AND VALVE BOX COVERS

- A. Valve Boxes Control Valves: Highline 12-inch standard, Model 071497, with 6-inch extensions as needed to facilitate required installation.
- B. Valve Boxes for Quick Coupling and Isolation Valves: Highline 10" diameter, with 6-inch extensions as needed to facilitate required installation.

2.10 SWING JOINT ASSEMBLIES

- A. Polyethylene Pipe Swing Joint Assemblies: Where "poly-pipe" swing joint assemblies are detailed 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-inch (+/- 0.010-inch). It shall have an inside diameter of 0.490-inch (+/- 0.010-inch) 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-inch intervals along the length of the pipe. Each section of pipe used shall be capable of pressure testing at the rate of 100 lbs./sq.in. to a minimum burst pressure of 475 lbs./sq.in.. All pipe must have an operating pressure rating of 80 lbs./sq.in. at 110 degrees F.
- B. 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 lbs./sq.in.. All fittings shall be

constructed of UV resistant, thermoplastic material and be so designed to permit twist-in insertion eliminating the need for glue or clamps.

- C. Triple swing joints:
 - 1. For quick coupling valves, all threaded nipples to be Sch. 80 PVC and all threaded fittings shall be 40 PVC.

2.11 CONTROLLER AND CONTROLLER ACCESSORIES

- A. Controller: Hunter I-CORE –IC-600-PL: 16 Station outdoor controller with plastic wall-mount case to be provided by irrigation installer, see irrigation drawings and specifications. Provide additional compatible station zone expansion modules as required to run the complete irrigation system as well as 4 additional zones for future expansion.
- B. Controller Cabinet: Strong Box SB-24SS/120V Metered Enclosure, double door design.
- C. Rain Sensor: Hunter Rain-Clik WR-Clik-TR and WR-Clik-R receiver unit. Coordinate location in field with Owner's Representative. Coordinate wiring with electrical contractor.

2.12 WIRE, CABLE AND ELECTRICAL CONNECTORS

- A. Control Valve and Tracer Wires: 14 gauge copper wire designed for 24 volts or greater, Type UF, Underwriter's Lab (UL) approved for direct burial in NEC Class II circuits.
 - 1. Remote control valve pilot wires shall be red in color.
 - 2. Remote control ground wires shall be white in color.
 - 3. Extra remote control valve wires shall be blue in color.
 - 4. Tracer wires shall be yellow in color.
- B. Electrical Connectors for all irrigation wires: 3-M DBY/DBR, Rain Bird Snap-Tite or Pen-Tite PVC Socket and Sealing Plus.

2.14 OTHER MATERIALS

- A. Pipe Joint Tape: Pipe joint tape shall be a minimum of ½-inch wide Teflon tape intended for use in wrapping threaded PVC pipe fittings and joints, as required.
- B. Drain Rock: ¾-inch to 1¼-inch washed round rock, with no fines.

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 detailed 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, and the Contract Documents. The Owner's Representative may require the Contractor to correct to the Owner's Representative's satisfaction any work installed that results from such conflicts at no additional cost to the Owner.

- C. The location of pipe, sprinkler heads, valves, and other equipment shall be as detailed 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 the 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 changes to the project. All changes shall be recorded within 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 have 18-inches minimum and maximum 18-inches depth of cover.
 - 2. Where multiple pipes are laid in common trench, the Contractor must maintain a minimum separation of 2-inches in any direction between all pipe.
 - 3. All sleeves and conduits shall have 24-inches minimum and 30-inches maximum depth of cover.
- B. 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.
- C. Before back-filling trenches, all pipe shall be flushed clear and clean of all dirt and foreign material.
- D. Backfill trenches in layers of not more than 6-inches in depth and compact each layer. Fill trenches to finish grade with native or imported topsoil keeping the top 12-inches free of rock. Restore surface to original or better than original condition.
- E. 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.
- F. Backfilling under all paved areas shall conform to minimum density and compaction requirements as described in applicable specification sections.

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. Snake pipe in trenches to allow for expansion and contraction as recommended by the manufacturer.
- E. At all installed joints cut pipe ends square and remove all burrs.
- H. Where Pipe is installed under pedestal paving system, route strategically to minimize conflicts. In order to prevent movement, mainlines shall be securely fastened to pedestal system with cable ties at 4' maximum spacing. Where pipe is in direct contact with pedestals or any other elements that may abrade the pipe, the pipe shall first be wrapped with specified PVC pipe foam tape.

3.4 VALVES

- A. Install within shrub planting areas whenever possible. Install as detailed and as recommended by the manufacturer, complete with valve box and extension(s) and as detailed. All valve boxes shall be installed so that the top of the box is flush with adjacent finish lawn grade or 1-inch above planting area grade, after settling. Valves shall not be manifolded and shall be located no closer than 3' on center apart. Owner's Representative shall approve final valve locations prior to commencement of trenching operations.
- B. See Plumbing drawings for installation of all valves located inside the building.

3.5 CONTROLLER, CONTROLLER ACCESSORIES AND RAIN GAUGE

- A. Install as shown on the drawings and as recommended by the manufacturers.
- B. Coordinate with other trades as necessary to facilitate complete installation.
- C. Contractor shall meet on-site with the controller manufacturer's representative, prior to commencement of installation of controller.

3.6 IRRIGATION HEADS

- A. Install irrigation heads of types, sizes and coverage called for in the Irrigation Legend/Key at the locations as detailed. Minor changes in head location may be necessary to achieve the required coverage at no additional expense. Notify the Owner's Representative for approval prior to making any changes. Document all changes on project Record Drawings as they occur.
- B. Unless otherwise noted on the drawings, locate no head closer than 3-inches from any adjacent walk (gravel, concrete or otherwise), and no closer than 6-inches from any adjacent structure, deck or building.

3.7 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 12-inches. All sleeves shall be installed with a minimum depth of cover to the top of the pipe of 24-inches. 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. Stake both ends of sleeves with a readily visible stake extending 12-inches 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 the Record Drawings and after irrigation lines and/or control wires are installed and inspected.
- D. In areas of new paving, place a minimum of 4-inches of sand backfill over the top of all sleeves before back-filling with soil or other subgrade materials.
- E. Where sleeves pass under concrete paving or curbs, concrete shall be marked with a marking tack as described in the concrete section.

3.8 IRRIGATION WIRING AND CABLES

- A. Tape control wires and cables in trench under main line or lateral lines whenever they occur in the same trench. Place control wires in electrical conduits or sleeves under all paving and when not in common trench with main line or lateral lines.
- B. Make all wire and splices moisture proof using specified electrical connectors. Splices shall be made in valve boxes only. All splices shall be noted on Record Drawings. Provide a minimum of 1-foot 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 10-feet. Wires shall be placed below mainline or laterals when in same trench.
- D. Sharp bends or kinks in wires and cables shall not be permitted. Wires shall be unreeled in place alongside of or in the trench and shall be carefully placed along the bottom of the trench. Wire shall not be unreeled and pulled into trench from one end.
- E. Install tracer wires with all lateral line pipes and sleeves, taped to top of pipe or sleeve at 10-foot intervals with electrical tape. Where pipes tee off, make wire connections with specified waterproof connectors.
- F. For control wires, cables and tracer wires, provide 18-inches loop of extra wire in all valve boxes.
- G. Contractor shall install all remote control valve wires and cables from valves to controller shown at the approximate location on the Drawings. Contractor shall coordinate with other trades as necessary to facilitate this installation.
- H. Label all installed wires on each end with waterproof tags for all wires including those for future use.

3.9 IRRIGATION CONTROLLER

- A. The Contractor is responsible for providing a power source and making connections to the specified controller locations in accordance with the manufacturer's standard specifications and all applicable local and state codes.
- B. The Contractor shall install controllers as detailed and as recommended by the manufacturers.
- C. The Contractor shall determine the sizes and quantities of all conduits coming into the controller that will be required for all specified wiring. The use of smaller gauge wiring than specified in order to route through undersized conduits shall not be allowed.
- D. All wiring within the building shall be installed with securely mounted conduits.

3.10 FLUSHING AND TESTING

- A. Thoroughly flush all piping before testing and installation of irrigation heads and before back-filling 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 24-hours to set and cure.
- D. Before testing, fill pipe with water and expel all air from pipes. Thrust blocks and all valves shall be in place prior to filling the main line with water for testing.
- E. Minimum pressure test on mainline, valves, joints and fittings, shall be 100-lbs./sq.in. without losing more than 1-pound per square inch during a period of 1-hour. Lateral lines shall be visually inspected by the Owner's Representative at line pressure with swing joints installed and capped. The Contractor shall first perform the tests for himself and repair any leaks or defects. The Contractor shall then notify the Owner's Representative at least 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.
- F. The Contractor shall adjust and balance the irrigation system to provide uniform coverage prior to commencement of planting operations. The Contractor shall change or adjust heads and/or nozzles as required to provide uniform coverage and match 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 24 hours in advance, and perform another coverage test in the presence of the Owner's Representative for approval.
- G. Where inspected work does not comply with specified requirements or if pressure tests fail, replace the rejected work until re-inspected by the Owner's Representative and found to be acceptable. The Contractor shall credit the Owner, against the contract amount, at the rate of \$75.00/hr. for re-inspection of failed tests.

3.11 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.

3.12 FINAL SUBMITTAL

- A. Submit Record Drawings and project manuals. Provide owner with laminated 11x17 zone chart with each zone numbered and color coded to identify zone and area of coverage. Record Drawing Document to be provided in PDF format to Owner as well.
- B. Provide training to Owner as described in Paragraph 1.2 D.

END OF SECTION

SECTION 32 91 19

LANDSCAPE, GRADING, TOPSOIL AND SOIL PREPARATION

PART 1 GENERAL

1.1 SUMMARY

- A. This section covers all Work necessary to furnish and place amended topsoil and general preparation of planting areas as denoted on plan.
- B. Balanced Site:

The intent is to balance cut and fill onsite. Prior to grading operations, contractor to supply cut and fill analysis of proposed grades for review. At that time, slight adjustments of the site earthwork may be necessary. During earthwork operations, Owner's Representative and Contractor to monitor earthwork operation to achieve a balanced site. Adjustments to the contract document grades deemed necessary to balance the site and associated earthwork changes shall be done at no cost to the owner.
- C. Related Sections:
 - 1. Section 31 20 00 – EARTHWORK
 - 2. Section 32 84 00 – IRRIGATION
 - 3. Section 32 92 19 – SEEDING
 - 4. Section 32 93 00 – TREES SHRUBS AND GROUNDCOVER

1.2 PROTECTION

- A. Protect existing trees to be preserved as denoted on plan, and other features such as fences, roads, sidewalks, paving, and curbs as final work.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter, sand, silt, and clay particles: fertile, friable, pervious natural fine sandy loam, or silt loam, a darker shade of brown or gray than underlying subsoil, with a pH range of 5.5 to 7, 4 percent organic material minimum, free of subsoil, stones or hard earth 1-inch or larger, free of noxious weeds (including quack grass and horsetail), roots, stones, sticks or other extraneous material.

1.4 SUBMITTALS

- A. The Contractor shall make all submittals in accordance with Section 01 30 00-ADMINISTRATIVE REQUIREMENTS.
- B. Submit manufacturer's or vendor's certified analysis for soil amendments, fertilizer and other materials. Submit other data substantiating that materials comply with specified

requirements. Such certificates may be tags, labels, and manufacturer's literature, and all submittals shall be reviewed for approval by Architect prior to installation.

- C. Furnish Ziploc bag of of the following, including supplier's name and location of supply to Owner's Representative for approval before delivering to job site:
 - 1. Compost mulch.
- D. Product data and proof of purchase for all fertilizers and soil amendments, as well as other specified amendments.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver packaged materials in manufacturer's unopened containers fully identified by name, brand, type, weight and analysis.
- B. Store and handle packaged materials to prevent damage and intrusion of foreign matter.
 - 1. Maintain stockpiled topsoil in designated areas. Provide erosion control measures for stockpiled topsoil on site to prevent contamination of the soil.
- C. Submit receipts of all fertilizers and compost to Owner's Representative.

1.6 SITE CONDITIONS

- A. Topsoil placement and soil preparation shall not take place during periods where saturated soil or surface water is present in work areas.
- B. Work shall not take place when temperature is less than 32° F. or soil is frozen.
- C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before placing topsoil.
- D. Utilities: Determine location of above grade and underground utilities and perform work in a manner that will avoid damage. Hand excavate as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

1.7 PROTECTION

- A. Provide adequate measures to protect workers and passersby at the site. Execute all works in an orderly and careful manner with due consideration for any and all surrounding areas, plantings, or structures which are to remain. Protect all adjacent property and improvements from work damage, and replace any portions damaged through this operation.

PART 2 PRODUCTS

2.1 NATIVE TOPSOIL

- A. It is the intent of the project to use existing native stockpiled topsoil for all topsoil placement meeting the requirements of Paragraph 1.3.

2.2 COMPOST

- A. Compost shall be a commercially manufactured material, medium grind, made from dead plant material such as grass clippings, weeds, green and dead dry leaves, garden and vegetable material, and ground branches of trees and shrubs. Furnish a product that is composted under controlled aerobic decomposition, with the internal temperature reaching 57°Celsius (135°F) for 15 days, without exceeding 68°Celsius (155°F). Ensure that it is a mature compost and does not contain detrimental components. Certification by testing will be required.
- B. Compost Analysis: Have a Compost Foodweb Analysis test performed on a sample of the compost at a soil food web lab and submit a copy of the test results to the Owner's Representative for approval. The compost must meet the criteria of this section. The test must give results in the following categories:
 - 1. Active Bacterial Biomass
 - 2. Total Bacterial Biomass
 - 3. Active Fungal Biomass
 - 4. Total Fungal Biomass
 - 5. Hyphal Diameter
 - 6. Protozoa Numbers
 - 7. Total Nematode Numbers
- C. An approved Soil Food Web Lab is:
Soil Foodweb Inc.
1128 NE 2nd Street, Suite 120
Corvallis OR 97330
541-752-5066 www.soilfoodweb.com

2.3 SOIL AMENDMENTS/ADDITIVES

- A. Soil additives for correction of pH and nutrient deficiencies shall be factory labeled containers and approved prior to application.
- B. Yard Debris Compost: Compost must be yard debris certified by Metro Earthwise program. Available from Yard Debris and Recycling (503.286.0886) or approved equal. Compost to be well-aged and weed-free.
- C. Lime: HumiSmart Lime by Proturf Solutions or approved Equal
- D. Pro Gold Plus 22-2-10 by Proturf Solutions
- E. Herbicide: TriMec, Round-up, or other herbicides as approved.

F. Water: Potable.

2.4 STORMWATER PLANTER SOIL: Import topsoil to meet City of Portland BES standards:

A. General Composition. The medium shall be any blend of loamy soil, sand, and compost that is 30-40 percent compost (by volume) and meets the other criteria in this specification.

B. Analysis Requirements for the Blended Material.

1. Particle Gradation. A particle gradation analysis of the blended material, including compost, shall be conducted in conformance with ASTM C117/C136 (AASHTO T11/T27). The analysis shall include the following sieve sizes: 1 inch, 3/8 inch, #4, #10, #20, #40, #60, #100, #200. The gradation of the blend shall meet the following gradation criteria.

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 that it is well graded (has a broad range of particle sizes). The coefficient is the ratio of two particle diameters on a grain-size distribution curve; it is the particle diameter at 60 percent passing divided by the particle diameter at 10 percent passing.

2. Organic Matter Content. An analysis of soil organic matter content shall be conducted in conformance with ASTM D2974 (loss on ignition test). The soil organic matter content shall be a minimum of 10 percent, as reported by that test.
3. pH. The pH of the blended material shall be tested. The material shall have a pH of 5 to 8.

C. General Requirements for the Blended Material.

1. The material shall be loose and friable.
2. It shall be well mixed and homogenous.
3. It shall be free of wood pieces, plastic, and other foreign matter.
4. It shall have no visible free water.

D. Compost. The compost shall be derived from plant 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 providers in Portland. 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.

1. 100 percent of the material must pass through a ½-inch screen.
2. The pH of the material shall be between 6 and 8.
3. Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0 percent by weight.
4. The organic matter content shall be between 35 and 65 percent.
5. Soluble salt content shall be less than 6.0 mmhos/cm.
6. Germination (an indicator of maturity) shall be greater than 80%.
7. Stability shall be 5-7.
8. Carbon/nitrogen ration shall be less than 25:1.
9. Trace metals test result = “pass.”

PART 3 EXECUTION

3.1 EQUIPMENT

- A. Contractor shall furnish and maintain earth-moving and compaction equipment in satisfactory condition and shall operate such equipment as necessary to control uniform density, and smoothness.

3.2 INSPECTION

- A. Verify site conditions and note irregularities affecting work in this Section.
- B. Beginning work of this section means acceptance of existing conditions.

3.3 EXCAVATION HANDLING

- A. Remove all foreign matter obtained from site soil cleaning, screening and/or picking process from the site and legally dispose of as required by the appropriate jurisdiction. Dispose of all waste off-site.

3.4 GRASS REMOVAL

- A. General Site Areas — All site work areas within the projects:
Contractor to remove top layer of grass, approximately 2-inches and haul off-site. Contractor to use care not to removal additional topsoil below existing grass layer.

3.5 CULTIVATION AT EXISTING TREES

- A. Do not cultivate within the dripline of existing trees (Tree Protection Zones).

3.6 SHRUB AND SEEDED GRASS PLANTING AREAS

- A. This section pertains to those areas on-site where seeded grasses, ground covers and shrubs are scheduled to be planted.
- B. Excavate and remove existing topsoil to a 6-inch depth and stockpile on site.

- C. Grade subgrade as necessary to achieve finish elevation prior to adding topsoil. Thoroughly rototill subgrade to a minimum 6-inches depth for approval.
- D. Place topsoil backfill a 6-inch lift, watering lightly to allow topsoil to settle between lifts. Add additional topsoil to bring soil level to grades shown on Drawings.
- E. Incorporate the following into the top 6 inches of topsoil in all planting areas.
 - 1. Pro Gold Plus 22-2-10 at a rate 4.6 pound per 1,000 square feet.
 - 2. HumiSmart Lime at a rate of 50 pounds per 1,000 square feet.
- F. The following organics shall be added to the soil per 1,000 square feet and rototilled to a 6-inch depth (average 2-inch layer):
 - 1. 6 cubic yards yard debris compost.
- G. See Section 32 93 00 – Trees, Shrubs and Groundcover for mulch placement in beds.

3.7 SOIL PREPARATION FOR PLANTING PITS OF TREES AND SHRUBS

- A. Thoroughly mix 3 parts approved topsoil with 1 part yard debris compost and 2 lbs. of Woodburn fertilizer "Pro Ornamental" per cubic yard 14/18/12 slow release. Place in planting pits as specified in Section 32 93 00-TREES, SHRUBS AND GROUNDCOVER.
- B. Grade smooth to elevations shown on Contract Documents.

3.8 FINAL FINISH GRADING

- A. All Topsoil and Conditioner placement shall not be performed when satisfactory results cannot be obtained due to rain freezing weather, or other unsatisfactory conditions.
- B. Rocks, stones, sticks, brush, roots, and other objectionable materials shall be removed and disposed of off-site.
- C. All areas to be planted shall be graded and floated to eliminate water holding depressions and pockets.
- D. Undulations and unsightly variations in grade that will not permit the use of normal mowing equipment without scalping or missing shall be re-graded and floated to smooth surfaces.
- E. Grading tolerance shall be within ± 1 -inch from finish grades. All areas shall be graded to provide positive drainage. Owner's Representative shall review grades prior to Contractor proceeding with further construction, irrigation or planting.
- F. All planted areas shall be machine or hand worked to eliminate objectionable lumps and soil clods, as deemed necessary by the Owner's Representative. Tillage shall include the removal of all equipment ruts and tracks, areas of compaction or erosion, and any other undesirable soil conditions which would prevent the proper formation of a finely pulverized seedbed, as directed by Owner's Representative.

- G. Finish grade after full settlement, not including mulch, shall be 1-inch below tops of curbs, walks, or existing grades in shrub, groundcover and ornamental grass areas, and ½-inch lower in seeded grass areas.

3.10 UTILITY PROTECTION

- A. Contractor shall be responsible for protecting all existing and proposed water lines, underground utilities, and any other subsurface features while excavating and working on the project site

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish labor, material and equipment required for the application of seed to establish finish lawn and grass areas as shown on the Drawings. The following specification addresses both methods.
- B. Owner's Representative shall determine areas beyond those shown on Contract Drawings disturbed by construction and to be prepared and seeded at no additional cost to the Owner.

1.2 REFERENCES

- A. AOSA- Association of Official Seed Analysis:
 - 1. Rules for Testing Seeds, Journal of Seed Technology, 1991 Edition.
- B. FSA- Federal Seed Act.

1.3 DEFINITIONS

- A. PLS: Pure Live Seed.

1.4 SUBMITTALS

- A. Submit certificates of inspection as required by County Agricultural Inspector. Submit manufacturer's or vendor's certified analysis for soil amendments, fertilizer and other materials. Submit other data substantiating that materials comply with specified requirements. Such certificates may be tags, labels, and manufacturer's literature, and all submittals shall be reviewed for approval by Owner's Representative prior to installation.
- B. Submittals shall include but not be limited to the following:
 - 1. Fertilizer: Chemical and percentage composition.
 - 2. Mulch: Size, type of material and fertilizer amendments.
 - 3. Amendments: Type, size and composition.
 - 4. Seed: Botanical and common name, percentage by weight, percentages of purity, germination and weed seed for each grass seed species.
 - 5. Tackifier.

6. Planting schedule indicating anticipated dates for seeding.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful grass establishment.
 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that grass planting is in progress.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
 1. Ship and store seed, mulch and fertilizer with protection from weather or other conditions that would damage or impair the effectiveness of the product.
 2. Contractor shall save all seed and fertilizer tags and fiber mulch bags for the Owner's Representative to verify compliance with the drawings and specifications.

1.7 COORDINATION AND SCHEDULING

- A. Planting Season: Sow lawn seed during normal planting seasons for type of lawn work required. Correlate planting with specified maintenance periods to provide required maintenance from date of Substantial Completion.
- B. Weather Limitations: Proceed with planting only when existing and forecast weather conditions are suitable for work.
- C. Coordinate work with installation of other site work including irrigation and planting.

1.8 INSPECTIONS

- A. Site visits for review of work shall be scheduled by the Contractor a minimum of 48 hours in advance with the Owner's Representative.

PART 2 PRODUCTS

2.1 SEED

- A. Grass Seed: Certified, Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.
 1. See drawings for seed mixes.
- B. Substitutions:

1. If specified seed material is not obtainable, submit proof of non-availability to Owner's Representative, together with proposal for use of equivalent material.
2. Substantiate such proof in writing no later than 30 days after Award of Contract.

2.2 MATERIALS

- A. Fiber Mulch: Biodegradable dyed-wood cellulose-fiber mulch, non-toxic, free of plant growth or germination inhibitors, with maximum moisture content of 15% and a pH range or 4.5 to 6.5.
- B. Non-asphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application, non-toxic and free of plant growth or germination inhibitors.
- C. Fertilizer: 16-16-16 with 6-percent slow release available from Woodburn Fertilizer, (503.981.3521) at 400 lbs per acre or approved equal.
- D. Hydro Slurry Mix: Hydro slurry mix to contain wood cellulose fiber mulch, dyed green at 2,000 lbs. per acre. Tackifier shall be applied at 50 lbs per acre.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and for conditions affecting performance of work in this section. Do not proceed with installation until 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 hydroseed overspraying.
 2. Agitate as necessary the slurry to assure an even mix of ingredients.

3.3 HYDROSEEDING

- A. Installation procedures:
 1. Inspection of conditions: Examine related work including irrigation and grading of surface before proceeding with any work and notify the Owner's Representative in writing on conditions which may prevent the proper execution of this work. Failure to report unsuitable conditions will require the contractor to rectify unacceptable work at no additional cost to the Owner.
 2. Water all plant areas thoroughly to saturate upper layers of soil prior to the hydroseeding operation.

3. Allow the planting area soil surface to dry out for one day only prior to the hydroseeding application. Exercise care not to allow the soil surface to be overly saturated with water prior to the hydroseeding installation. At the same time the soil surface should not become too dry during this period. There should be some residual moisture within the first 1/4 inch of the soil surface.
- B. Hydroseeding Application – First Step:
1. Apply the hydroseeding in the form of the seed and 10-percent of the hydro-slurry mix. When hydraulically sprayed onto the soil, the mulch shall form a blotter-like material. Direct the spray operation so that this procedure will drill and mix the slurry components into the soil, the slurry spray will also penetrate the soil surface, thus ensuring maximum impregnation and coverage.
 2. Do not let the hydroseeding slurry components in the hydroseeding machine for more than two (2) hours.
 3. Spray the area with a uniform visible coat, using the dark color of the cellulose fiber as a visual guide. The slurry shall be applied in a downward drilling motion via a fan stream nozzle. Insure that all of the slurry components enter and mix with the soil. Insure the uniformity of the hydroseed application.
- C. Hydroseeding Application – Second Step:
1. After area has been seeded and not longer than 48 hours, contactor shall apply the remaining hydrosilurry mix with the fertilizer over all turf areas.
 2. Exercise special care to prevent any of the slurry from being sprayed onto any hardscape areas including concrete walks, fences, walls, buildings, etc. Remove all slurry sprayed onto these surfaces at the contractor's expense.
- D. Hydroseeding Establishment:
1. Upon acceptance of hydroseeding operations, maintain all hydroseeded areas for a period of 60 calendar days as follows:
 - a. Germination stage irrigation: Approximately 25 hours after hydroseeding the planting areas, initiate the watering sequence. Leave the water on long enough to moisten the soil thoroughly to the depth of the slurry mulch taking care not to super saturate or wash away the slurry and seed. Perform frequent, light irrigation until the seed has germinated. Repair all seed washings and erosion.
 - b. Establishment stage irrigation: After germination, reduce each watering.
 - c. All seed areas to receive water through irrigation or handwatering to ensure establishment.
- E. Provide hand-watering of areas that do not have irrigation for grass establishment.

3.4 MAINTENANCE

- A. Begin maintenance of lawns immediately after full stand of grass has germinated to a minimum 1.5-inches in height and Substantial Completion has been accepted for entire site area. Maintenance shall continue for not for less than the following periods.
 - 1. Seeded Lawns: 60 calendar days after full stand of grass has germinated to a minimum 1.5-inches in height and Substantial Completion. Substantial Completion is when all areas have been seeded and planted. Approvals will not be given for partially completed areas.
 - a. When full maintenance period has not elapsed before end of planting season (October 15th), continue maintenance during next planting season (March 15th). Contractor to fulfill remaining part of the 60 calendar day requirement during the following year.
- B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn free of weeds and eroded or bare areas.
 - 1. Replant bare areas with same materials specified for lawns.
 - 2. Water lawns at such frequency as weather conditions require, to maintain appropriate soil moisture throughout the rootzone.
 - 3. Weeding: All concentrated developments of weed growth appearing in the seed mix planting areas during the maintenance period shall be removed at two (2) week intervals. The contractor may elect to remove such concentrations of weeds manually or by a City approved herbicide program.
- C. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain following grass height.
 - 1. Mow lawn areas from 2- to 3-inches high.
- D. Post Fertilization: Apply fertilizer to lawn after first mowing and when grass is dry. Apply Wilco Farmers 25-5-10-7-2MG-2FE at 300 lbs per acre.
- E. If maintenance period is delayed into the following year, Contractor is to apply post fertilization at the end of the 60-day period as required under D.

3.5 FINAL ACCEPTANCE

- A. Acceptance of all seeded areas will be based on growth of a uniform color and dense stand of grass, without bare spots of over 100 sq.in. Grass shall have a lush, green appearance without yellow spots.

3.6 CLEAN UP 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 soils onto surfaces of roads, walks, or other paved areas. Remove germinated seed in planting areas without harming other plant material.

3.7 FINAL PROTECTION

- A. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period until lawn is established.

END OF SECTION

SECTION 32 93 00

TREES, SHRUBS, AND GROUNDCOVER

PART 1 GENERAL

1.1 SUMMARY

- A. The work included in this section, whether mentioned or not, shall consist of all labor, tools, materials, tests, permits, and other related items necessary for the installation of all plant materials as shown on the drawings and/or as specified in the Specifications.
- B. The work in this section includes:
 - 1. Trees, plants, and groundcover.
 - 2. Staking.
 - 3. Mulching.
 - 4. Fertilizer.
 - 5. Pruning.
 - 6. Weed Control.
 - 7. Root Barriers.
 - 8. Maintenance.

1.2 RELATED WORK

- A. Topsoil placed and graded to a grade tolerance of +/-0.1-foot prior to start of the landscape work.
- B. Grass and weed removal for planting areas shall be performed per these specifications.

1.3 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A300 - Tree Care Operations - Tree, Shrubs, and Other Woody Plant Maintenance - Standard Practices.
 - 2. ANSI Z60.1 - Nursery Stock.

1.4 SUBMITTALS

- A. Certified Confirmed Orders: Certify in writing to the Owner's Representative within 30 days of the award of the contract, confirmed orders for plants and provide the quantity, location, phone number, and address of the grower who has agreed to provide any plant material. Should the Contractor neglect to provide this documentation within the allocated time, Contractor may forfeit any substitution benefits.

- C. Certificates: Certificates required by law shall accompany shipments. Upon completion of the installation, submit certificates to the Owner's Representative.
- D. Quantity Certification: Provide certification of quantities of mulch, fertilizer, herbicide, and planting accessories delivered to the site.

1.5 QUALITY ASSURANCE

- A. Tree Pruning: ANSI A300 Pruning Standards for Woody Plants.
- B. Field Superintendent – Provide one person who shall:
 - 1. Be present at all times during execution of work in this section;
 - 2. Be familiar with the materials and best methods for installation;
 - 3. Direct work performed under this section.
 - 4. Be a Certified Landscape Technician, certified by the Oregon Landscape Contractors' Association.
- C. Government Inspection: All plants and planting material shall meet or exceed the specifications of federal, state, and county laws requiring inspection for plant disease and control.
- D. Industry Standards: Quality definitions, size tolerances and caliper-to-height ratios shall be no less than minimums specified in American Standards for Nursery Stock, published by American Association of Nurserymen, Inc., ANSI Z60.1-1990.
- E. Provide documentation that all plant material has been sourced and procured from nurseries that do not use neonicotinoids.
- F. Owner reserves the right to reject any or all plant material at any time until final review and acceptance. Remove rejected plants immediately from site.
- G. Produce upon request, sales receipts for all nursery stock and certificates of inspection from federal, state, and other authorities.

1.6 CHANGE ORDERS AND SUBSTITUTIONS

- A. The Contractor shall provide all plants of the size, species, variety, and quality noted and specified. If unavailable, the Contractor shall notify the Owner's Representative in writing immediately and provide the names and telephone numbers of five nursery suppliers that he has contacted. If substitution should be permitted, it can be made only with the prior written approval of the Owner. The nearest variety, size, and grade as approved by the Owner's Representative shall then be furnished.

1.7 QUALIFICATIONS

- A. Installer: The Contractor installing work covered by this specification section must be a state licensed and bonded Landscape Contractor. Contractor must be 2-5 year

experienced in landscape work of best-accepted trade practices and have equipment and personnel adequate to perform the work specified. Contractor must be familiar and comply with American Standard for Nursery Stock published by the American Association of Nurserymen.

1.8 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Notify Owner's Representative of delivery schedule so plant materials may be inspected upon job site delivery. Remove unacceptable products immediately from job site.
- B. Storage and Handling: Protect products against damage or dehydration. Cover plant roots and root balls with soil or other accepted material upon job site delivery if not to be planted within four hours. Store plant material in light shade and protect against harmful weather until planted. Maintain plant materials not to be planted within four hours.
- C. Plant material damaged as a result of delivery, storage or handling will be rejected.
- D. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not install plant life when ambient temperatures may drop below 35°F or rise above 90 °F.
- B. Do not install plant life when wind velocity exceeds 30 mph.

1.11 COORDINATION

- A. Install plants after finish grading and coordinate with installation of underground irrigation system piping and sprinkler heads, and installation of root barriers.
- B. Coordinate the removal of grass and weeds for planting areas prior to work in this section.

1.12 PROTECTION

- A. Protect Existing Site Improvements: Verify location of underground facilities prior to doing work. Protect active service lines whether indicated or not. Repair and make good any damage to service lines or improvements caused by planting operations.

- B. Barricade or Cover Excavations: Barricade or cover as necessary all excavations to protect pedestrians & workers.
- C. Contractor is responsible for protecting plant material through final acceptance.

1.13 WARRANTY

- A. Warranty begins at date of substantial completion.
- B. Plant materials must be in healthy condition at end of a one-year warranty period, or for one full growing season from substantial completion, whichever is longer.
- C. Contractor is responsible to assume liability for all plant material and to warranty plants against disease, insect infestation, desiccation, sun scald, freeze damage, or any other condition that would cause plants to be unhealthy or to die through substantial completion.
- D. Replace all trees, shrubs, and groundcovers when plants are no longer in a satisfactory growing condition as determined by the Owner for the duration of the Warranty period. Make replacements within seven days of notification from the Owner. Remove dead plants within two days of notification and mark the planting plan showing the exact location of replaced plants.
- E. Contractor is not responsible for damage to plants due to vandalism, theft, or accidental damage from pedestrians during the warranty period.

1.14 PERMITS, CODES, AND REGULATIONS

- A. The Contractor shall obtain and pay for all necessary permits and fees as required by local authority and prevailing ordinances and/or codes.
- B. The Contractor shall keep fully informed and shall comply with all existing laws, codes, ordinances, and regulations which in any way affect the conduct of the work.

PART 2 PRODUCTS

2.1 TREES, PLANTS, AND GROUNDCOVER

- A. All plants shall be nursery grown, or normal habit of growth, healthy, vigorous and free of disease, insect eggs and larvae. Plants shall not be pruned prior to delivery. Plants shall have all leaders and buds intact. Grading of plant material and root ball / container sizes shall be in accordance with the code of standards of the American Association of Nurserymen.
- B. Provide the number of plants shown graphically on the Landscape Drawing or listed on the Plant Materials List, whichever is greater, or to cover at specified spacings.

- C. Tree with multiple leaders, unless specified, will be rejected. Trees with a damaged or crooked leader, bark abrasions, sunscald, disfiguring knots, insect damage, or cuts of limbs over ¾-inch in diameter that are not completely closed will be rejected.
- D. Plants are required to be from stock acclimated to 'Project Site' environmental conditions, having been consistently cultivated and grown under these conditions.
- E. Root Protection: Large plants Balled and Burlapped (B&B) with natural ball of size to ensure healthy growth. Small plants container-grown furnished in removable containers or integral peat pots well rooted to ensure healthy growth. Grow container plants in containers from six months to two years prior to delivery with roots filling container but not root bound.
- F. Plant Names: Plants shall be true to name and one of each bundle or lot shall be tagged with the common and botanical name and size of the plants in accordance with the standards of practice of the American Association of Nurserymen and shall conform to Standardized Plant Names, 1942 Edition, published by J. Horace McFarland Company. In all cases, botanical names shall take precedence over common names.

2.2 FERTILIZER

- A. Fertilizer: Agriform planting tablets, 10 and 21 gram, or approved equal.

2.3 PRE-EMERGENT HERBICIDE

- A. Ronstar G, granular or approved equal.

2.4 MULCH MATERIALS

- A. Bark Mulch: Commercial product, medium ground bark mulch. Bark shall be medium ground, dark hemlock bark of uniform color, free from weeds, seed, sawdust, and splinters and shall not contain resin, tannin, wood fiber or other compounds detrimental to plant life. Source shall be from freshwater mill.

2.5 ACCESSORIES

- A. Tree Wrap: Corrugated or crepe paper, designed specifically to resist insect infestation and sun scald.
- B. Stakes: 2-inch x 2-inch x 8 feet rough, Douglas fir stakes, standard and better grade, free of large knots, pre-stained with one coat oil base wood stain, Olympic Redwood Natural Tone #717 or approved equal.
- C. Cable, Wire and Accessories: 3/32-inch minimum 5 strand galvanized steel wire rope. Install 12- inch length of ¾-inch PVC pipe flag on evergreen guys. 5/16-inch galvanized turnbuckles and eye hooks.

- D. Tree Ties: Broad belt-type strapping or plastic chain (min. ½-inch width). Submit sample for approval.
- E. Root Barrier “UB-18-2”, deep root barrier, as available from Deep Root, www.deeproot.com.

2.6 WATER

- A. Contractor shall make, at Contractor expense, whatever arrangements are necessary to ensure an adequate water delivery system to meet the needs of this Contract. The Owner will make water available to the Contractor from the existing domestic water meter on site.
- B. Water for plant irrigation must be clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of plants.

2.7 ANTI-DESICCANT

- A. Anti-desiccant shall be ‘Wilt-Pruf’, or approved equal, delivered in manufacturer’s containers and used in accordance with manufacturer’s recommendations.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify prepared subsoil and planting beds are ready to receive the Work of this section, including the removal of grass and weeds per these specifications and as shown on the drawings.

3.2 SOIL PREPARATION

- A. Prepare planting bed soils per specification Section 32 91 19, LANDSCAPE GRADING, TOPSOIL, AND SOIL PREPARATION.

3.3 EXCAVATION

- A. Excavate planting pits or beds for trees, shrubs, and groundcover consistent with good horticultural practices. The inside surfaces of all planting holes are to be rough, not smooth. If the Contractor encounters any unusual condition which, in his opinion, is detrimental to the new planting, he shall notify Owner’s Representative immediately.

3.4 PLANTING

- A. Contractor shall field stake tree locations for approval. Make required field adjustments as directed without additional cost to the Owner. The right to make minor adjustments in layout is reserved by the Owner.

- B. Place all plants as shown on drawings. Plant upright and orient to give best appearance or relationship to adjacent plants and structures. Place all shrubs 5 feet from trails, all trees 10 feet from trails. Notify Owner's Representative for review and approval of final orientation.
- C. Tree Base: Place a 2-inch lightly compacted layer of prepared planting soil under root system.
- D. Set plants in prepared pits or beds. Loosen and remove twine binding and burlap from top one-half of root balls. Weeds in the top of root balls must be removed prior to planting.
- E. Place bare root plant materials so roots lay in natural position.
- F. Cut off cleanly all broken or frayed roots.
- G. Backfill planting hole with prepared planting mix material comprised of a mixture of native topsoil and compost. When planting hole is one-half backfilled, fill with water and let stand until water is absorbed into soil. Continue topsoil fill and when planting hole is three-fourths filled, place planting tablets evenly spaced around each plant or tree. Provide the following quantities per plant or tree:
 - 1. 4-inch potted plant: one 10 gram tablet.
 - 2. Gallon container shrubs up to 12-inch spread: two 10 gram tablets.
 - 3. Shrubs 15-inch to 36-inch spread: four 10 gram tablets.
 - 4. Shrubs 36-inch and larger spread: three 21 gram tablets.
 - 5. Evergreen trees: four 21 gram tablets.
 - 6. Deciduous trees up to 1½-inch caliper: three 21 gram tablets.
 - 7. Deciduous trees 1½-inch caliper: four 21 gram tablets.
 - 8. Deciduous trees 2- inch and larger: five 21 gram tablets.
- H. Place and compact topsoil backfill to finish grade and provide 2-inch depressed water basin at each shrub and tree.
- I. Water each plant thoroughly upon completion of planting. Initial water-in of trees and shrubs by underground sprinkler system is not permitted.
- J. Remove non-biodegradable root containers and all plant pots from site.

3.5 WEED CONTROL

- A. Apply pre-emergent herbicide according to the manufacturer's directions on the planting beds that will not be seeded, after planting and before mulching. No herbicide shall be applied to areas of annual flower plantings, as shown on plans. Herbicide must be applied by a licensed chemical applicator. WARNING: Pre-emergent herbicide will prevent germination of lawn grass seed. The Contractor shall use his best judgment during application procedures to avoid lateral movement of chemical into lawn areas. The

Contractor may elect to skip certain portions of planting beds if lateral movement of chemical cannot be avoided. Notify Owner's Representative of areas that did not receive herbicide. Contractor is still responsible for weed control until final acceptance.

3.6 INSTALLATION OF ACCESSORIES

- A. Stake all deciduous trees. Refer to planting details.
- B. Brace plants vertically with plant support(s) specified and per planting details.
- C. Contractor shall make all possible efforts to provide favorable conditions for healthy plant growth, and should notify the Owner's Representative immediately upon concerns and/or conflicts with design drawings.

3.7 FIELD PRUNING

- A. Prune trees and shrubs to remove damaged branches.
- B. Paint all cuts more than ½-inch in diameter with tree paint approved by American Association of Nurserymen.

3.8 MULCH

- A. Apply a 2½-inch layer of specified mulch over all planting areas after planting and rake to a smooth finish grade.
- B. Provide mulch layer around newly planted trees as detailed.
- C. At existing trees, provide a 5-foot diameter mulch ring at base of tree, 2-inches thick, but keep mulch from touching actual base of tree trunk.

3.9 ADJUSTMENT AND CLEANING

- A. Remove and replace plants or materials not meeting specified standards.
- B. Areas are to be kept clean during progress of work until completion.
- C. Pressure Washing of Concrete, Masonry, and Asphaltic Paving: Any paved area or surfaces stained or soiled from landscaping materials having been hauled, carried or spilled over or around it shall be cleaned with a power sweeper using water under pressure. Building surfaces shall be washed with proper equipment and materials as approved by the Owner's Representative.

3.10 MAINTENANCE

- A. Maintain plant life immediately after placement. Continue maintenance through substantial completion.

- B. Protect and maintain work in this specification section against all defects of materials and workmanship. Maintenance of all the planted areas shall include, but not be limited to, watering, mowing, weeding, herbicide and insecticide applications, cultivation of beds, mulch replacement, guys, turnbuckles, and stakes, and pruning as well as replacement of any plants that appear to be in distress.
- C. Irrigate when necessary to avoid drying out of plant materials, and to promote healthy growth.
- D. It is understood that the Owner will be responsible during the Warranty period for normal landscape maintenance of the project.

3.11 FIELD QUALITY CONTROL

- A. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

END OF SECTION

SECTION 32 94 00

SITE FURNISHINGS

PART 1 GENERAL

1.1 SUMMARY

- A. The work in this section includes:
 - 1. Site furnishings include but are not limited to drinking fountain, benches, bike racks, picnic tables, removable bollards, and disc golf equipment.
 - 2. Owner provided, Owner installed items include:
 - a. NCPRD Standard Park Sign: Owner to provide and install sign and post.
- B. References:
 - 1. American Society of Testing and Materials (ASTM).

1.2 SUBMITTALS

- A. Product Data: Submit to Owner's Representative two sets of manufacturer's technical data and installation instructions for each item, with list of accessory items. Clearly indicate options of size, model, and finish.

1.3 QUALITY ASSURANCE

- A. Manufacturing Standards: Provide each item of equipment as a complete unit produced by a single manufacturer, including fittings, accessories, bases, and anchorage devices.
- B. Construction: Construct each item and ship to the site in minimum number of sections.

1.4 WARRANTY

- A. Provide / submit to Owner's Representative the manufacturer's warranty for each product / item supplied by Contractor. Contractor shall warrant each product / item for one year minimum.

1.5 PROJECT CONDITIONS

- A. Existing Conditions: Locate all underground utilities and modify work, as approved by Owner's Representative, if necessary to avoid conflicts.

PART 2 PRODUCTS

2.1 BACKED BENCH

- A. DuMor Inc., Model: 131-60PL/S-2. 6-foot length. Color: Bronze. Slats: Recycled Plastic Lumber, Color: Walnut

2.2 PICNIC TABLE

- A. Kay Park Recreation Corp., J2-Series.
 - 1. Accessible Table: J2-HC Series, 8-foot length, Color: Brown vinyl plastisol with coated brown frame.
 - 2. Non Accessible Table: J2 Series, 6-foot length, Color: Brown vinyl plastisol with coated brown frame.
- B. Install anchor as detailed on the Drawings.

2.3 DRINKING FOUNTAIN

- A. MDF Inc., Model: 410 SM. Color: Powdercoat Brown.

2.4 BIKE RACKS

- A. PW Athletic Manufacturing Co., Model: Rainbow Bike Rack, Model #1608-01, surface-mount option. Color: Powdercoat 246 Cast Bronze.

2.5 DISC GOLF EQUIPMENT

- A. Innova Disc Catcher Pro. 28-chain catcher. All components galvanized or powdercoated. Permanent in-ground installation with concrete footing. Or approved equal.

2.6 REMOVABLE BOLLARD

- A. Removable Metal Bollard by Timberform, model #2190-R. Color: Powdercoat Brown.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces or conditions where Site Furnishings are to be erected. Notify the Owner's Representative of any conditions detrimental to the proper and timely completion of the work. Do not proceed with installation until unsatisfactory conditions have been corrected and are acceptable to the installer.

3.2 INSTALLATION

- A. Install work in this section in accordance with the manufacturer's recommendations and as approved by the Owner's Representative. All furnishings to be installed plumb and true.
- B. Secure benches and bike racks to paving with expansion anchor bolts as recommended by manufacturer.

3.3 FOOTINGS

- A. Unless specified otherwise by manufacturer, comply with the following:
 - 1. Excavate for concrete footing to neat, clean lines in undisturbed soil. Provide forms in unstable soil conditions.
 - 2. Footings shall be sized and installed, including reinforcement as recommended by manufacturer.
 - 3. Top of footing in unpaved areas: 1-inch above finish grade. Slope toward edge of footing to prevent water pooling.

3.4 CLEAN-UP

- A. Clean up excess materials and debris from project site upon completion of work or sooner if directed.
- B. Leave in a neat and tidy condition daily.

END OF SECTION

SECTION 32 95 00

PLAYGROUND EQUIPMENT AND SURFACING

PART 1 GENERAL

1.1 SUMMARY

- A. Play Equipment will be purchased and installed by Contractor. Furnish all labor, material, equipment, and services required for the installation of playground equipment and surfacing.
 - 1. Play Area Surfacing:
 - a. Engineered wood fiber surfacing as detailed and specified herein.
- B. References:
 - 1. American Society of Testing and Materials (ASTM).
 - 2. International Play Equipment Manufacturer's Association (IPEMA).
 - 3. National Playground Safety Institute (NPSI).

1.2 SUBMITTALS

- A. Product Data: Submit to Owner's Representative two sets of manufacturer's technical data and installation and maintenance instructions for each item, with list of accessory items. Clearly indicate size, model, finish and color.
 - 1. For engineered wood fiber surfacing, additionally provide ASTM F 11292 test results, ASTM F 1951 test results and ½ cu. ft. sample.
- B. Shop Drawings: Contractor to provide all final shop drawings; and, provide all coordination and execution of building permits and related requirements. Submit shop drawings of those items requiring shop fabrication, needing detail or structural clarification, or those having special considerations to adapt to site conditions.
 - 1. Detailed erection drawings and bills of materials shall be furnished by manufacturer for each play structure. Drawings shall include footing details and technical data necessary for correct assembly. To facilitate ease of assembly, each manufactured metal component shall be indelibly marked with an easily recognized identification number keyed to the erection drawings.
 - 2. Submit 3 copies to Owner's Representative.
 - 3. Maintain one copy at the Project Site for reference purposes.
 - 4. Do not proceed with the installation of manufactured products until an approved copy of the submittal is in the Installer's possession at the Project Site.
- C. Play equipment manufacturer to provide \$2 million product liability insurance certificate for any single occurrence, with the DISTRICT named as certificate holder.

- D. Product data for Playground Surfacing: Submit manufacturer's product data, including warranty and installation instructions, ASTM F 1292 test results, ASTM F 1952 test results, IPEMA certification of compliance and samples.

1.3 QUALITY ASSURANCE

- A. Manufacturing Standards: Provide each item of equipment as a complete unit produced by a single manufacturer, including fittings, accessories, bases, and anchorage devices.
- B. Construction: Construct each item and ship to the site in minimum number of sections.
- C. Manufacturer's Qualifications for Engineered Wood Fiber Playground Surfacing:
 - 1. Member of IPEMA.
 - 2. Certified by NPSI.
- D. All playground equipment shall meet or exceed current U.S. Consumer Product Safety regulations and state and local government laws and codes, as well as the standards and requirements of IPEMA and NPSI.
- E. Installer's Qualifications for Playground Surfacing and Equipment Installation: Installer shall be a certified installer by manufacturer of specified playground equipment and surfacing system and shall have 5 years successful experience in installing playground surfacing and equipment of similar size and complexity. Contractor shall have CCB Good-standing, and successful track record of Playground Installs with references.

1.4 WARRANTY

- A. Provide / submit to Owner's Representative the manufacturer's warranty for each product / item supplied by Contractor. Contractor shall warrant each product / item for one year minimum.
- B. Warranty on playground equipment and surfacing shall be 10 years minimum.

1.5 PROJECT CONDITIONS

- A. Existing Conditions: Locate all underground utilities and modify work, as approved by Owner's Representative, if necessary to avoid conflicts.

PART 2 PRODUCTS

2.1 MANUFACTURERS / DISTRIBUTORS

- A. GameTime (800) 235-2440
- B. The Fibar Group (914) 273-8770

2.2 PLAYGROUND EQUIPMENT

- A. Contact: Martha Rainey MRC GameTime (503) 708-4878
- B. GameTime Xscape Playground Model #MR092217
- C. GameTime #26119 Xscape Swing with (2) belt seats Model #8910 and (1) bucket seat, Model #18696
- D. Gametime Mini Pod Toad Stools, Model #6141
- E. All play equipment shall be Green and Blue Color scheme

2.3 PLAYGROUND SURFACING

- A. Surfacing Material: Fibar Engineered Wood Fiber Playground Safety Surfacing by The Fibar Group LLC.
 - 1. Or approved equal.
- B. Geotextile Weed Barrier Fabric: Nonwoven geotextile fabric, 55 mils thick, with a tested 170 gallons per square foot per minute permeability.
- C. Drain Rock and Drain Pipe: See civil engineer drawings for layout and connection to dry well.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces or conditions where Site Furnishings are to be erected. Notify the Owner's Representative of any conditions detrimental to the proper and timely completion of the work. Do not proceed with installation until unsatisfactory conditions have been corrected and are acceptable to the installer.

3.2 INSTALLATION

- A. Install a 6-foot high panelized chainlink fence around play area prior to play equipment being installed and leave fence up until play equipment has been fully installed. The panels shall be attached to one another and locked at one end.
- B. Excavate area to depths required, grade and compact subgrade, sloping surface 1 percent minimum to insure proper subdrainage.
- C. Install play area curbs and fluctuation ramp as detailed.
- D. Install play equipment and concrete footings per manufacturer's instructions and as indicated on approved Shop Drawings. Stake out locations of playground equipment for approval by Owner's Representative prior to initiating installation.
- E. Install drainage pipe and cleanouts per civil and landscape drawings.

- F. Install geotech fabric. Cover subgrade with geotextile fabric. Overlap all seams a minimum of 3-inches and secure the fabric rings with pliers every one to two inches. It will be necessary to slit the fabric to fit around equipment uprights. Where possible, overlap all slits with next piece of fabric. Install drainrock and wrap with geotextile fabric as indicated.
- G. Place warning labels on uprights as recommended by manufacturer.
- H. Install the engineered wood fiber to the proper depth. Spread material manually. Initially the surface material will be several inches above grade until it compacts. Use compactor to achieve uniform accessible surface.
- I. Rake surface for uniform appearance. Rake again two weeks following installation.

3.3 FOOTINGS

- A. Unless specified otherwise by manufacturer, comply with the following:
 - 1. Excavate for concrete footing to neat, clean lines in undisturbed soil. Provide forms in unstable soil conditions.
 - 2. Footings shall be sized and installed, including reinforcement as recommended by manufacturer.
 - 3. Top of footing in unpaved areas: 1-inch above finish grade. Slope toward edge of footing to prevent water pooling.

3.5 CLEAN-UP

- A. Use all means necessary to protect the materials of this section before, during and after installation and to protect installed work and materials of other trades.
- B. Clean up excess materials and debris from project site upon completion of work or sooner if directed.
- C. Leave in a neat and tidy condition daily.

END OF SECTION

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish labor, material and equipment required for the installation of water-distribution piping and related components for water service.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Valves and accessories
 - 2. Backflow preventers and assemblies.
 - 3. Pipe.
- B. Field quality-control test reports.
- C. Operation and maintenance data for the following:
 - 1. Valves
 - 2. Backflow preventers

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- 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:

1.5 COORDINATION

- A. Coordinate installation of water meter with City of Milwaukee.

PART 2 PRODUCTS

2.2 PIPE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K, 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. PVC Schedule 40 Pipe: STM D 1785.
 - 1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

2.3 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8, BCuP Series.
- B. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- C. Soldering Flux: ASTM B 813, water-flushable type.
- D. Solder Filler Metal: ASTM B 32, lead-free type with .20 percent maximum lead content.

2.4 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.

2.5 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. 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.

2.6 BACKFLOW PREVENTERS

- A. Double-Check, Backflow-Prevention Assemblies:
 - 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. Ames Fire & Waterworks; a division of Watts Regulator Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Water Technologies, Inc.
 - f. Wilkins; a Zurn company.
 - 2. Standard: AWWA C510.
 - 3. Operation: Continuous-pressure applications, unless otherwise indicated.
 - 4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
 - 5. Size: 2"
 - 6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 - 7. Configuration: Designed for horizontal, straight through flow.
 - 8. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller;

PART 3 EXECUTION

3.2 EARTHWORK

- A. Refer to Section 31 20 10 "Earth Moving - Utilities" for excavating, trenching, and backfilling.

3.3 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:

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

3.4 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:
 - a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.

3.5 PIPING INSTALLATION

- A. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- B. Bury piping with depth of cover over top at least 36 inches with top at least 12 inches below level of maximum frost penetration unless otherwise indicated.

3.6 JOINT CONSTRUCTION

- A. 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.

3.7 VALVE INSTALLATION

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

3.8 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.

3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water-distribution piping to existing water meter.

3.10 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.

3.11 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 NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. 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 33 11 00

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes gravity-flow nonpressure storm drainage outside the building, with the following components:
 - 1. Cleanouts.
 - 2. Dry wells.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Cleanouts.
 - 2. Dry well.
- B. Field quality-control reports.

1.3 PROJECT CONDITIONS

- A. Site Information: Research public utility records, and verify existing utility locations prior to ordering any materials. Notify Landscape Architect immediately if any discrepancies are found in the project Survey.

PART 2 PRODUCTS

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

2.2 GRAVITY SEWER PIPE AND FITTINGS

- A. See section 33 46 00 Subdrainage.

2.3 CLEANOUTS

- A. Plastic Cleanouts:
 - 1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.4 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.

- B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.5 DRY WELLS

- A. Description: ASTM C 478, precast, reinforced, perforated concrete rings. Include the following:
 - 1. Diameter: 48 inches minimum, unless otherwise indicated.
 - 2. Wall Thickness: 5 inches minimum with perforations arranged in rows parallel to axis of ring. Contractor is required for sizing wall and riser sections based on soil bearing pressure.
 - 3. Perforations: 4-inch x 1 1/2-inch tapered or 2 3/8-inch diameter holes evenly distributed.
 - 4. Ring Construction: Designed to be self-aligning.
 - 5. Base Section: 6-inch minimum thickness for floor slab and 5 inches base riser section, and having separate base slab or base section with integral floor. Contractor is responsible for sizing base riser and floor based on the actual soil bearing pressure.
 - 6. Riser Sections: 5-inches minimum thickness, and lengths to provide depth indicated. Contractor is responsible for sizing base riser and floor based on the actual soil bearing pressure.
 - 7. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone size that matches grade rings.
 - 8. Gaskets: ASTM C 443 rubber.
 - 9. Grade Rings: Include two or three reinforced-concrete rings, or 6- to 9-inch total thickness, that match 24-inch diameter frame and cover.
 - 10. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
 - 11. Dry Well Filter Material: ASTM D 448, Size No. 24, 3/4- to 2 1/2-inch washed crushed stone or gravel.

2.6 GEOSYNTHETIC FABRIC

- A. 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 4491.
 - 5. Apparent Opening Size: No. 50; ASTM 4751.

PART 3 EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 31 20 10 "Earth Moving Utilities." Install tracer wire directly over piping and at outside 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 into account design considerations. 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 use of 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. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process or microtunneling.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow at a minimum slope of 0.5 percent, unless otherwise indicated.
 - 2. Install piping with 36-inch minimum cover, unless otherwise indicated.
 - 3. Install PE corrugated sewer piping according to ASTM D 2321.
 - 4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 5. Install piping below frost line.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
 - 2. Join PVC corrugated sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints.
 - 3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to terminate between 4 and 8 inches from finished grade. Use PVC fittings in sewer pipes at branches for cleanouts

and PVC 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.
- B. Set cleanout with meter box covers in earth, as indicated on plans. Set with tops flush with surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.6 DRYWELL INSTALLATION

- A. Excavate hole to diameter of at least 18 inches greater than outside of dry well. Do not extend excavation into ground-water table.
- B. Install precast, concrete-ring dry wells according to the following:
 1. Install complete with appurtenances and accessories indicated.
 2. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.
 3. Install precast concrete manhole sections with gaskets according to ASTM C 891.

3.7 CONNECTIONS

- A. 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.
 2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 3. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- B. Pipe couplings and expansion joints 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.

3.8 IDENTIFICATION

- A. Install green tracer wire directly over piping and at outside edges of underground structure. 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 be a minimum of 45 mil. thick. Joints or splices shall be waterproof. The wire shall be rated for 30 Volt.

3.9 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 reports 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. Damage: Crushed, broken, cracked, or otherwise damaged 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.

END OF SECTION 33 41 00

SECTION 33 46 00

SUBDRAINAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes subdrainage systems for play areas and planters:
 - 1. Perforated-wall pipe and fittings.

1.2 SUBMITTALS

- A. Product Data:
 - 1. For geotextile filter fabrics.
 - 2. Perforated pipe.
 - 3. Solid-wall pipe.
 - 4. Perforated panel pipe
- B. Inspection report.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

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

2.2 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated schedule 40 ABS Pipe and Fittings: ASTM F628 or D2661, solvent welded joints.
- B. Perforated schedule 40 PVC Sewer Pipe and Fittings: ASTM D 1785, D2665 or F891, solvent welded joints.

2.3 SOLID-WALL PIPES AND FITTINGS

- A. ABS Schedule 40 Pipe and Fittings: ASTM D 1527, D 2611, F 1488, or F628 with solvent welded fittings per ASTM D 2661.
- B. PVC Schedule 40 Sewer Pipe and fittings: ASTM D 1785, F 1488, or D2665 with solvent welded fittings (ASTM D 2665, or DF 1866).

2.4 PERFORATED PANEL PIPE AND FITTINGS

- A. ADS AdvanEDGE panel pipe and fittings or approved equal.

2.5 SPECIAL PIPE COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of the same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.

2.6 CLEANOUTS

- A. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.
- B. Cast Iron Cleanouts: ASME A112.36.2M; with rounded flanged, cast iron housing and secured, scoriated, medium duty loading class, cast iron cover; including cast iron ferrule and countersunk, brass cleanout plug.

2.7 SOIL MATERIALS

- A. Backfill, drainage course, and satisfactory soil materials are specified in Division 31 Section 31 20 10 "Earth Moving - Utilities."

2.8 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.
- B. Structure Type: Nonwoven, needle-punched continuous filament.
 - 1. Style(s): Flat and sock.

PART 3 EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section 31 20 10 "Earth Moving - Utilities."

3.2 PIPING APPLICATIONS

- A. Underground Subdrainage Piping:
 - 1. Perforated PE pipe and fittings, couplings, and coupled joints.
 - 2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.
 - 3. Perforated panel pipe and fittings, couplings and coupled joints.
- B. Header Piping:
 - 1. PE Drainage tubing and fittings, couplings, and coupled joints.
 - 2. PVC sewer pipe and fittings, couplings and coupled joints.

3.3 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:

1. At Grade in Earth: PVC Cleanouts.
2. At Grade in Pave Areas: PVC cleanouts.

3.4 DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- D. Install drainage piping as indicated in Part 3 "Piping Installation".
- E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests. Refer to Part 3 "Field Quality Control."
- F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Install panel pipe per manufacturer's recommendations.

3.5 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 1. Install Piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
 2. Lay perforated pipe with perforations down.
 3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install PE piping according to ASTM D 2321.
- D. Install PVC piping according to ASTM D 2321.

3.6 PIPE JOINT CONSTRUCTION

- A. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."
- B. Join perforated PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; or according to ASTM D 2321 with loose banded, coupled, or push-on joints.
- C. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
- D. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.
- E. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.7 CLEANOUT INSTALLATION

- A. Comply with requirements for cleanouts specified in Section 33 41 00 "Storm Utility Drainage Piping."

3.8 CONNECTIONS

- A. Connect low elevations of subdrainage system to proposed drywell.

3.9 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
 - 2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- B. Drain piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 46 00