

Meadow Ridge Park

Bid Specifications | April 28, 2023



Owner: City of Albany Parks & Recreation

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END OF SECTION

SEALS PAGE

LANGO HANSEN LANDSCAPE ARCHITECTS, JOB NUMBER 2228
PROJECT: MEADOW RIDGE PARK, ALBANY OREGON

LANDSCAPE ARCHITECT:

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Portland, OR 97209
(503) 295-2437

Contact: Katherine Sheie, Senior Associate



Landscape Architect of Record: Kurt Lango, Principal

SECTIONS:

- 013000 - SUBMITTALS
- 013350 - SUBSTITUTION REQUEST FORM
- 015639 - TREE AND PLANT PROTECTION
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- 024119 - SELECTIVE DEMOLITION
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SEALS PAGE

<p><u>CIVIL ENGINEER:</u> Humber Design Group 110 SE Main Street, Suite 200 Portland, OR 97214 (503) 488-5711 Contact: Allen Schmitz, Senior Project Engineer</p> <p><u>SECTIONS:</u> 331100 - WATER SYSTEM 334100 - STORM UTILITY DRAINAGE 334600 - SUBDRAINAGE</p>	 <p>REGISTERED PROFESSIONAL ENGINEER 89353 OREGON SEPT. 12, 2017 ALLEN SCHMITZ RENEWAL DATE 6/30/2024</p>
<p><u>ELECTRICAL ENGINEER:</u> R&W Engineering 9615 SW Allen Blvd, Suite 107 Beaverton, OR 97005 (503) 726-3337 Contact: Jonathan Lilly, Senior Electrical Engineer</p> <p><u>SECTIONS:</u> 260010 - SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS 260923 - LIGHTING CONTROL DEVICES 262726 - WIRING DEVICES 265619 - LED EXTERIOR LIGHTING</p>	 <p>REGISTERED PROFESSIONAL ENGINEER 88445PE OREGON NOV 12, 2019 JONATHAN PATRICK LILLY RENEWAL DATE: 12/31/2024 2023.04.26 09:54:30-07'00'</p>

END OF SECTION

SUBMITTALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures.
- B. Shop Drawings.
- C. Product data.
- D. Samples.
- E. Manufacturer's installation instructions.
- F. Manufacturers' certificates.
- G. Related Sections:
 - 1. [City of Albany Standard Construction Specifications](#).
 - 2. Section 013350 – Request For Substitution Form.
 - 3. Section 017000 – Execution and Closeout Requirements.

1.2 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Contractor's standard transmittal form as approved by Owner's Representative.
- B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
- E. Schedule submittals to expedite the Project and deliver to Owner's Representative at business address. Coordinate submission of related items.
- F. For each submittal, allow 15 days for Owner's Representative's review excluding delivery time to and from the Contractor.
- G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.
- H. Provide space for Contractor and Owner's Representative's review stamps.
- I. For submittals required to be revised and resubmitted, identify all changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.
- K. Submittals not requested will not be recognized or processed.

1.3 SUBMITTAL SCHEDULE

- A. A list of submittals will be provided by the Owner's Representative prior to the start of work. It is the Contractor's responsibility to submit all materials and documentation noted in the construction documents.

1.4 SHOP DRAWINGS

- A. Shop Drawings: Submit digitally for review.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.5 PRODUCT DATA

- A. Submit digitally for review.

SUBMITTALS

- B. Mark each submittal to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this project.
- C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. After review, distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 017000 - Contract Closeout.

1.6 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Submit samples of finishes from the full range of manufacturers' standard colors, and in custom colors where specified, textures, and patterns for Owner's Representative's selection.
- C. Include identification on each sample, with full project information.
- D. Submit the number of samples specified in individual specification sections; one of which will be retained by Owner's Representative.
- E. Reviewed samples which may be used in the Work are indicated in individual specification sections.

1.7 MANUFACTURER INSTALLATION INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Owner's Representative in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.8 MANUFACTURER CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer to Owner's Representative, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product but must be acceptable to Owner's Representative.

1.9 OWNER'S REPRESENTATIVE DUTIES

- A. The review will be for conformance of the design concept and compliance with information given in the Contract Documents. The Owner's Representative will make notations directly on the submittals.
- B. The review is intended to foresee unacceptable products and to avoid the possibility of their rejection at the site. The review shall not be construed as:
 - 1. Permitting a departure from the Contract Documents, unless specifically so noted.
 - 2. Relieving the Contractor of the responsibility for errors or omissions.
 - 3. Acceptance of an assemble in which an approved item is a part.
 - 4. Approval of variations from previously approved items.
 - 5. Approval of dimensions.
- C. The Owner's Representative will review all samples. Such review will be for appearance only. Compliance with all other requirements is the responsibility of the Contractor.
- D. Where the Contract Documents require the design of structural, mechanical or electrical systems or components of systems by a supplier, or where a Contractor initiates a change in the design of a system or component thereof, such systems or components shall be designed by a registered professional engineer and all calculations submitted to the Owner's Representative will not be responsible for the designs of such other professional engineers.

SUBMITTALS

1.10 VARIATIONS FROM CONTRACT DOCUMENTS

- A. If the Owner's Representative determines a variation from the Contract Documents is in the best interest of the Owner, and it does not involve change in the contract price or item, the Owner's Representative, with the Owner's concurrence, may permit such variation.
- B. Unless the Owner's Representative receives immediate written notification, he/she will assume the Contractor approves any variation shown.
- C. If the Contractor fails to mention variations from the Contract Documents, he/she will not be relieved of the responsibility for executing the Work in accordance with the Contract Documents.
- D. When a variation from the Contract Documents is permitted and such variation involves corresponding adjustment in an adjacent or related item, the responsibility for making and paying all costs for such adjustment rests with the Contractor requesting the original variation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SUBSTITUTION REQUEST FORM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Section No.	Page	Paragraph	Description
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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)

General Contractor (if after award of Contract)

Signature

Firm Name

Address

City, State, Zip

Phone Number Email Address

Date

For use by A/E:	
___ Approved	___ Approved as Noted
___ Not Approved	___ Received Too Late
___ Not Approved	___ Received Too Late
By _____	Date _____
Remarks _____	

Attachments on following page(s)

TREE PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Furnish all labor, materials, equipment, and services necessary for the installation of temporary fencing, barricades, and guards to protect trees and plants indicated to remain, as necessary and required to prevent damage above and below grade.
 - 1. Protection shall include trees which are located beyond the project boundaries but which have drip lines which extend into the project site.
 - 2. Protection shall include all portions of the delineated wetland area on site.
- B. Related Sections:
 - 1. [City of Albany Standard Construction Specifications](#).
 - 2. Section 024119 – Selective Demolition.
 - 3. Section 311000 – Site Clearing.
 - 4. Section 312000 – Earth Moving.

1.2 DEFINITIONS

- A. Drip Line: Outer perimeter of branches of any tree or plant.
- B. DBH: Tree Diameter at Breast Height.
- C. Root Protection Zone (RPZ): a minimum of 1 foot radius per inch of tree diameter (DBH), or as shown on the Tree Inventory in the Drawings.
- D. Ground Cover: Includes, but is not limited to, shrubs, woody and herbaceous groundcovers, and grass.

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures".
- B. Proposal for tree and plant protection, describing methods of protection and stabilization.
- C. Drawings and supporting documentation as directed.

1.4 QUALITY ASSURANCE

- A. Contractor's Condition Inspection: Include written report and digital photos recording the condition of the site prior to commencing construction.
- B. Construction survey: include wetland delineation boundaries in survey.

1.5 PROJECT CONDITIONS

- A. Performance Requirements: Prevent damage to trees and plants including soil, roots, bark, trunks, limbs, branches, and foliage due to construction activities including, but not limited to, the following:
 - 1. Soil contamination, erosion, and compaction.
 - 2. Excessive wetting, ponding of storm water, and construction run-off.
 - 3. Alteration of grade and stockpiling of soil, debris, and materials.
 - 4. Unauthorized cutting, breaking, skinning, and bruising of trees and plants.
- B. Project Conditions: Install protection during initial mobilization at the site and maintain until Substantial Completion.
 - 1. Driving and Parking: Not permitted within drip line of trees, plants and sensitive natural areas without Owner's Representative's written permission.
 - 2. Storage of Materials and Debris: Not permitted within drip line of trees and plants.
 - 3. Where Owner's Representative permits construction traffic, parking, or materials storage on prepared lawn and planting areas, provide planks, plywood and similar protection; prevent rutting, and compaction of soil.

PART 2 - PRODUCTS

NOT USED

TREE PROTECTION

PART 3 - EXECUTION

3.1 EXISTING TREES AND PLANTS

- A. Water existing trees and plants as necessary to maintain existing condition throughout the Contract period until Substantial Completion.
- B. Tree protection fencing:
 - 1. Protect all trees and plants indicated to remain, including bark and root zones. Install protection fencing as indicated on the Drawings. Protection fencing shall be placed before start of demolition or any other construction activities. Protection fencing shall not be moved, removed, or entered by equipment, and shall stay in place until after planning official authorizes their removal or a final certificate of occupancy is issued, whichever occurs first. Protection fencing shall be maintained in good repair throughout construction.
 - a. Fence the entire perimeter of the on-site wetland. The fence must be installed on the outside of the surveyed wetland delineation line.
 - 2. Tree protection fencing shall be chain link, minimum of 6-foot height, secured with 8-foot steel posts driven into the ground, installed at the edge of the RPZ or as indicated on the Drawings.
 - 3. Signage designating the protection zone and penalties for violations shall be secured in a prominent location periodically on each protection fence.
- C. Erosion control:
 - 1. Any silt fencing required to be installed within the RPZ shall not be trenched in per manufacturer specifications to avoid root damage. Instead, roll the base of the silt fence around a straw wattle and stake the wattle securely into the ground.
- D. Work within Root Protection Zones:
 - 1. No construction activity shall occur within the RPZ or wetland unless approved in advance by the City Forester or landscape architect. Prohibited activities include, but are not limited to the following:
 - a. Ground disturbance, including vehicle and equipment access, storage, or maneuvering.
 - b. Staging or storage of materials or equipment, including soil stockpiling.
 - c. Dumping or runoff of any waste material, debris, chemically injurious materials and liquids (e.g. paints, solvents, oils, concrete, etc.).
 - d. Grade change during or after construction.
 - e. Soil compaction or new impervious surfaces.
 - f. Utility or irrigation work, including trenching.
 - 2. Where construction activity must be done within Root Protection Zones, review conditions with City Forester prior to performing any work, including the pruning or cutting of roots, branches, or foliage. Work shall conform to the requirements in this specification. Proceed as directed by City Forester.
 - 3. Excavation and root pruning within Root Protection Zones:
 - a. Excavate under or around roots with an air spade, by hand digging, or by boring. Use of backhoes or similar mechanical excavators is prohibited.
 - b. Excavation shall be avoided within the RPZ if alternatives are available.
 - c. Roots smaller than 2-inches in diameter that interfere with the work may be pruned clean to sound wood using a sharp saw as digging progresses to avoid pulling and tearing roots. Excavation immediately adjacent to roots larger than 2-inches in diameter within the RPZ shall be by hand or other non-invasive techniques to ensure that roots are not damaged. The City Forester shall assess and document roots 2-inches and larger in diameter prior to impacts. Where feasible, roots 2-inches and larger shall be protected by tunneling or other means to avoid destruction or damage.
 - 1) Exceptions can be made if, in the opinion of the City Forester, unacceptable damage will not occur to the tree. Excavation activity adjacent to protected trees and root pruning regardless of root size shall be documented by the City Forester.
 - 4. Do not allow exposed roots to be scarred nor to dry out; provide temporary earth cover, or pack with peat moss and wrap with burlap. Water and maintain in moist condition and temporarily support and protect from damage.
 - 5. All pruning and cutting shall be performed with sharp instruments intended for the purpose. Do not break or chop.

TREE PROTECTION

- E. For plant protection areas shown on the Drawings for which no protection fencing is indicated, protect all existing trees and plants. No construction activities are permitted within plant protection areas except with written permission by Owner's Representative.

3.2 REPAIR AND RESTORATION

- A. Repair trees and plants damaged by construction operations as directed by the Owner's Representative. Make repairs promptly after damage occurs to prevent progressive deterioration.
- B. Replace trees and plants damaged by construction operations where the Owner's Representative determines restoration to normal growth pattern is not possible. Plant and maintain as directed.
 - 1. Trees less than 12-inch caliper: Same size as damaged tree; species selected by Owner's Representative.
 - 2. Trees 12-inch caliper and larger: Compensate Owner as determined by an acceptable consulting arborist registered with the American Society of Consulting Arborists.
 - 3. Plants: Same size, quality, and quantity as damaged; species selected by Owner's Representative.

END OF SECTION

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations of Work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment
- H. Demonstration and instruction
- I. Closeout procedures, except payment procedures.

1.2 RELATED SECTIONS

- A. [City of Albany Standard Construction Specifications](#).
- B. Section 013000 – Submittals and submittal procedures.
- C. Individual product Specification Sections.
- D. Advanced notification to other Sections of openings required in Work of those sections.

1.3 SUBMITTALS

- A. See Section 013000 - Submittals, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor; or Engineer before starting work.
- C. On request, submit documentation verifying accuracy of survey work.
- D. Submit a copy of site drawing; and certificate signed by the Land Surveyor; or Engineer, that the elevations and locations of the work are in conformance with Contract Documents.
- E. Submit surveys and survey logs for the project record.
- F. Demolition Plan: Submit demolition plan for Owner's Representative review.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- G. Cutting and Patching: Schedule and coordinate with the Owner's Representative in advanced of cutting or alteration which affects:
 - 1. Structural integrity of any occupied element of project.
 - 2. Integrity of weather exposed or moisture resistant elements.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Location and description of affected work.
 - b. Necessity for cutting or alteration.
 - c. Description of proposed work and products to be used.
 - d. Alternatives to cutting and patching.
 - e. Date and time work will be executed.
- H. Project Record Documents: Accurately record actual locations of capped and active utilities.

EXECUTION AND CLOSEOUT REQUIREMENTS

1.4 QUALIFICATIONS

- A. For survey work, employ a land surveyor; or professional engineer registered in Oregon and acceptable to Owner's Representative. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an insurance Certificate.
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Oregon.

1.5 PROJECT CONDITIONS

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water as noted in the Erosion Control Plans.
- C. Ventilate enclosed area to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from barrow and waste disposal area. Prevent erosion and sedimentation per the Erosion Control plans.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.6 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work, which are indicated diagrammatically on Drawings. Follow routing shown for pipes and conduit, as closely as practicable; place runs parallel with lines of building, structures and/or paving. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated conceal pipes, conduit, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of Work of separate section.
- G. After Owner occupancy of premises, coordinate access to site for connection of defective Work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

- A. All patching shall be done in accordance with the City of Albany Standard Construction Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of Work means acceptance of existing conditions.

EXECUTION AND CLOSEOUT REQUIREMENTS

- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting and patching means acceptance of existing conditions.

3.2 PREPARATIONS

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material of substance.
- C. Apply manufactures required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contract or bond.

3.3 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a pre-installation meeting at the site prior to commencing Work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specified section.
- C. Notify Landscape Architect and Owner's Representative four (4) days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with copies to Landscape Architect and Owner's Representative, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Landscape Architect and Owner's Representative of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that established by Owner provided survey.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Owner's Representative the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Owner's Representative.
- H. Utilize recognized engineering survey practices.
- I. Establish a minimum of two permanent benchmarks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project Record Documents.
- J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- K. Periodically verify layouts by same means.
- L. Maintain a complete and accurate log of control and survey work as it progresses.

EXECUTION AND CLOSEOUT REQUIREMENTS

- M. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.5 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with the manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipments and fitting plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise noted.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise noted.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6 CUTTING AND PATCHING

- A. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing to provide openings in the work for penetrations of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
- B. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to specified condition or original condition when none specified.
- C. Employ skilled and experienced installer to perform Work.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- E. Restore work with new products in accordance with requirements of Contract Documents.
- F. Fit work airtight to pipes, sleeves, conduits, and other penetrations through surfaces.
- G. Refinish surfaces to match adjacent finish, for continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- H. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.
- I. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.7 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition; remove debris and rubbish from work site.
- B. Clean surfaces prior to start of surface finishing, and continue cleaning to eliminate dust.
- C. Collect and remove waste materials, debris, and trash/rubbish from the site and dispose off-site.

3.8 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate area to prevent damage.
- D. Provide protective coverings to avoid damage to finished products.
- E. Protect finished floors, stairs, and other surface from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roof material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle plastics coverings if possible.

EXECUTION AND CLOSEOUT REQUIREMENTS

3.9 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Landscape Architect and Owner's Representative seven (7) days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper connections, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under the supervision of applicable Contractor personnel and/or manufacture's representative in accordance with manufacturer's instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipments or system has been properly installed and is functioning correctly.

3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

- A. Execute final cleaning prior to Substantial Completion.
- B. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
 - 1. Use cleaning materials that are non-hazardous.
 - 2. Clean: surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, wipe and/or dust all surfaces exposed to construction including all horizontal and vertical planes. Expect the white glove test.
 - 3. Clean equipments and fixtures to a sanitary condition with cleaning materials appropriate to the surface being cleaned.
 - 4. Replace filters of all operating equipment.
 - 5. Clean debris form roofs, gutters, downspouts, and drainage systems.
 - 6. Clean site; seep paved areas, rake clean landscape surfaces.
 - 7. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
 - 8. Clean Owner occupied areas that were exposed to construction work.

3.12 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Provide copies to Landscape Architect and Owner's Representative.
 - 1. Final inspections:
 - a. Contractor to review project and write deficiency lists. Submit lists to Landscape Architect and Owner's Representative for review and amendments/additions as required
 - b. Completed the deficiency list work items and notify and schedule Owner's Representative and Landscape Architect for an inspection. Contractor writes final inspection deficiency list.
 - c. Complete any final deficiency item and request substantial completion inspection with Landscape Architect and Owner's Representative.
 - d. Substantial completion is granted when all deficiency list items are complete.
 - e. A punch list will note any remaining work items that may be completed during occupancy.
 - 2. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's and Owner's Representatives final review- all punch list items complete.
 - a. Submit following releases or as otherwise approved by Owner:
 - 1) AIA Document G707, "Consent of Surety to Final Payment."
 - 2) AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 - 3) AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."

EXECUTION AND CLOSEOUT REQUIREMENTS

3. Update final statement, accounting reflecting final changes to the Contract Sum.

3.13 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components indicated in specification sections during the warranty period.
- B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- D. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of above- and below-grade utilities and site improvements not affected by or related to demolition of a building or structure.
 - 2. Salvage of existing items to be reused or recycled.
 - 3. Salvage, demolition, and capping of irrigation piping associated with the existing Timber Ridge School irrigation system.
- B. Related Requirements:
 - 1. [City of Albany Standard Construction Specifications](#).
 - 2. Erosion Control Drawings and Notes for erosion control requirements.
 - 3. Section 015639 "Tree Protection" for temporary protection of existing trees and plants.
 - 4. Section 311000 "Site Clearing" for site clearing.
 - 5. Section 312000 "Earth Moving" for backfilling requirements.
 - 6. Section 323113 "Chain Link Fencing" for chain link fencing requirements.
 - 7. Section 328400 "Irrigation" for irrigation requirements.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction or site and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction or site, in a manner to prevent damage, and store and then deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction or site, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREDEMOLITION MEETING

- A. Predemolition Conference: Conduct conference at Project site. Coordinate with preinstallation conference specified in Section 311000 "Site Clearing".
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 4. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for dust control. Indicate proposed locations and construction of barriers.
- B. Predemolition Photographs

SELECTIVE DEMOLITION

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the following:
 - 1. EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of Authorities Having Jurisdiction.
 - 2. ANSI A10.6 "Safety & Health Program Requirements for Demolition Operations."
 - 3. NFPA 241: "Safeguarding Construction, Alteration, and Demolition Operations."
 - 4. Applicable local codes for demolition work, safety of structure, and dust control.
- B. Record Drawings: Comply with Section 017000 "Execution and Closeout Requirements". Identify and accurately show locations of capped utilities and other subsurface structural, electrical and mechanical conditions.

1.8 FIELD CONDITIONS

- A. Notify Owner of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Utility locates: Call the Oregon Utility Notification Center at 811 for underground utility locations 48 hours in advance of removing materials.
- C. The south portion of the site was previously part of the Timber Ridge School track and field property, and includes existing fencing and irrigation related to that property. Coordinate with Timber Ridge School on the following conditions:
 - 1. Demolition of portions of existing chain link fencing as shown on the Construction Drawings.
 - 2. Shut-off of existing irrigation zones on Timber Ridge Property that will be affected by demolition activities and provision for temporary irrigation for areas on the Timber Ridge School property affected by irrigation disruptions.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Record Documents.
- C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - 1. Show existing conditions of adjoining construction or site, including finish surfaces and vegetation, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.
 - a. Provide photographs or video date stamped and recorded at exposure and resolution sufficient to show details.

SELECTIVE DEMOLITION

2. Inventory and record the condition of items to be removed and salvaged. Show conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

3.3 PROTECTION

- A. Temporary Protection: Comply with requirements specified in Section 015639 "Tree and Plant Protection" and Erosion Control Drawings. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent structures and park facilities to remain.
- B. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION OF SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove subsurface slabs, stumps, and other obstacles as indicated and as necessary to facilitate new construction, to a minimum depth of 24 inches.
- C. Remove concrete slabs on grade, paving, curbs, gutters, and aggregate base as indicated.
- D. Existing chain link fencing:
 1. Remove existing fencing and poles to the extents shown on the Demolition Drawings. Protect existing fence poles to remain on Timber Ridge School property.
- E. Existing irrigation:
 1. Irrigation work shall comply with the requirements of Section 328400.
 2. Mainline. Cut and cap mainline found on the property at the Timber Ridge property line.
 3. Control wiring. Label the wiring with the associated valve(s) at the property line. Cut wiring at the property line and install in valve box on Timber Ridge Property.
 4. Valves and valve boxes. Salvage valves and valve boxes for reinstallation on Timber Ridge School property. Replace valves and valve boxes damaged by demolition activities.
 5. Laterals. Cut and cap laterals at the property line. Remove on-site laterals.
 6. Sprayheads and rotors. Note make and model of sprayheads and rotors to be removed. Remove all on-site sprayheads and rotors.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to City of Albany Standard Specifications.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.

3.6 CLEANING

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

END OF SECTION

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete footings.
- B. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 312000: Earth Moving, for aggregate base course for footings.
 - 3. Section 116816: Play Structures, for play structure footings and related items embedded in concrete.
 - 4. Section 320523: Pervious Concrete Paving, for pervious exterior concrete paving.
 - 5. Section 321313: Standard Concrete Paving, for standard exterior concrete paving.
 - 6. Section 323113: Chain Link Fencing, for fencing footings.
 - 7. Manufacturer's Written Instructions: Play Equipment, Light Poles, and Structural Notes.

1.2 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
 - 1. Provide schedule of specific areas to receive each type of product specified for exterior slab-on-grade treatment, such as sealers and hardeners. Identify name of each product proposed for use.
- B. Design Mixes: For each concrete mix. Submit at least 10 days prior to concrete delivery to site.
- C. Test Reports: Submit copies of laboratory and field test reports for concrete work.
- D. Material certificates signed by product manufacturers certifying that product complies with requirements.
- E. Batch Ticket: Provide a batch weight ticket with each truck for inspection agency.
 - 1. Comply with requirements of ASTM C 94 in Article 16 Batch Ticket Information.

1.3 QUALITY ASSURANCE

- A. Quality Assurance: Comply with ACI 301, "Specification for Structural Concrete," and ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- B. Reinforcing Steel Standards: CRSI "Manual of Standard Practice."
- C. Mix Design Qualifications: Employ testing laboratory or concrete supplier to perform materials evaluation, testing, and design of concrete mixes.
- D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- E. Installer Qualifications: Use skilled workers trained and experienced in necessary crafts and familiar with requirements and methods needed for proper performance of Work of this Section.

1.4 SITE CONDITIONS

- A. Temperature and Weather Requirements:
 - 1. Do not place concrete when temperature or weather will affect performance or appearance of concrete.
 - a. Temperature Range for Ambient Air During Concrete Placement: 40 to 80 degrees F.
 - b. Temperature Range for Ambient Air During Epoxy Bonding Grouts: 40 to 85 degrees F.
 - 2. Maximum wind velocity for unprotected floor slabs, stairs, ramps, and walks: 15 mph.
 - 3. Minimum Ambient Air Temperature: 40 degrees F.
 - 4. No precipitation expected within 8 hours for unprotected concrete surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS / PRODUCTS

- A. Provide products by manufacturers indicated in this Section, or approved.
 - 1. Substitutions: Submit according to requirements of Division 01 Section for "Substitutions."

2.2 FORM MATERIALS

- A. Forms for Exposed Concrete: Plywood, metal, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces.

CAST-IN-PLACE CONCRETE

1. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings.
- B. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 1. High-density overlay, Class 1 or better.
- C. Form Lumber: Douglas Fir, Construction Grade, No. 2 or better, dressed on at least two edges and one side (S1S2E) for tight fit.
- D. Forms for Cylindrical Columns: Round, type that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation, one of the following:
 1. Cylindrical Forms: Smooth faced, fiberglass reinforced polyester.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips.
 1. Shape: Beveled, 45 degrees, size as indicated on the Drawings.
 2. Shape: Radiused, size as indicated on the Drawings.
- F. 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.
 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than one inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.

2.3 REINFORCEMENT

- A. Reinforcing Bars: Intermediate grade steel conforming with "Specifications for Billet-Steel Concrete Reinforcing Bars," ASTM A 615, Grade 60, deformed, unless specifically noted as grade 40, and the following:
 1. Ties and Stirrups: ASTM A 615, Grade 40.
 2. Weldable Bars: ASTM A 706, Grade 60.
 3. Column Spiral Bars: ASTM A 616, Grade 50, plain.
- B. Weld Type Reinforcing Bars: ASTM A 706, Grade 60.
- C. Reinforcing Accessories:
 1. Chairs for Support of Rebar: "Concrete Brick," Precast concrete or fiber-reinforced concrete, of greater strength than concrete; do not use steel devices over vapor retarder. PVC protected steel, nylon or nylon coated.
 2. Reinforcing Tie Wire: ASTM A 82, 16 gauge, double annealed iron wire.
 3. Dowels: as indicated on in Drawings.
 4. Dowel Caps: Crimp or welded type, 5 inches minimum length, F46 by JEF, Inc
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets, 6" x 6" - W1.4/W1.4.

2.4 CONCRETE MATERIALS

- A. Concrete:
 1. Portland Cement: ASTM C 150, Type IA or IIA.
 - a. Fly Ash: ASTM C 618, Class F or Class C.
 2. Aggregate: ASTM C 33.
 3. Lightweight Aggregates: ASTM C 330.
 4. Water: ASTM C 94, clean, free of oils, acids, organic material.
 5. Air-Entraining Admixture: ASTM C 260.
 6. Water-Reducing Admixture: ASTM C 494, Type A.
 7. Chemical Admixture: ASTM C 494, Type A water reducing or Type D water reducing and retarding.
 8. Mineral Admixture: ASTM C 618, Class F or Class C.

CAST-IN-PLACE CONCRETE

- B. Accessory Materials:
1. Joint-Filler Strips: Deck-o-foam expansion joint filler, by W.R. Meadows.
 2. Expansion Joint Filler Cap: 1/2 inch deep, 1/2 inch wide, 941 by JEF, Inc.
 3. Tongue and Groove Keyed Joint Fillers: Reinforced asphalt core between asphalt saturated felt liners, 1/4 inch thick with 1 inch deep and 2-1/2 inches at base of trapezoid, full depth of concrete slab, 10 feet long, with punched holes 24 inches on center for stakes and 30 inches on center for dowel bars.
 4. Construction Joints: 1 inch deep. 2-1/2 inch minimum at base of trapezoid, 24 gage galvanized steel or plastic keyway.
 5. Control Joint Forms: 1 inch deep, PVC, JEF Zip Joint by JEF Inc.
 6. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene; one of the following:
 - a. Euclid Chemical Company; Tammsweld.
 - b. Larsen; Weld-crete.
 - c. BASF Building Systems; Thorobond.
 7. Patching Compound: Two component cement base and acrylic polymer compound, 5,000 psi in 28 days minimum compressive strength; one of the following:
 - a. The Burke Company; Burke Acrylic Patch.
 - b. Sonneborn; Epolith Patcher or Sonopatch.
 8. Curing Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet, or synthetic fiber mat complying with AASHTO M-171, such as the following:
 - a. Synthetic Fiber Mat for Traffic Areas: Transguard, by Armorlon, a Division of Reef Industries, Inc.
- C. Exterior Curing Compound:
1. Chem-Masters; Polyseal.
 2. Dayton Superior; J-20 Acrylic Cure, Seal & Dustproofer 14.
 3. A.C. Horn; Acrylic Sealer.
 4. Preston Pacific; Preston C & S 600.
 5. Sonneborn; Kure-N-Seal.
 6. W.R. Meadows; Sealtight CS-309.
 7. Sika; Sikagard.
 8. Symons; Cure & Seal.
 9. Upco; Polyclear.
- D. Nonmetallic Nonshrink Grout.
- a. Industry Standard: ASTM C 1107.
 - b. Type: Shrink resistant, nonstaining, noncorrosive.
 - c. Minimum Compressive Strength: $f_c = 5,000$ psi in 28 days.
 - d. Acceptable Grouts:
 - e. Bostik Construction Products; Upcon.
 - f. The Burke Company; Nonmetallic Grout.
 - g. Euclid Chemical; Euco N-S Grout or Euco Dry Pack Grout.
 - h. Fosroc Preco; Conbextra S.
 - i. W.R. Meadows; Sealtight 588.
 - j. Master Builders; Masterflow 713.
 - k. Sika; SikaGrout 212.
 - l. Sonneborn; Sonogrout and Sonogrout G.P.
 - m. U.S. Grout; Five Star Grout.
- E. Epoxy Grout:
1. Industry Standard: ASTM C 881.
 2. Type: Premixed, packaged, two component, epoxy resin.
 3. Minimum Compressive Strength: $f_c = 6,000$ psi in 28 days.
 4. Acceptable Grouts to Bond Plastic Concrete to Existing Concrete:
 - a. Adhesive Engineering; Conpressive 1001 LPL.
 - b. Bostik Construction Products; Upcon Epoxy Grout.
 - c. The Burke Company; Medium Viscosity 881 LPL Patch and Bond Epoxy.
 - d. Euclid Chemical; High Strength Grout.
 - e. ProKrete Industries; Probond 812 medium viscosity.

CAST-IN-PLACE CONCRETE

- f. Sika; Sikadur 32 Hi-Mod.
- g. Sonneborn; Sonobond.
- h. U.S. Grout; Five Star Epoxy Grout.
- 5. Acceptable Grouts to Bond Concrete to Reinforcing Steel:
 - a. Adhesive Engineering; Concessive 1441.
 - b. The Burke Company; 881 LPL Topping and Crack Grouting Epoxy.
- F. Anchoring Cement:
 - 1. Type: Premixed, packaged, shrink resistant.
 - 2. Minimum Compressive Strength: $f'c = 4,000$ psi in 28 days.
 - 3. Acceptable Anchoring Cements:
 - a. The Burke Company; Burke Stone.
 - b. Euclid Chemical; K-Ment.
 - c. Master Builders; Embeco 153.
 - d. Thoro System Product; Thorogrip.
- G. Reinforced Laminated Paper Moisture Retaining Membrane for Pedestrian Traffic Areas: ASTM C 171, Orange Label Sisalkraft by Fortifiber Corp.
- H. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Eucobar; Euclid Chemical.
 - 2. Sure Film; Dayton Superior Corporation.
 - 3. Sealtight Evapre; W.R. Meadows, Inc
- I. Surface Retarder: Water-based top-surface retarder designed to retard the setting (hydration) of the upper layer of cement paste, producing an exposed aggregate appearance of the concrete surface. Design intent is for product to work equally well on both horizontal and vertical surfaces.
 - 1. Dayton Superior "TopCast" Surface Retarder, or approved equal, of the following grade as required to achieve the intended aesthetic effect:
 - 2. Product code: 03. Package color: violet. Depth of aggregate exposure: acid-etch finish.

2.5 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, with the following properties:
 - 1. Minimum Compressive Strength: $f'c = 3,500$ psi in 28 days.
 - a. Minimum Compressive Strength for Foundations: $f'c = 2,500$ psi in 28 days.
 - 2. Maximum Aggregate Size: 3/4 inch.
 - 3. Maximum Slump for Footings, Walks, Curbs, Exterior Slabs, and Floor Slabs: 4 inches + 1/2 to - 1 inch.
 - 4. Maximum Slump for Walls, Columns, and Beams: 3 inches + 1/2 to - 1 inch.
 - 5. Air Content: 4.5 to 7.0 percent.
 - 6. Water/Cement Ratio: 0.50.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
 - 1. Mix full load of concrete for 3 minutes at high speed upon arrival at site.
 - 2. Mix concrete for an additional 5 minutes after adding water

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork in accordance with ACI 301.
- B. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- C. Construct formwork so concrete structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- D. Chamfer exterior corners and edges of permanently exposed concrete, unless otherwise shown or indicated.

CAST-IN-PLACE CONCRETE

- E. Coat contact surfaces of forms with form-release agent, according to manufacturer's instructions before placing reinforcement.
- F. Leave formwork for structural elements in place until concrete has achieved 28-day design compressive strength.
- G. Anchor Bolts:
 - 1. Set anchor bolts for structural plates with anchor bolts double nutted to plywood or steel templates.
 - 2. Set anchor bolts for equipment with anchor bolts double nutted to templates furnished by equipment manufacturer.
- H. Installation of Anchor Bolts with Anchoring Cement:
 - 1. Set anchor bolts for structural plates with anchor bolts double nutted to CDX plywood or oriented strand board templates.
 - 2. Set anchor bolts for equipment with anchor bolts double nutted to templates furnished by equipment manufacturer.
 - 3. Fill space around anchor bolts in drilled concrete and masonry with anchoring cement as recommended by anchoring cement manufacturer.
- I. Drilled in Grouted Anchors: When approved, in lieu of embedding anchor bolt, holes may be drilled in hardened concrete and anchor bolts and other items installed with special mortars, with procedure as follows:
 - 1. Drill with diamond boring or coring bits.
 - 2. Use epoxy grout type bonding mortar;
 - 3. Blow holes clean and dry before installation of embedded items.
 - 4. Before insertion, coat both hole and the item to be embedded with bonding compound.
 - 5. Studs of equal size and length may be substituted for anchor bolts if nut fasteners are used.
 - a. Drilled in studs or anchors utilizing mechanical expansion locking in any process areas are not allowed.

3.2 INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- B. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice," MSP-1, for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
 - 2. Comply with UBC and ACI 318, Chapter 7 for minimum concrete cover over reinforcing steel.
 - 3. Stagger reinforcing bar splices 48 inches minimum at alternate bars.
 - 4. Lap continuous deformed bars 36 diameters and not less than 24 inches.
 - 5. Reinforce corners and intersections with 24 inch by 24 inch corner bars.
 - 6. Install two Number 5 bars around wall openings larger than 30 by 30 inches.
- C. Installation of Reinforcing Accessories:
 - 1. Comply with CRSI Manual of Standard Practice for wire tie reinforcing.
 - 2. Install reinforcing couplers and splices in reinforcing.
 - 3. Locate and support reinforcing with metal chairs, bolsters, spacers, and hangers as required.
 - 4. Dolbys are not allowed.
 - 5. Install dowels and slab edges at size and spacing indicated in on Drawings.
- D. Joints: Locate and install construction, isolation, and contraction joints.
 - 1. Install keyed joints between footings and retaining walls.
 - 2. Install construction joints at locations which will not impair concrete strength or appearance.
 - 3. Install expansion and control joints in slabs on grade at spacing indicated on Drawings.
 - a. Where spacing of expansion joints is not specified on the Drawings, install exterior expansion joints at not more than 30 feet on center.

CAST-IN-PLACE CONCRETE

3.3 CONCRETE PLACEMENT

- A. Deposit concrete continuously and avoid segregation. Deposit concrete in forms in horizontal layers no deeper than 24 inches, avoiding cold joints.
 - 1. Consolidate concrete with mechanical vibrating equipment.
 - 2. Screed and initial-float concrete floors and slabs using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
 - 3. Comply with ACI 306.1 for cold-weather concrete placement.
 - 4. Place concrete according to recommendations in ACI 305R when hot-weather conditions exist.

3.4 FINISHING VERTICAL CONCRETE

- A. Rough Form Finishing Concealed Vertical Concrete Surfaces:
 - 1. Comply with ACI 301, paragraph 10.2.1.; Remove fins and projections exceeding 1/4 inch in height and patch tie holes and surface defects.
- B. Smooth Form Finishing Exposed Vertical Concrete Surfaces:
 - 1. Comply with ACI 301, paragraph 10.2.2.; Remove fins and projections and patch tie holes and surface defects.

3.5 FINISHING HORIZONTAL AND INCLINED CONCRETE

- A. Floated Slab Finish:
 - 1. Provide floated finish for slab surfaces to receive washed, troweled, and broomed finish.
 - 2. Comply with ACI 301, paragraph 5.3.4.2.b.
 - 3. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit float finishing.
 - 4. Check surface plane with a 10 foot straightedge at two or more angles during or after first floating.
 - 5. Level to flatness of 1/4 inch in 10 feet.
 - 6. Refloat immediately to a uniform sandy texture.
- B. Joint Finishing:
 - 1. Tool radius exterior slab, walk, ramp, and curb edges.
 - 2. Cut or form interior floor slab crack control joints.
 - 3. Cut or form exterior curb slab and ramp crack control joints.
- C. Horizontal Surface Finish Tolerances: Finish concrete horizontal surfaces as specified in ACI 302, paragraph 8.3.

3.6 GROUT PLACEMENT

- A. Surface Preparation:
 - 1. Remove loose aggregate and coating materials from substrate surfaces prior to placing grout and anchoring cement.
 - 2. Support bearing plates above cleaned bearing surfaces with double nutted anchor bolts and wedges.
 - 3. Position and plumb supporting steel members, then tighten double nutted anchor bolts.
 - 4. Cut off part of wedges and shims that protrude beyond the edge of base and bearing plates.
- B. Installation of Cementitious Grout Under Bases and Bearing Plates:
 - 1. Pack space below base and bearing plates supporting structural members and stationary equipment with nonmetallic nonshrink grout until no voids remain.
 - 2. Pack space below bearing plates supporting vibrating equipment with metallic nonshrink non-catalyzed grout until no voids remain.
 - 3. Trowel exposed grout surfaces to smooth finish.
 - 4. Cure grout to comply with manufacturer's printed instructions.
- C. Installation of Epoxy Grout:
 - 1. Coat existing concrete contact surfaces with epoxy grout at spalled concrete areas prior to filling with plastic cement.
 - 2. Fill space between existing drilled and dowel sleeved concrete and new reinforcing bars and dowels with epoxy grout.

CAST-IN-PLACE CONCRETE

3.7 FIELD QUALITY CONTROL

- A. Do not place concrete or reinforcement in footing forms until Owner or his representative has examined compacted soil and aggregate materials within forms.
- B. Do not place concrete until Owner's Representative has examined formwork, reinforcing steel, and condition of vapor retarder.
 - 1. Notify Owner's Representative 24 hours prior to concrete placement for inspection of reinforcing.
 - 2. Adjusting Reinforcing: Adjust location of reinforcing as required.
- C. Test Requirements:
 - 1. When special Inspection is required by State Building Code, Owner will employ an Independent Testing Laboratory to evaluate concrete delivered to and placed at site.
 - a. Notify Independent Testing Laboratory 24 hours prior to delivery and placement of concrete.
 - 2. Comply with Building Code, Section 1701 for evaluation and acceptance of concrete.
- D. Ready Mixed Concrete Inspection and Testing:
 - 1. Sample each truck load of ready mixed concrete, complying with ASTM C172.
 - 2. Perform one slump test for each truck load of ready mixed concrete, complying with ASTM C 143.
 - 3. Perform one air content test for each set of compressive strength specimens, complying with ASTM C 231.
 - 4. Make one set of 3 of compressive strength specimens for each day of structural concrete pouring or each 50 cubic yards or fraction thereof for each class of concrete, complying with ASTM C 31.
 - 5. Test one specimen in accordance with ASTM C 39 after curing 7 days, two specimens after curing 28 days, unless first specimen tested at 28 days does not meet specified compressive strength, in which case retain one specimen for testing after 35 days or as directed by Owner's Representative.
 - 6. Batch Ticket:
 - a. Receive a batch weight ticket from each truck; batch ticket to comply with requirements of ASTM C 94 in Article 16 for Batch Ticket Information.
 - b. Verify water/cement ratio.
 - 1) No water may be added if load is at specified ratio.
 - 2) Reject truck if ratio does not conform.
- E. Grout Testing:
 - 1. When required by the Building Code, Section 306, Special Inspection Requirements, Owner will employ an independent testing laboratory to evaluate grout supporting structural members.
 - 2. Comply with procedures in Section 01 4000, Quality Requirements.
 - 3. Test nonmetallic nonshrink grout in accordance with ASTM C 109.
 - 4. Test epoxy grout in accordance with ASTM C 579, Method B.
 - 5. Manufacturer's Field Service: Grout and anchoring cement manufacturer's representative shall provide technical assistance and two project site visits to ensure that grout and anchoring cement work is performed in accordance with manufacturer's instructions.

3.8 REPAIRS AND PROTECTION

- A. Surface Repairs for Exposed Concrete:
 - 1. Thoroughly clean, dampen with water and brush-coat area to be patched with Bonding Agent.
 - 2. Fill honeycomb voids and rock pockets with patching compound.
 - 3. Compact in place and screed as recommended by patching compound manufacturer.
 - 4. Finish to match adjoining work.
 - 5. Strike off excess mortar at surface.
 - 6. If defects in color and texture of surface cannot be repaired, remove and replace concrete.
- B. Replace damaged and defective grout and anchoring cement work.
- C. Protection:
 - 1. Protect concrete from frost damage until protected by soil backfill or until cured for 28 days.
 - 2. Protect concrete from physical damage or reduced strength caused by air temperatures below 45 degrees F. and above 75 degrees F. during curing period, complying with recommendations in ACI 306R and 305R respectively.
 - 3. Protect concrete from shrinkage crack damage until protected by curing procedure.

CAST-IN-PLACE CONCRETE

4. Cover fresh grout and anchoring cement with plywood or oriented strand board for 24 hours minimum, where exposed to public, pedestrian, and animal traffic.
- D. Physical Barrier Protection:
1. Barricade area containing fresh concrete slabs, stairs, ramps and walks for 24 hours minimum.
 2. Cover fresh concrete with plywood where exposed to public, pedestrian, and animal traffic.

END OF SECTION

PLAY STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Manufactured and shop fabricated play structures and equipment.
- B. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 033000: Cast-In-Place Concrete, for formwork, reinforcing, and concrete for play structure footings.
 - 3. Section 312000: Earth Moving, for boring play structure footings and aggregate bases.
 - 4. Section 321817: Playground Protective Surfacing.
 - 5. Section 334600: Subdrainage System.

1.2 DEFINITIONS

- A. IPEMA: International Playground Equipment Manufacturer's Association.
- B. CPSC: US Consumer Product Safety Commission, Guidelines for Public Playground Safety.
- C. Fall Height: In accordance with ASTM F 1487, "the vertical distance between a designated play surface and the protective surfacing beneath it,".
- D. Use Zone: In accordance with ASTM F 1487, the "area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment.

1.3 SYSTEM DESCRIPTION

- A. Design Performance Requirements:
 - 1. Design play structures to conform to U.S. Consumer Product Safety Commission, Handbook for Public Playground Safety.
 - 2. Design play structures so that corners, edges, and ends of play structures have no exposed pinching and/or crushing points that may result through the unplanned movement of any piece of the structure.
 - 3. Design play structures for children in the tot's and kid's age range of 2 years and older.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's specifications, data, and installation instructions.
- B. Shop Drawings showing layout, dimensions and installation details for each play structure and custom fabrication.
 - 1. Shop drawings shall include paving, curbs, and other structures located within or at the perimeter of the play surfacing.
 - 2. Shop drawings shall include safety zones.
 - 3. Shop drawings for custom fabrications shall show all dimensions, cross sections, fabrication tolerances, finishes, welds, penetrations and supports, and integration with other work.
- C. Samples:
 - 1. Submit two samples of polyester powder coat finish on aluminum and steel framing components.
 - 2. Submit two samples of PVC coated materials.
 - 3. Submit two color chips for each finish specified.
- D. Quality Assurance Submittals:
 - 1. Design data for play structures bearing the seal and signature of a structural engineer registered in the State of Oregon.
 - 2. Test reports for powder coated surfaces including adhesion tests in accordance with ASTM D 3359 and knife scratch tests in accordance with ASTM D 2197.
- E. Maintenance Instructions: Manufacturer's complete instructions for maintenance.
- F. Certification and Warranty Submittals:
 - 1. International Playground Equipment Manufacturer's Association (IPEMA) certification.
 - 2. Play structure manufacturer's standard 15 year warranty against structural failure due to corrosion, deterioration of components, and defective labor for aluminum posts and collars.

PLAY STRUCTURES

1.5 QUALITY ASSURANCE

- A. Comply with governing codes and regulations for installation of play structures for public use.
- B. Design play structures to comply with the following standards:
 - 1. ASTM F 1487, "Standard Consumer Safety Performance Specification for Playground Equipment for Public Use."
 - 2. US Consumer Product Safety Commission (CPSC), Guidelines for Public Playground Safety.
- C. Certification: Provide certification by the International Playground Equipment Manufacturer's Association (IPEMA) that products comply with specified ASTM standards.
- D. Use skilled workers who are trained and experienced in crafts and familiar with requirements and methods needed for proper performance of Work of this Section.
- E. Manufacturer's Qualifications: Minimum 5 years experience in the manufacture of play structures.

1.6 SITE CONDITIONS

- A. Existing Conditions:
 - 1. Locate existing site improvements, underground utility systems, and other below grade site improvements in area of surface and footing excavations.
 - 2. Call the Oregon Utility Notification Center at 811 for underground utility locations 48 hours in advance of removing soil materials and boring post holes.
 - 3. If necessary, modify with Owner's approval play structure layout to avoid conflicts with existing underground utilities and site improvements.

1.7 DELIVERY, STORAGE, PROTECTION AND HANDLING

- A. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Store metal materials not less than 4 inches above grade.
- C. Protect prefabricated metal from abrasion and corrosion during storage and assembly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers and Products for Shop Fabricated Play Structures:
 - 1. Playworld Systems, Inc.
 - 2. ID Sculpture.
 - 3. Contact: Jim Protiva at Northwest Playground 808.281.1849.
- B. All play equipment shall be Owner-Furnished and Contractor-Installed, except as follows:
 - 1. ID Sculpture "Paradise Boulder" shall be Owner-Furnished and Manufacturer-Installed, with the exception of the concrete footing. See Drawings and Paragraph 2.4.B.1, below.

2.2 MATERIALS

- A. Round Extruded Aluminum Structural Tube Posts:
 - 1. Industry Standard: ASTM B 429, 6061 alloy and T6 temper.
 - 2. Minimum Yield Strength: 35,000 psi.
 - 3. Minimum Tensile Strength: 38,000 psi.
 - 4. Minimum Outside Diameter: 4.5 inches.
 - 5. Minimum Wall Thickness: 0.125 inches.
 - 6. Minimum Weight: 2.02 pounds per lineal foot.
 - 7. Shop Finish: Polyester powder coat.
- B. Aluminum Tube Post Collars:
 - 1. Industry Standard: ASTM B 429, 6061 alloy and T6 temper.
 - 2. Minimum Yield Strength: 35,000 psi.
 - 3. Minimum Tensile Strength: 38,000 psi.
 - 4. Minimum Outside Diameter: 4.5 inches.
 - 5. Minimum Wall Thickness: 0.125 inches.
 - 6. Minimum Weight: 2.02 pounds per lineal foot.
 - 7. Shop Finish: Polyester powder coat.

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- C. Aluminum Tube Post Caps:
 - 1. Aluminum Tube Post Caps.
- D. Aluminum Seamless Pipe:
 - 1. Industry Standard: ASTM B 209, extruded aluminum 6063-T6, 6063-T52, or 6063-T832 alloy and temper, Schedule 5, 10, or 40.
 - 2. Maximum Length: 20 feet.
 - 3. Nominal Inside Diameter Pipe Size: 3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, 3-1/2, 4, 5, 6, and 8 inch.
- E. Round Steel Pipe Beams:
 - 1. Industry Standard: ASTM A 53, Grade B, Seamless, Schedule 40.
 - 2. Minimum Size: 4 inch NPS, 4.5 inch outside diameter.
 - 3. Minimum Wall Thickness: 0.237 inch.
 - 4. Minimum Weight: 10.79 pounds per lineal foot.
 - 5. Shop Finish: Hot dip galvanized and powder coated.
- F. Round Steel Pipe Framing for Rails, Climbing Rungs, and Connectors:
 - 1. Industry Standard: ASTM F 1083, Type I, Schedule 40.
 - 2. Minimum Size for Rails and Climbing Rungs: 2 inches NPS, 2.375 inches outside diameter.
 - 3. Minimum Weight for Rails and Climbing Rungs: 3.65 pounds per foot.
 - 4. Minimum Size for Pipe Connectors: 1 inch NPS, minimum 1.315 inch outside diameter.
 - 5. Minimum Weight for Connectors: 1.68 pounds per foot.
 - 6. Shop Finish: 0.9 ounces of zinc per square foot of surface and prime coated with manufacturer's standard prime coat that allows adhesion for shop applied powder coat
- G. Chains and Chain Connectors:
 - 1. Material: Hardened steel chain, do not use proof coil chain.
 - 2. Size: 4/0.
 - 3. Minimum Tensile Strength: Not less than 1,000 pounds.
 - 4. Shop Finish: Hot dip galvanized steel.
- H. Slip Resistant Surface Texture:
 - 1. Manufacturers standard slip resistant surface for flat steps, ladders, footholds, handrails, and grab rails.
- I. Play Structure Accessories:
 - Exposed Accessible Fasteners: Designed to require the use of specialized tools not generally available to the public.
 - Steel Pipe Framing End Caps: Round weatherproof metal cap welded to steel pipe on exposed ends.
 - 1. Equipment Fasteners and Hardware: Equipment manufacturer's standard vandal resistant, flush and not protruding, fasteners, fittings, collars, sleeves, spacers, caps, hooks, and hangers shop finished to match adjacent surfaces.

2.3 CONCRETE FOOTING MATERIALS

- A. Provide forms, reinforcing, and materials for concrete post footings in accordance with requirements of Section 033000, "Cast-In-Place Concrete," and additional requirements of this Section.
- B. Forms for Post Footings:
 - 1. Type: Cylindrical fiber forms.
 - 2. Size: As shown on the Drawings, minimum 12 inch diameter, not less than 24 inches long.
 - 3. Acceptable Cylindrical Fiber Forms, one of the following:
 - a. Sleek Tube by Alton.
 - b. Vulco by Vulcan.
 - c. Sonotube by Sonoco.
 - d. Burke Tube by Burke.
- C. Concrete for Footings: Minimum Compressive Strength: $f_c = 3,000$ psi in 28 days.

2.4 MANUFACTURED PLAYGROUND EQUIPMENT

- A. Playworld Systems:
 - 1. Olympia Timber Stacks Play Structure, product number ZZXX1327.
 - a. Materials:

PLAY STRUCTURES

- 1) Wood timbers per manufacturer.
 - 2) Rope and fixtures per manufacturer. Rope color: black.
 2. Arch Swing with "add-a-bay" for second bay, product number 500-ARCH. Two bays, four total swings.
 - a. Materials:
 - 1) Frame: Powdercoated 5-inch aluminum tube. Color: Forest Green.
 - b. Swings:
 - 1) (2) Standard belt swings. Color: Black.
 - 2) (1) Toddler swing. Color: Black.
 - 3) (1) Accessible swing seat ZZXX0892. Color: Tropical Yellow.
 - 4) Includes galvanized chain from manufacturer.
 3. Loopy Whoop, product number ZZUN7096.
 - a. Color: Forest Green.
 4. Spin Cup, product number ZZXX0065.
 - a. Color: Tropical Yellow.
- B. ID Sculpture:
1. IDS Paradise Boulder. Rock texture: Quartzite.
 2. IDS The Drift Boulder. Rock texture: Quartzite.

2.5 FABRICATION

- A. Fabrication of Play Structure Exposed Corners, Edges, and Ends:
 1. Hem, roll, curl, ease, or cap exposed corners, edges, and ends of structure members.
- B. Shop Powder Coat Finish for Aluminum and Steel Components:
 1. Powder coat metal components after fabricating, preparing, and cleaning metal substrates to a minimum thickness of 4 mils, and oven cure at 400 degrees F.
 2. Do not powder coat expanded stainless steel and metal chains.
 3. Place permanent horizontal line marking at designed level of playground fiber surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify areas to receive products of this Section are free of impediments likely to interfere with installation and are ready to receive Work of this section.
 1. Examine play structures and verify that components are undamaged and ready for field assembly.
 - a. Remove and replace damaged and non-conforming products.
 2. Identify location of underground utility lines on surface.
 3. Correct unsatisfactory conditions prior to installation.

3.2 INSTALLATION - POSTS AND FOOTINGS

- A. Lay out play structures and play surface areas.
- B. Post Footings:
 1. Bore 18 inch minimum diameter holes with power auger to not less than 24 inches below substrate below aggregate base course and to not less than 3 inches below bottom of support posts.
 2. Install cylindrical fiber or steel forms in the top 12 inches of soil with the top edge 4 inches above adjacent subgrade surfaces and flush with adjacent aggregate base course surface.
 3. Install 24 inch long fiber forms where adjacent soil is not self supporting.
- C. Installation of Posts:
 1. Set post to depth with concrete cover as recommended by manufacturer of play structure equipment.
 2. Firmly secure brace posts during concrete placement.
 3. Place anchor rods in pipes prior to placement of concrete.
 4. Fasten anchors securely to prevent dislodgement during concrete placement.
- D. Installation of Reinforcing Steel:
 1. Comply with CRSI Manual of Standard Practice, MSP-1.
- E. Concrete Placement:
 1. Wet forms and holes thoroughly with water prior to depositing concrete.
 2. Do not allow water to puddle in footing excavation.

PLAY STRUCTURES

3. Place concrete in hole in continuous operation, rod and tamp concrete to consolidate concrete.
4. Trowel concrete to form a convex surface with 1/2 inch minimum slope to direct water away from posts.

F. Form Removal and Backfilling:

1. Remove forms 24 hours after concrete pour and backfill around concrete footings.
2. Compact backfill to 95 percent of maximum density at optimum moisture content according to requirements of Section 312000, "Earth Moving."
3. Maintain post footing in moist condition and cover footing for 7 days after concrete placement.

3.3 INSTALLATION – PLAY STRUCTURES

- A. Install play structures in accordance with manufacturer's written instructions and approved Shop Drawings.
1. Installation of the ID Sculpture Paradise Boulder shall be by the manufacturer.
 - a. Contractor shall construct footing to specified concrete strength prior to delivery of Boulder.
 - b. Contractor shall coordinate delivery, staging, and installation of Paradise Boulder with ID Sculpture installation crew.
- B. Install play structures plumb and level.
- C. Where required or indicated, anchor playground equipment to prepared concrete footings or slabs, or other solid substrates capable of supporting equipment.
- D. Installation of Shop Fabricated Play Structures:
1. Install play structure framing 7 days after concrete pour.
 2. Assemble steel framing members as recommended by manufacturer.
 3. Cover bolt ends with washers and caps.
 4. Anchor play structures to concrete footings with anchor bolts.
 5. Install fixed playground equipment level and anchor components to beams, posts, and other framing members.
 6. Install components without exposed sharp surface protrusions, corners, edges, and ends.
 7. Tighten anchors as securely as possible without damaging the shop finish.
 8. Do not install decks and accessories until playground surface material is in place.
 9. Attach decks and accessories in accordance with manufacturer's instructions.
 10. Deck heights indicated in Drawings are measured either from top of playground surface material to deck surface or as spot elevations developed from existing datum.

3.4 PROTECTION

- A. Protect adjacent facilities, plants, trees, ground covers, grass, paved and playground protective surfaces, and other site improvements from damage during assembly and installation of post footings and play structures.

3.5 ADJUSTING AND CLEANING

- A. Replace damaged and defective play structure components.
- B. Hose wash and towel dry all exposed surfaces at time of Substantial Completion.
- C. Remove excess material, including footing concrete, and other construction debris from the site daily.

END OF SECTION

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included in this Section:
 - 1. Site furnishings: furnish all labor, material and equipment necessary to complete the installation of all site furnishings shown on the drawings and as specified herein.
- B. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 033000 – Cast-in-Place Concrete.
 - 3. Section 320523 – Pervious Concrete Paving.
 - 4. Section 321313 – Concrete Paving.
 - 5. Section 331100 – Water System.

1.2 SUBMITTALS

- A. Submit the following in accordance with Division 01 Section “Submittal Procedures”.
 - 1. Product information indicating quantity, factory finish, and size of products.
 - 2. Samples as indicated.
 - 3. Prior to fabrication, submit shop drawings for all concrete, metal and wood fabrications and as indicated. Show all dimensions, cross sections, fabrication tolerances, finishes, welds, penetrations and supports, and integration with other work.
 - 4. Qualifications as specified herein.

1.3 QUALITY ASSURANCE

- A. General:
 - 1. Concrete fabrications, foundations, and footings in this section shall meet the requirements of Division 03 – Concrete.

PART 2 - PRODUCTS

2.1 TRASH RECEPTACLES

- A. Dumor 102-22SH trash receptacle with BT lid, surface mount.
 - 1. Color: Forest Green.
- B. Available from Northwest Playground Equipment 800.726.0031.
- C. Provide tamper-proof concrete anchors for fastening to concrete paving.

2.2 BENCHES

- A. Backed Benches: Dumor 58-60 6' Bench with back and arms, surface mount.
 - 1. Color: Forest Green.
- B. Backless Benches: Dumor 92-60 6' Bench, backless, surface mount.
 - 1. Color: Forest Green.
- C. Available from Northwest Playground Equipment 800.726.0031.
- D. Provide tamper-proof concrete anchors for fastening to concrete paving.

2.3 PICNIC TABLES

- A. Dumor 298-60-2HS 6' ADA-accessible picnic table and benches, surface mount.
 - 1. Color: Forest Green.
- B. Available from Northwest Playground Equipment 800.726.0031.
- C. Provide tamper-proof concrete anchors for fastening to concrete paving.

2.4 BIKE RACKS

- A. Huntco “The Staple” Bike Rack.
 - 1. 2-inch Sch. 40 galvanized steel pipe.
 - 2. Flanged for surface mounting.
- B. Available from Huntco 503.224.8700.

SITE FURNISHINGS

- C. Provide tamper-proof concrete anchors for fastening to concrete paving.
- 2.5 DRINKING FOUNTAIN
- A. MDF 440 SMSS ADA-accessible outdoor drinking fountain.
 - 1. Color: Green.
 - 2. Include the following features:
 - a. Pet Fountain.
 - b. Jug Filler.
 - c. Cutoff Valve and Low-Point Drain.
 - d. Freeze-resistant valves.
 - e. Template 10 NS.
 - B. Available from Most Dependable Fountains 901.867.4008.
 - C. Provide concrete anchor suitable for fastening to concrete paving per Manufacturer's Recommendations.
- 2.6 PARK SIGN
- A. Park sign shall be Owner-furnished, Contractor-installed.
 - B. Sign: custom design by Custom Wood Signs, 503.233.1539.
- 2.7 CHAIN LINK FENCING
- A. See 323113 – Chain Link Fencing.
- 2.8 PARK LIGHTING
- A. Includes fixtures and poles.
 - B. See Division 26 – Electrical.
- PART 3 - EXECUTION
- 3.1 INSTALLATION, GENERAL
- A. Install site furnishings in accordance with manufacturer's printed instructions and as indicated on Drawings.
 - B. Install all site furnishings to be level, plumb, and true.
 - C. Provide tamper-resistant fasteners for attaching furnishings to concrete or other surfaces as required and per manufacturer's recommendations.
 - D. Provide concrete footings as required and as shown on the Drawings.
 - E. Coordinate installation work with other trades.
- 3.2 COMPLETION
- A. Protect finished surfaces and elements from damage during installation.
 - B. Clean exposed surfaces after installation of site furnishings. Use cleaning materials suitable for each material to be cleaned; do not stain or mar surfaces during cleaning.

END OF SECTION

ELECTRICAL SPECIFICATIONS

SECTION 26 00 10	SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL
SECTION 26 05 19	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
SECTION 26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
SECTION 26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
SECTION 26 05 33	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
SECTION 26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS
SECTION 26 09 23	LIGHTING CONTROL DEVICES
SECTION 26 27 26	WIRING DEVICES
SECTION 26 56 19	LED EXTERIOR LIGHTING

SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements generally applicable to the Work specified in Division 26. This Section is also referenced by related Work specified in other Divisions.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:

1. A: Ampere, unit of electrical current.
2. AC or ac: Alternating current.
3. AFCI: Arc-fault circuit interrupter.
4. AIC: Ampere interrupting capacity.
5. AL, Al, or ALUM: Aluminum.
6. AWG: American wire gauge; see ASTM B258.
7. BAS: Building automation system.
8. BIL: Basic impulse insulation level.
9. BIM: Building information modeling.
10. CAD: Computer-aided design or drafting.
11. CATV: Community antenna television.
12. CB: Circuit breaker.
13. cd: Candela, the SI fundamental unit of luminous intensity.
14. CO/ALR: Copper-aluminum, revised.
15. COPS: Critical operations power system.
16. CU or Cu: Copper.
17. CU-AL or AL-CU: Copper-aluminum.
18. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
19. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
20. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
21. dBm: Decibel absolute power with respect to 1 mW.
22. DC or dc: Direct current.
23. DCOA: Designated critical operations area.
24. DDC: Direct digital control (HVAC).
25. EGC: Equipment grounding conductor.
26. ELV: Extra-low voltage.
27. EMF: Electromotive force.
28. EMI: Electromagnetic interference.
29. EPM: Electrical preventive maintenance.
30. EPS: Emergency power supply.
31. EPSS: Emergency power supply system.
32. ESS: Energy storage system.
33. fc: Footcandle, an internationally recognized unit of illuminance equal to one lumen per square foot or 10.76 lx. The simplified conversion 1 fc = 10 lx in the Specifications is common practice and considered adequate precision for building construction activities. When there are conflicts, lux is the primary unit; footcandle is specified for convenience.
34. FLC: Full-load current.
35. ft: Foot.
36. ft-cd: Foot-candle, the antiquated U.S. Standard unit of illuminance, equal to one international candle measured at a distance of one foot, that was superseded in 1948 by the unit "footcandle" after the SI unit candela (cd) replaced the international candle; see "fc,"
37. GEC: Grounding electrode conductor.
38. GFCI: Ground-fault circuit interrupter.
39. GFPE: Ground-fault protection of equipment.
40. GND: Ground.
41. HACR: Heating, air conditioning, and refrigeration.

SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

42. HDPE: High-density polyethylene.
43. HID: High-intensity discharge.
44. HP or hp: Horsepower.
45. HVAC: Heating, ventilating, and air conditioning.
46. Hz: Hertz.
47. IBT: Intersystem bonding termination.
48. inch: Inch. To avoid confusion, the abbreviation "in." is not used.
49. IP: Ingress protection rating (enclosures); Internet protocol (communications).
50. IR: Infrared.
51. IS: Intrinsically safe.
52. IT&R: Inspecting, testing, and repair.
53. ITE: Information technology equipment.
54. kAIC: Kiloampere interrupting capacity.
55. kcmil or MCM: One thousand circular mils.
56. kV: Kilovolt.
57. kVA: Kilovolt-ampere.
58. kVA_r or kVAR: Kilovolt-ampere reactive.
59. kW: Kilowatt.
60. kWh: Kilowatt-hour.
61. LAN: Local area network.
62. lb: Pound (weight).
63. lbf: Pound (force).
64. LCD: Liquid-crystal display.
65. LCDI: Leakage-current detector-interrupter.
66. LED: Light-emitting diode.
67. Li-ion: Lithium-ion.
68. lm: Lumen, the SI derived unit of luminous flux.
69. LNG: Liquefied natural gas.
70. LP-Gas: Liquefied petroleum gas.
71. LRC: Locked-rotor current.
72. LV: Low voltage.
73. lx: Lux, the SI derived unit of illuminance equal to one lumen per square meter.
74. m: Meter.
75. MCC: Motor-control center.
76. MDC: Modular data center.
77. MG set: Motor-generator set.
78. MIDI: Musical instrument digital interface.
79. MLO: Main lugs only.
80. MV: Medium voltage.
81. MVA: Megavolt-ampere.
82. mW: Milliwatt.
83. MW: Megawatt.
84. MWh: Megawatt-hour.
85. NC: Normally closed.
86. Ni-Cd: Nickel-cadmium.
87. Ni-MH: Nickel-metal hydride.
88. NIU: Network interface unit.
89. NO: Normally open.
90. NPT: National (American) standard pipe taper.
91. OCPD: Overcurrent protective device.
92. ONT: Optical network terminal.
93. PC: Personal computer.
94. PCS: Power conversion system.
95. PCU: Power-conditioning unit.
96. PF or pf: Power factor.
97. PLFA: Power-limited fire alarm.

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98. PoE: Power over Ethernet.
 99. PV: Photovoltaic.
 100. PVC: Polyvinyl chloride.
 101. RFI: (electrical) Radio-frequency interference; (contract) Request for interpretation.
 102. RMS or rms: Root-mean-square.
 103. RPM or rpm: Revolutions per minute.
 104. SCADA: Supervisory control and data acquisition.
 105. SCR: Silicon-controlled rectifier.
 106. SPD: Surge protective device.
 107. sq.: Square.
 108. SWD: Switching duty.
 109. UL: (standards) Underwriters Laboratories, Inc.; (product categories) UL, LLC.
 110. UL CCN: UL Category Control Number.
 111. USB: Universal serial bus.
 112. UV: Ultraviolet.
 113. V: Volt, unit of electromotive force.
 114. V(ac): Volt, alternating current.
 115. V(dc): Volt, direct current.
 116. VA: Volt-ampere, unit of complex electrical power.
 117. VAR: Volt-ampere reactive, unit of reactive electrical power.
 118. VFC: Variable-frequency controller.
 119. VOM: Volt-ohm-multimeter.
 120. VPN: Virtual private network.
 121. W: Watt, unit of real electrical power.
 122. WR: Weather resistant.
- B. Abbreviations and Acronyms for Electrical Raceway Types:
1. EMT: Electrical metallic tubing.
 2. EMT-A: Aluminum electrical metallic tubing.
 3. EMT-S: Steel electrical metallic tubing.
 4. EMT-SS: Stainless steel electrical metallic tubing.
 5. ENT: Electrical nonmetallic tubing.
 6. EPEC: Electrical HDPE underground conduit (thin wall).
 7. EPEC-A: Type A electrical HDPE underground conduit.
 8. EPEC-B: Type B electrical HDPE underground conduit.
 9. ERMC: Electrical rigid metal conduit.
 10. ERMC-A: Aluminum electrical rigid metal conduit.
 11. ERMC-S: Steel electrical rigid metal conduit.
 12. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.
 13. ERMC-S-PVC: PVC-coated-steel electrical rigid metal conduit.
 14. ERMC-SS: Stainless steel electrical rigid metal conduit.
 15. FMC: Flexible metal conduit.
 16. FMC-A: Aluminum flexible metal conduit.
 17. FMC-S: Steel flexible metal conduit.
 18. FMT: Steel flexible metallic tubing.
 19. FNMC: Flexible nonmetallic conduit. See "LFNC."
 20. HDPE: HDPE underground conduit (thick wall).
 21. HDPE-40: Schedule 40 HDPE underground conduit.
 22. HDPE-80: Schedule 80 HDPE underground conduit.
 23. IMC: Steel electrical intermediate metal conduit.
 24. LFMC: Liquidtight flexible metal conduit.
 25. LFMC-A: Aluminum liquidtight flexible metal conduit.
 26. LFMC-S: Steel liquidtight flexible metal conduit.
 27. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
 28. LFNC: Liquidtight flexible nonmetallic conduit.
 29. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
 30. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.

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31. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
 32. PVC: Rigid PVC conduit.
 33. PVC-40: Schedule 40 rigid PVC conduit.
 34. PVC-80: Schedule 80 rigid PVC Conduit.
 35. PVC-A: Type A rigid PVC concrete-encased conduit.
 36. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
 37. RGS: See ERM-C-S-G.
 38. RMC: See ERM-C.
 39. RTRC: Reinforced thermosetting resin conduit.
 40. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
 41. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
 42. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
 43. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
 44. RTRC-BG: Low-halogen, belowground reinforced thermosetting resin conduit.
- C. Abbreviations and Acronyms for Electrical Single-Conductor and Multiple-Conductor Cable Types:
1. AC: Armored cable.
 2. CATV: Coaxial general-purpose cable.
 3. CATVP: Coaxial plenum cable.
 4. CATVR: Coaxial riser cable.
 5. CI: Circuit integrity cable.
 6. CL2: Class 2 cable.
 7. CL2P: Class 2 plenum cable.
 8. CL2R: Class 2 riser cable.
 9. CL2X: Class 2 cable, limited use.
 10. CL3: Class 3 cable.
 11. CL3P: Class 3 plenum cable.
 12. CL3R: Class 3 riser cable.
 13. CL3X: Class 3 cable, limited use.
 14. CM: Communications general-purpose cable.
 15. CMG: Communications general-purpose cable.
 16. CMP: Communications plenum cable.
 17. CMR: Communications riser cable.
 18. CMUC: Under-carpet communications wire and cable.
 19. CMX: Communications cable, limited use.
 20. DG: Distributed generation cable.
 21. FC: Flat cable.
 22. FCC: Flat conductor cable.
 23. FPL: Power-limited fire-alarm cable.
 24. FPLP: Power-limited fire-alarm plenum cable.
 25. FPLR: Power-limited fire-alarm riser cable.
 26. IGS: Integrated gas spacer cable.
 27. ITC: Instrumentation tray cable.
 28. ITC-ER: Instrumentation tray cable, exposed run.
 29. MC: Metal-clad cable.
 30. MC-HL: Metal-clad cable, hazardous location.
 31. MI: Mineral-insulated, metal-sheathed cable.
 32. MTW: (machine tool wiring) Moisture-, heat-, and oil-resistant thermoplastic cable.
 33. MV: Medium-voltage cable.
 34. NM: Nonmetallic sheathed cable.
 35. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
 36. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
 37. NPLF: Non-power-limited fire-alarm circuit cable.
 38. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
 39. NPLFR: Non-power-limited fire-alarm circuit riser cable.
 40. NUCC: Nonmetallic underground conduit with conductors.

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41. OFC: Conductive optical fiber general-purpose cable.
 42. OFCG: Conductive optical fiber general-purpose cable.
 43. OFCP: Conductive optical fiber plenum cable.
 44. OFCR: Conductive optical fiber riser cable.
 45. OFN: Nonconductive optical fiber general-purpose cable.
 46. OFNG: Nonconductive optical fiber general-purpose cable.
 47. OFNP: Nonconductive optical fiber plenum cable.
 48. OFNR: Nonconductive optical fiber riser cable.
 49. P: Marine shipboard cable.
 50. PLTC: Power-limited tray cable.
 51. PLTC-ER: Power-limited tray cable, exposed run.
 52. PV: Photovoltaic cable.
 53. RHH: (high heat) Thermoset rubber, heat-resistant cable.
 54. RHW: Thermoset rubber, moisture-resistant cable.
 55. SA: Silicone rubber cable.
 56. SE: Service-entrance cable.
 57. SER: Service-entrance cable, round.
 58. SEU: Service-entrance cable, flat.
 59. SIS: Thermoset cable for switchboard and switchgear wiring.
 60. TBS: Thermoplastic cable with outer braid.
 61. TC: Tray cable.
 62. TC-ER: Tray cable, exposed run.
 63. TC-ER-HL: Tray cable, exposed run, hazardous location.
 64. THW: Thermoplastic, heat- and moisture-resistant cable.
 65. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
 66. THHW: Thermoplastic, heat- and moisture-resistant cable.
 67. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
 68. TW: Thermoplastic, moisture-resistant cable.
 69. UF: Underground feeder and branch-circuit cable.
 70. USE: Underground service-entrance cable.
 71. XHH: Cross-linked polyethylene, heat-resistant cable.
 72. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.
- D. Definitions:
1. Basic Impulse Insulation Level (BIL): Reference insulation level expressed in impulse crest voltage with a standard wave not longer than 1.5 times 50 microseconds and 1.5 times 40 microseconds.
 2. Cable: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "cable" is (1) a conductor with insulation, or a stranded conductor with or without insulation (single-conductor cable); or (2) a combination of conductors insulated from one another (multiple-conductor cable).
 3. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.
 4. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.
 5. Conductor: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "conductor" is (1) a wire or combination of wires not insulated from one another, suitable for carrying an electric current; (2) (National Electrical Safety Code) a material, usually in the form of wire, cable, or bar, suitable for carrying an electric current; or (3) (general) a substance or body that allows a current of electricity to pass continuously along it.
 6. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
 - a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
 - b. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

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- c. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
 - d. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
 - e. Device Box: A box with provisions for mounting a wiring device directly to the box.
 - f. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
 - g. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
 - h. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
 - i. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
 - j. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
 - k. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
 - l. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
 - m. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
 - n. Raised-Floor Box: A floor box intended for use in raised floors.
 - o. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.
 - p. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
 - q. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
 - r. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
 - s. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.
7. Fault Limited: Providing or being served by a source of electrical power that is limited to not more than 100 W when tested in accordance with UL 62368-1.
- a. The term "fault limited" is intended to encompass most Class 1, 2, and 3 power-limited sources complying with Article 725 of NFPA 70; Class ES1 and ES2 electrical energy sources that are Class PS1 electrical power sources (e.g., USB); and Class ES3 electrical energy sources that are Class PS1 and PS2 electrical power sources (e.g., PoE). See UL 62368-1 for discussion of classes of electrical energy sources and classes of electrical
8. Jacket: A continuous nonmetallic outer covering for conductors or cables.
9. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.
10. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the Energy Independence and Security Act (EISA) of 2007.
11. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
12. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
13. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
14. Sheath: A continuous metallic covering for conductors or cables.

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15. UL Category Control Number (CCN): An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.
16. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
 - a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
 - b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
 - c. Extra-Low Voltage (ELV): Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
 - d. Low Voltage (LV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
17. Wire: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "wire" is a slender rod or filament of drawn metal. A group of small wires used as a single wire is properly called a "stranded wire." A wire or stranded wire covered with insulation is properly called an "insulated wire" or a "single-conductor cable." Nevertheless, when the context indicates that the wire is insulated, the term "wire" will be understood to include the insulation.

1.3 COORDINATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions:
 1. Notify Architect Construction Manager Owner no fewer than seven days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Arrange to provide temporary electrical service or power in accordance with requirements specified in Division 01.

1.4 PREINSTALLATION MEETINGS

- A. Electrical Preconstruction Conference: Schedule conference with Architect and Owner, not later than 10 days after notice to proceed. Agenda topics include, but are not limited to, the following:
 1. Electrical installation schedule.
 2. Status of power system studies.
 3. Value analysis proposals and requests for substitution of electrical equipment.
 4. Utility work coordination and class of service requests.
 5. Commissioning activities.
 6. Sustainability activities, including Measurement and Verification Plan.

1.5 SEQUENCING

- A. Conduct and submit results of power system studies before submitting Product Data and Shop Drawings for electrical equipment.

1.6 ACTION SUBMITTALS

- A. Coordination Drawings for Structural Supports: Show coordination of structural supports for equipment and devices, including restraints and bracing for control of seismic and wind loads, with other systems, equipment, and structural supports in the vicinity.
- B. Coordination Drawings for Ceiling Areas: Where indicated on drawings, provide reflected ceiling plan(s), supplemented by sections and other details, drawn to scale on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Suspended ceiling components.
 2. Size and location of access panels on ceilings.
 3. Elevation, size, and route of 2 inch or larger conduit.
 4. Elevation and size of wall-mounted and ceiling-mounted equipment.
 5. Luminaires.
 6. Indicate clear dimensions for maintenance access in front of equipment.
 7. Indicate dimensions of fully open access doors.

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- C. Coordination Drawings for Conduit Routing: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

1.7 INFORMATIONAL SUBMITTALS

- A. Electrical Installation Schedule: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for electrical installation Work to Owner and Architect including, but not limited to, milestone dates for the following activities:
1. Submission of specified coordination drawings.
 2. Submission of action submittals specified in Division 26.
 3. Orders placed for major electrical equipment.
 4. Arrival of major electrical equipment on-site.
 5. Preinstallation meetings specified in Division 26.
 6. Utility service outages.
 7. Closing of walls and ceilings containing electrical Work.
 8. System startup, testing, and commissioning activities for major electrical equipment.
 9. System startup, testing, and commissioning activities for emergency lighting.
 10. System startup, testing, and commissioning activities for automation systems (SCADA, BMS, lighting, HVAC, fire alarm, fire pump, etc.).
 11. Requests for special inspections.
 12. Requests for inspections by authorities having jurisdiction.
- B. Delegated Design Drawings for Structural Masonry Wall Penetrations: Where indicated on Drawings, provide reflected ceiling plan(s), supplemented by elevations, sections, and other details, drawn to scale, signed, and sealed by a qualified structural professional engineer, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Location and dimensions of structural members supporting wall.
 2. Location and dimensions of columns near penetrations.
 3. Location and dimension of headers and lintels.
 4. Doors and windows near penetrations.
 5. Location and dimensions of penetrating cuts.
 6. Sprinkler piping and sleeves.
 7. Plumbing piping and sleeves.
 8. Ductwork and sleeves.
 9. Cable tray and sleeves.
 10. Conduit and sleeves.
 11. Firestopping assemblies for rated penetrations.
 12. Structural supports for piping, ductwork, and conduit on both sides of wall.
- C. Seismic-Load Performance Certificates: Provide special certification for designated seismic systems as indicated in Paragraph 13.2.2 "Special Certification Requirements for Designated Seismic Systems" of ASCE/SEI 7-05 ASCE/SEI 7-10 ASCE/SEI 7-16 for all designated seismic-load systems identified on Drawings or in the Specifications.
1. Include the following information:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - d. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
 - e. Provide equipment manufacturer's written certification for each designated active electrical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to

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authorities having jurisdiction, or experience data as permitted by ASCE/SEI 7-05 ASCE/SEI 7-10 ASCE/SEI 7-16.

- f. Provide equipment manufacturer's written certification that components with hazardous contents maintain containment following the design earthquake by methods required in ASCE/SEI 7-05 ASCE/SEI 7-10 ASCE/SEI 7-16.
- g. Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by qualified structural professional engineer.
2. The following systems and components are Designated Seismic Systems and require written special certification of seismic qualification by manufacturer:
 - a. Hangers and supports specified in Section 260529 "Hangers and Supports for Electrical Systems."

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:
2. Include the following information:
 - a. Manufacturer's operating specifications.
 - b. User's guides for software and hardware.
 - c. Schedule of maintenance material items recommended to be stored at Project site.
 - d. Detailed instructions covering operation under both normal and abnormal conditions.
 - e. Time-current curves for overcurrent protective devices and manufacturer's written instructions for testing and adjusting their settings.
 - f. List of load-current and overload-relay heaters with related motor nameplate data.
 - g. List of lamp types and photoelectric relays used on Project, with ANSI and manufacturers' codes.
 - h. Manufacturer's instructions for setting field-adjustable components.

1.9 QUALIFICATIONS

- A. Qualified Regional Manufacturer: Manufacturer, that maintains a service center capable of providing training, parts, and emergency on-site repairs to Project site with response time less than eight hours.

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR ELECTRICAL EQUIPMENT

- A. Substitution requests for electrical equipment will be entertained under the following conditions:
 1. Substitution requests may be submitted for consideration prior to the Electrical Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for Owner throughout life of facility.
 2. Substitution requests may be submitted for consideration concurrently with submission of power system study reports when those reports indicate that substitution is necessary for safety of maintenance personnel and facility occupants.
 3. Contractor is responsible for sequencing and scheduling power system studies and electrical equipment procurement. After the Electrical Preconstruction Conference, insufficient lead time for electrical equipment delivery will not be considered a valid reason for substitution.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL WORK

- A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of Work specified in Division 26. Consult Architect for resolution of conflicting requirements.

3.2 FIELD QUALITY CONTROL

- A. Administrant for Low-Voltage Electrical Tests and Inspections:
 1. Owner will engage qualified low-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
 2. Engage qualified low-voltage electrical testing and inspecting agency to administer and perform tests and inspections.

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3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
 4. Administer and perform tests and inspections with assistance of factory-authorized service representative.
- B. Administrant for Power-Limited Electrical Tests and Inspections:
1. Owner will engage qualified power-limited electrical testing and inspecting agency to administer and perform tests and inspections.
 2. Engage qualified power-limited electrical testing and inspecting agency to administer and perform tests and inspections.
 3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
 4. Administer and perform tests and inspections with assistance of factory-authorized service representative.
- C. Administrant for Field Tests and Inspections of Lighting Installations:
1. Owner will engage qualified lighting testing and inspecting agency to administer and perform tests and inspections.
 2. Engage qualified lighting testing and inspecting agency to administer and perform tests and inspections.
 3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
 4. Administer and perform tests and inspections with assistance of factory-authorized service representative.

3.3 CLEANING

- A. Waste Management:
1. Refer to design drawings.

3.4 CLOSEOUT ACTIVITIES

- A. Demonstration: With assistance from factory-authorized service representatives, demonstrate to Owner's maintenance and clerical personnel how to operate the following systems and equipment:
1. Lighting control devices specified in Section 260923 "Lighting Control Devices."
- B. Training: With assistance from factory-authorized service representatives, train Owner's maintenance personnel on the following topics:
1. How to implement Facility EPM Program.
 2. How to adjust, operate, and maintain devices specified in Section 260923 "Lighting Control Devices."

END OF SECTION 260010

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copper building wire.
 - 2. Connectors and splices.
- B. Related Requirements:
 - 1. Section 26 00 10 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated, and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Carol, General Cable, Okonite, Rome, Southwire, or approved.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type NM: Comply with UL 83 and UL 719.
 - 2. Type RHH and Type RHW-2: Comply with UL 44.
 - 3. Type USE-2 and Type SE: Comply with UL 854.
 - 4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
 - 5. Type THHN and Type THWN-2: Comply with UL 83.
 - 6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 - 7. Type UF: Comply with UL 83 and UL 493.
 - 8. Type XHHW-2: Comply with UL 44.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers:
 - 1. Connectors: Anderson, Burndy, IlSCO, Thomas & Belts, or approved.
 - 2. Splices: Branch circuit splices: Ideal, Scotch-Lock, 3M or approved. Feeder splices: Scotch 23 or layers of Scotch 33+ as vapor barrier.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc diecast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: Two hole with standard barrels.

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3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
 1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits:
 1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 2. Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application. Retain one shield option with Type TC-ER cable in "ASD Output Circuits" Paragraph below.

3.3 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inch of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. After installing conductors and cables and before electrical circuitry has been energized, test conductors feeding the following critical equipment and services for compliance with requirements:
3. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.
- C. Related Requirements:
 - 1. Section 26 00 10 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Grounding arrangements and connections for separately derived systems.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 26 00 10 "Supplemental Requirements for Electrical," include the following:
 - a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
 - 1) Grounding arrangements and connections for separately derived systems.
 - b. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B
 - 1) Tests must determine if ground-resistance or impedance values remain within specified maximums, and instructions must recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Grounding Electrode Conductors: Bare copper stranded conductors.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

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6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Mechanical-Type Bus-Bar Connectors: Cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Compression-Type Bus-Bar Connectors: Copper or copper alloy, with two wire terminals.
- E. Cable-to-Cable Connectors: Compression type, copper, or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- H. Water Pipe Clamps:
 1. Mechanical type, two pieces with stainless steel bolts.
 - a. Material: Tin-plated aluminum.
 2. U-bolt type with malleable-iron clamp and copper ground connector.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 1. Bury at least 30-inch below grade.
 2. Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.
- C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- D. Isolated Grounding Conductors: Green-colored insulation with more than one continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- E. Conductor Terminations and Connections:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode must be connected to the equipment grounding conductor and to the frame of the generator.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft. apart.
- G. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.

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3. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION - 260526

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Support, anchorage, and attachment components.
 - 2. Fabricated metal equipment support assemblies.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.
 - 1. Hangers. Include product data for components.
 - 2. Slotted support systems.
 - 3. Equipment supports.
 - 4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated Design Submittals: For hangers and supports for electrical systems.
 - 1. Include design calculations and details of hangers.
 - 2. Include design calculations for seismic restraints.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified structural professional engineer to design hanger and support system.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inch on center in at least one surface.
 - 1. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - a. CADDY; brand of nVent Electrical plc.
 - b. Cooper B-line; brand of Eaton, Electrical Sector.
 - c. Unistrut; Atkore International.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 4. Channel Width: Selected for applicable load criteria.
 - 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

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6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Unistrut; Atkore International.
 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Channel Material: 6063-T5 aluminum alloy.
 4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
 5. Channel Width: Selected for applicable load criteria.
 6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center, in at least one surface.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Champion Fiberglass, Inc.
 - c. Cooper B-line; brand of Eaton, Electrical Sector.
 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Channel Width: Selected for applicable load criteria.
 4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
 5. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
 6. Rated Strength: Selected to suit applicable load criteria.
 7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) MKT Fastening, LLC.

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2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
6. Toggle Bolts: All steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA NEIS 101
 2. NECA NEIS 102.
 3. NECA NEIS 105.
 4. NECA NEIS 111.
- B. Firestopping to be provided to restore fire rating of penetrations of fire rated walls.
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as required by NFPA 70. Minimum rod size must be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT IMC and ERMC may be supported by openings through structure members, in accordance with NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 3. To Light Steel: Sheet metal screws.
 4. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

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- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.4 PAINTING

- A. Touchup:
 - 1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION - 260529

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type EMT-A and Type EMT-SS raceways and elbows.
2. Type EMT-S raceways and elbows.
3. Type ENT raceways and fittings.
4. Type EPEC raceways and fittings.
5. Type ERMC-A and Type ERMC-SS raceways, elbows, couplings, and nipples.
6. Type ERMC-S raceways, elbows, couplings, and nipples.
7. Type FMC-S and Type FMC-A raceways.
8. Type FMT raceways.
9. Type IMC raceways.
10. Type LFMC raceways.
11. Type LFNC raceways.
12. Type PVC raceways and fittings.
13. Fittings for conduit, tubing, and cable.
14. Threaded metal joint compound.
15. Solvent cements.
16. Surface metal raceways and fittings.
17. Surface nonmetallic raceways.
18. Strut-type channel raceways and fittings.
19. Wireways and auxiliary gutters.
20. Metallic outlet boxes, device boxes, rings, and covers.
21. Nonmetallic outlet boxes, device boxes, rings, and covers.
22. Termination boxes.
23. Cabinets, cutout boxes, junction boxes, pull boxes, and miscellaneous enclosures.
24. Cover plates for device boxes.
25. Hoods for outlet boxes.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Wireways and auxiliary gutters.
2. Surface metal raceways.
3. Surface nonmetallic raceways.
4. Floor boxes.
5. Cabinets, cutout boxes, and miscellaneous enclosures.

- ##### B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details. Show that floor boxes are located to avoid interferences and are structurally allowable. Indicate floor thickness where boxes are embedded in concrete floors and underfloor clearances where boxes are installed in raised floors.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturers' Instructions:

1. For Type ERMC-S-PVC.

PART 2 - PRODUCTS

2.1 TYPE EMT-A AND TYPE EMT-SS RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 797A and UL Category Control Number FJMX.

B. Aluminum Electrical Metal Tubing (EMT-A) and Elbows:

1. Material: Aluminum.

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

- 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Colors: As indicated on Drawings.
- C. Stainless Steel Electrical Metal Tubing (EMT-SS) and Elbows:
 - 1. Material: Stainless steel.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Colors: As indicated on Drawings.

2.2 TYPE EMT-S RACEWAYS AND ELBOWS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 797 and UL Category Control Number FJMX.
- B. Steel Electrical Metal Tubing (EMT-S) and Elbows:
 - 1. Material: Steel.
 - 2. Options:
 - a. Exterior Coating: Zinc.
 - b. Interior Coating: Zinc.
 - c. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.3 TYPE ENT RACEWAYS AND FITTINGS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1653 and UL Category Control Number FKHU.
- B. Electrical Nonmetallic Tubing (ENT) and Fittings:
 - 1. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Fittings:
 - 1) Mechanically Attached Fittings: UL 1653.
 - 2) Solvent-Attached Fittings: UL 651.

2.4 TYPE EPEC RACEWAYS AND FITTINGS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 651A and UL Category Control Number EAZX.
- B. Schedule 40 Electrical HDPE Underground Conduit (EPEC-40):
 - 1. Dimensional Specifications: Schedule 40.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- C. Schedule 80 Electrical HDPE Underground Conduit (EPEC-80):
 - 1. Dimensional Specifications: Schedule 80.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- D. Type A Electrical HDPE Underground Conduit (EPEC-A):
 - 1. Dimensional Specifications: Type A.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- E. Type B Electrical HDPE Underground Conduit (EPEC-B):
 - 1. Dimensional Specifications: Type B.
 - 2. Options:

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- a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.5 TYPE ERMC-A AND TYPE ERMC-SS RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 6A and UL Category Control Number DYWV.
- B. Aluminum Electrical Rigid Metal Conduit (ERMC-A), Elbows, Couplings, and Nipples:
 - 1. Material: Aluminum.
 - 2. Options:
 - a. Protective Coating: Provide protective coating for use in concrete.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - c. Colors: As indicated on Drawings.
- C. Stainless Steel Electrical Rigid Metal Conduit (ERMC-SS), Elbows, Couplings, and Nipples:
 - 1. Material: Stainless steel.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Colors: As indicated on Drawings.

2.6 TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 6 and UL Category Control Number DYIX.
- B. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:
 - 1. Exterior Coating: Zinc.
 - 2. Options:
 - a. Interior Coating: Zinc.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - c. Colors: As indicated on Drawings.
- C. PVC-Coated-Steel Electrical Rigid Metal Conduit (ERMC-S-PVC), Elbows, Couplings, and Nipples:
 - 1. Additional Characteristics:
 - a. Fittings for PVC-Coated Conduit:
 - 1) Minimum coating thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
 - 2) Conduit bodies must be Form 8 with an effective seal and a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours must be available. Conduit bodies must be supplied with plastic-encapsulated stainless steel cover screws.
 - 3) Form 2 inch long or one pipe diameter long, whichever is less, PVC sleeve at openings of female fittings, except unions. Inside sleeve diameter must be matched to outside diameter of metal conduit.
 - 4) PVC coating on the outside of conduit couplings must be protected from tool damage during installation.
 - 5) Female threads on fittings and couplings must be protected by urethane coating.
 - 6) Fittings must be from same manufacturer as conduit.
 - 7) Beam clamps and U bolts must be formed and sized to fit outside diameter of coated conduit. Plastic-encapsulated nuts must cover the exposed portions of threads.
 - 2. Options:
 - a. Exterior Coating: PVC complying with NEMA RN 1.
 - b. Interior Coating: Zinc.
 - c. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - d. Colors: As indicated on Drawings.
 - e. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - f. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

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2.7 TYPE FMC-S AND TYPE FMC-A RACEWAYS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1 and UL Category Control Number DXUZ.
- B. Steel Flexible Metal Conduit (FMC-S):
 - 1. Material: Steel.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- C. Aluminum Flexible Metal Conduit (FMC-A):
 - 1. Material: Aluminum.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Colors: As indicated on Drawings.

2.8 TYPE FMT RACEWAYS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1652 and UL Category Control Number ILJW.
- B. Steel Flexible Metallic Tubing (FMT):
 - 1. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.9 TYPE IMC RACEWAYS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1242 and UL Category Control Number DYBY.
- B. Steel Electrical Intermediate Metal Conduit (IMC):
 - 1. Options:
 - a. Exterior Coating: Zinc.
 - b. Interior Coating: Zinc.
 - c. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.10 TYPE LFMC RACEWAYS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 360 and UL Category Control Number DXHR.
- B. Steel Liquidtight Flexible Metal Conduit (LFMC-S):
 - 1. Material: Steel.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- C. Stainless Steel Liquidtight Flexible Metal Conduit (LFMC-SS):
 - 1. Material: Stainless steel.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Colors: As indicated on Drawings.

2.11 TYPE LFNC RACEWAYS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1660 and UL Category Control Number DXOQ.

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- B. Layered (Type A) Liquidtight Flexible Nonmetallic Conduit (LFNC-A):
 - 1. Additional Criteria: Type A conduit with smooth seamless inner core and cover bonded together with one or more reinforcement layers between core and cover.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: Sunlight resistant.
- C. Integral (Type B) Liquidtight Flexible Nonmetallic Conduit (LFNC-B):
 - 1. Additional Criteria: Type B conduit with smooth inner surface with integral reinforcement within conduit wall.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: Sunlight resistant.
- D. Corrugated (Type C) Liquidtight Flexible Nonmetallic Conduit (LFNC-C):
 - 1. Additional Criteria: Type C conduit with corrugated internal and external surfaces without integral reinforcement within conduit wall.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: Sunlight resistant.

2.12 TYPE PVC RACEWAYS AND FITTINGS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 651 and UL Category Control Number DZYR.
- B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
 - 1. Dimensional Specifications: Schedule 40.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire.
- C. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:
 - 1. Dimensional Specifications: Schedule 80.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire.
- D. Type A Rigid PVC Concrete-Encased Conduit (PVC-A) and Fittings:
 - 1. Dimensional Specifications: Type A.
 - 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.13 FITTINGS FOR CONDUIT, TUBING, AND CABLE

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- B. Fittings for Type ERM, Type IMC, Type PVC, Type EPEC, and Type RTRC Raceways:
 - 1. General Characteristics: UL 514B and UL Category Control Number DWTT.
 - 2. Options:
 - a. Material: Steel.
 - b. Coupling Method: Compression coupling.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
- C. Fittings for Type EMT Raceways:
 - 1. General Characteristics: UL 514B and UL Category Control Number FKAV.
 - 2. Options:

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- a. Material: Steel.
- b. Coupling Method: Compression coupling.
- c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
- d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

D. Fittings for Type FMC Raceways:

- 1. General Characteristics: UL 514B and UL Category Control Number ILNR.

E. Fittings for Type LFMC and Type LFNC Raceways:

- 1. General Characteristics: UL 514B and UL Category Control Number DXAS.

2.14 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Performance Criteria:

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- 2. General Characteristics: UL 2419 and UL Category Control Number FOIZ.

2.15 SOLVENT CEMENTS

A. Performance Criteria:

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- 2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL Category Control Number DWTT.
- 3. Sustainability Characteristics:

2.16 WIREWAYS AND AUXILIARY GUTTERS

A. Performance Criteria:

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- 2. General Characteristics: UL 870 and UL Category Control Number ZOYX.

B. Metal Wireways and Auxiliary Gutters:

- 1. Additional Characteristics:
 - a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 - b. Finish: Manufacturer's standard enamel finish.
- 2. Options:
 - a. Degree of Protection: Type 1 unless otherwise indicated.
 - b. Wireway Covers: Screw-cover type unless otherwise indicated.

C. Nonmetallic Wireways and Auxiliary Gutters:

- 1. Additional Characteristics:
 - a. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings must match and mate with wireways as required for complete system.
 - b. PVC Solvents and Adhesives: As recommended by wireway manufacturer.
- 2. Options:
 - a. Material:
 - 1) PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

2.17 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- 2. General Characteristics: UL 514A and UL Category Control Number QCIT.

B. Metallic Outlet Boxes:

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1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
 2. Options:
 - a. Material: Sheet steel.
 - b. Sheet Metal Depth: Minimum 2 inch.
 - c. Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.
- C. Metallic Conduit Bodies:
1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
- D. Metallic Device Boxes:
1. Description: Box with provisions for mounting wiring device directly to box.
 2. Options:
 - a. Material: Sheet steel.
 - b. Sheet Metal Depth: minimum 2 inch.
- E. Metallic Extension Rings:
1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
- F. Metallic Floor Boxes and Floor Box Covers:
1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
- G. Metallic Raised-Floor Boxes and Floor Box Covers:
1. Description: Box mounted in raised floor with floor box cover and other components to complete floor box enclosure.
- H. Metallic Recessed Access-Floor Boxes and Recessed Floor Box Covers:
1. Description: Floor box with provisions for mounting wiring devices below floor surface and floor box cover with provisions for passage of cords to recessed wiring devices mounted within floor box.
- I. Metallic Concrete Boxes and Covers:
1. Description: Box intended for use in poured concrete.
- 2.18 NONMETALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS
- A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL 514C and UL Category Control Number QCMZ.
- B. Nonmetallic Outlet Boxes:
1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
- C. Nonmetallic Device Boxes:
1. Description: Box with provisions for mounting wiring device directly to box.
- D. Nonmetallic Extension Rings:
1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
- E. Nonmetallic Floor Boxes and Floor Box Covers:
1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
- F. Nonmetallic Raised-Floor Boxes and Floor Box Covers:
1. Description: Box mounted in raised floor with floor box cover and other components to complete floor box enclosure.

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- G. Nonmetallic Recessed Access-Floor Boxes and Recessed Floor Box Covers:
 - 1. Description: Floor box with provisions for mounting wiring devices below floor surface and floor box cover with provisions for passage of cords to recessed wiring devices mounted within floor box.
- H. Nonmetallic Floor Nozzles:
 - 1. Description: Enclosure intended primarily as housing for receptacle, provided with means, such as collar, for surface-mounting on floor, which may or may not include stem to support it above floor level, and is sealed against the entrance of scrub water at floor level.
- I. Nonmetallic Concrete Boxes and Covers:
 - 1. Description: Box intended for use in poured concrete.

2.19 TERMINATION BOXES

- A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
- B. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1773 and UL Category Control Number XCKT.
- C. Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment:
 - 1. Additional Characteristics: Listed and labeled for installation on load side of service equipment.

2.20 CABINETS, CUTOUT BOXES, JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS ENCLOSURES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. Non-Environmental Characteristics: UL 50.
 - b. Environmental Characteristics: UL 50E.
- B. Indoor Sheet Metal Cabinets:
 - 1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
 - 2. Additional Characteristics: UL Category Control Number CYIV.
 - 3. Options:
 - a. Degree of Protection: Type 1.
- C. Indoor Sheet Metal Cutout Boxes:
 - 1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
 - 2. Additional Characteristics: UL Category Control Number CYIV.
 - 3. Options:
 - a. Degree of Protection: Type 1.
- D. Indoor Sheet Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Additional Characteristics: UL Category Control Number BGUZ.
 - 3. Options:
 - a. Degree of Protection: Type 1.
- E. Indoor Cast-Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Additional Characteristics: UL Category Control Number BGUZ.
 - 3. Options:
 - a. Degree of Protection: Type 1.
- F. Indoor Polymeric Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

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2. Additional Characteristics: UL Category Control Number BGUI.
 3. Options:
 - a. Degree of Protection: Type 1.
- G. Indoor Sheet Metal Miscellaneous Enclosures:
1. Additional Characteristics: UL 1773 and UL Category Control Number XCKT.
 2. Options:
 - a. Degree of Protection: Type 1.
- H. Outdoor Sheet Metal Cabinets:
1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
 2. Additional Characteristics: UL Category Control Number CYIV.
 3. Options:
 - a. Degree of Protection: Type 3R.
- I. Outdoor Sheet Metal Cutout Boxes:
1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
 2. Additional Characteristics: UL Category Control Number CYIV.
 3. Options:
 - a. Degree of Protection: Type 3R.
- J. Outdoor Sheet Metal Junction and Pull Boxes:
1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Additional Characteristics: UL Category Control Number BGUI.
 3. Options:
 - a. Degree of Protection: Type 3R.
- K. Outdoor Cast-Metal Junction and Pull Boxes:
1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Additional Characteristics: UL Category Control Number BGUI.
 3. Options:
 - a. Degree of Protection: Type 3R.
- L. Outdoor Polymeric Junction and Pull Boxes:
1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Additional Characteristics: UL Category Control Number BGUI.
 3. Options:
 - a. Degree of Protection: Type 3R.
- M. Outdoor Sheet Metal Miscellaneous Enclosures:
1. Additional Characteristics: UL 1773 and UL Category Control Number XCKT.
 2. Options:
 - a. Degree of Protection: Type 3R.

2.21 COVER PLATES FOR DEVICES BOXES

- A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics:
 - a. Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - b. Wallplate-Securing Screws: Metal with head color to match wallplate finish.
- B. Metallic Cover Plates for Device Boxes:
1. Options:

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- a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
- b. Wallplate Material: As indicated on architectural Drawings.
- C. Nonmetallic Cover Plates for Device Boxes:
 - 1. Options:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - b. Wallplate Material: As indicated on architectural Drawings.
 - c. Color: As indicated on architectural Drawings.
- D. Illuminating Cover Plates for Device Boxes:
 - 1. Options:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - b. Wallplate Material: As indicated on architectural Drawings.
 - c. Color: As indicated on architectural Drawings.

2.22 HOODS FOR OUTLET BOXES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. Reference Standards:
 - 1) UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
 - b. Mounts to box using fasteners different from wiring device.
- B. Retractable or Reattachable Hoods for Outlet Boxes:
 - 1. Options:
 - a. Provides gray, weatherproof, "while-in-use" cover.
- C. Extra-Duty, While-in-Use Hoods for Outlet Boxes:
 - 1. Additional Characteristics: Marked "Extra-Duty" in accordance with UL 514D.
 - 2. Options:
 - a. Provides gray, weatherproof, "while-in-use" cover.
 - b. Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
 - 1. Exposed and Subject to Severe Physical Damage: ERMCM.
 - 2. Exposed and Subject to Physical Damage: ERMCM.
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 - 3. Exposed and Not Subject to Physical Damage: ERMCM Corrosion-resistant EMT.
 - 4. Concealed Aboveground: EMT.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
- C. Indoors:
 - 1. Exposed and Subject to Severe Physical Damage: ERMCM. Subject to severe physical damage includes the following locations:

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- a. Loading docks.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
 2. Exposed and Subject to Physical Damage: ERM. Subject to physical damage includes the following locations:
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 - b. Stub-ups to above suspended ceilings.
 3. Exposed and Not Subject to Physical Damage: EMT.
 4. Concealed in Ceilings and Interior Walls and Partitions: ERM EMT.
 5. Damp or Wet Locations: ERM Corrosion-resistant EMT.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFM FMC.
- D. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
1. ERM and IMC: Provide threaded type fittings unless otherwise indicated.

3.2 SELECTION OF BOXES AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
- B. Degree of Protection:
1. Outdoors:
 - a. Type 3R unless otherwise indicated.
 - b. Locations Exposed to Hosedown: Type 4.
 - c. Locations Subject to Potential Flooding: Type 6P.
 - d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
 - e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
 - f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.
 2. Indoors:
 - a. Type 1 unless otherwise indicated.
 - b. Damp or Dusty Locations: Type 12.
- C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:
1. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.3 INSTALLATION OF RACEWAYS

- A. Installation Standards:
1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
 2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
 3. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
 4. Comply with NECA NEIS 101 for installation of steel raceways.
 5. Comply with NECA NEIS 102 for installation of aluminum raceways.
 6. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
 7. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
 8. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts.
 9. Raceway Terminations at Locations Subject to Moisture or Vibration:
 - a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- B. General Requirements for Installation of Raceways:

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1. Complete raceway installation before starting conductor installation.
 2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
 3. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
 4. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
 5. Support conduit within 12-inch of enclosures to which attached.
 6. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
 7. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where an underground service raceway enters a building or structure.
 - c. Conduit extending from interior to exterior of building.
 - d. Conduit extending into pressurized duct and equipment.
 - e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - f. Where otherwise required by NFPA 70.
 8. Keep raceways at least 6-inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
 9. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
 10. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12-inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- C. Requirements for Installation of Specific Raceway Types:
1. Types EMT-A, ERMC-A, and FMC-A:
 - a. Do not install aluminum raceways or fittings in contact with concrete or earth.
 2. Types ERMC and IMC:
 - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
 3. Types FMC, LFMC, and LFNC:
 - a. Comply with NEMA RV 3. Provide a maximum of 36 inch of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 4. Types PVC and EPEC:
 - a. Do not install Type PVC or Type EPEC conduit where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
 - b. Comply with manufacturer's written instructions for solvent welding and fittings.
- D. Stub-ups to Above Recessed Ceilings:
1. Provide EMT, IMC, or ERMC for raceways.
 2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- E. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
1. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

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2. EMT: Provide compression, fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

F. Expansion-Joint Fittings:

1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground ERMC and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

G. Raceways Penetrating Rooms or Walls with Acoustical Requirements:

1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.4 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.
- C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
- D. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
- E. Locate boxes so that cover or plate will not span different building finishes.
- F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- I. Set metal floor boxes level and flush with finished floor surface.
- J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
- M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 2. Provide gaskets for wallplates and covers.

3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies to restore original fire rating.

3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.7 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION - 260533

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Labels.
 - 2. Bands and tubes.
 - 3. Tapes and stencils.
 - 4. Tags.
 - 5. Signs.
 - 6. Cable ties.
 - 7. Miscellaneous identification products.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Labels.
 - 2. Bands and tubes.
 - 3. Tapes and stencils.
 - 4. Tags.
 - 5. Signs.
 - 6. Cable ties.
 - 7. Miscellaneous identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with 29 CFR 1910.144 for color identification of hazards; 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs and tags; and the following:
 - 1. Fire-protection and fire-alarm equipment must be finished, painted, or suitably marked safety red.
 - 2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 ft above finished floor.
- C. Signs, labels, and tags required for personnel safety must comply with the following standards:
 - 1. Safety Colors: NEMA Z535.1.
 - 2. Facility Safety Signs: NEMA Z535.2.
 - 3. Safety Symbols: NEMA Z535.3.
 - 4. Product Safety Signs and Labels: NEMA Z535.4.
 - 5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.
- D. Comply with NFPA 70E requirements for arc-flash warning labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, must comply with UL 969.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 1000 V or Less:
 - 1. Black letters on orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - 1. Color must be factory applied or field applied for sizes larger than 8 AWG if authorities having jurisdiction permit.
 - 2. Colors for 208Y/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Colors for 480Y/277 V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 5. Color for Neutral: White or gray.
 - 6. Color for Equipment Grounds: Green.
 - 7. Colors for Isolated Grounds: Green with two or more yellow stripes.
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on orange background.
- D. Warning labels and signs must include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 3 FEET MINIMUM."
- E. Equipment Identification Labels:
 - 1. Black letters on white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3 mil thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.
 - 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over legend. Labels sized such that clear shield overlaps entire printed legend.
 - 3. Marker for Labels:
 - a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3 mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.
 2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inch for raceway and conductors.
 - b. 3-1/2 by 5 inch for equipment.
 - c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

- A. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch long, with diameters sized to suit diameters and that stay in place by gripping action.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F. Comply with UL 224.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.

2.5 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Brady Corporation.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.

2.6 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ideal Industries, Inc.
 2. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F in accordance with ASTM D638: 7000 psi.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F.
 5. Color: Black.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 1000 V: Identification must completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.
- J. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- K. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.
- L. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.
- M. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.
- N. Self-Adhesive Labels:
 - 1. Install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high label; where two lines of text are required, use labels 2 inch high.
- O. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.
- P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.
- Q. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- R. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.
- U. Metal Tags:
 - 1. Place in location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- V. Nonmetallic Preprinted Tags:
 - 1. Place in location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- W. Baked-Enamel Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
 - 2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on minimum 1-1/2 inch high sign; where two lines of text are required, use signs minimum 2 inch high.
- X. Metal-Backed Butyrate Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
 - 2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high sign; where two lines of text are required, use labels 2 inch high.
- Y. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
 - 2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high sign; where two lines of text are required, use labels 2 inch high.
- Z. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Concealed Raceways, Duct Banks, More Than 1000 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3 inch high, black letters on 20 inch centers.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10 ft maximum intervals.
- D. Accessible Raceways and Metal-Clad Cables, 1000 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
- E. Accessible Fittings for Raceways and Cables within Buildings: Identify cover of junction and pull box of the following systems with self-adhesive labels containing wiring system legend and system voltage. System legends must be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- F. Power-Circuit Conductor Identification, 1000 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
- G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with conductor or cable designation, origin, and destination.
- H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with conductor designation.
- I. Conductors to Be Extended in Future: Attach marker tape to conductors and list source.
- J. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- K. Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.
- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- M. Operating Instruction Signs: Self-adhesive labels.
- N. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for load shedding.
- O. Equipment Identification Labels:
 - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of engraved, laminated acrylic or melamine label.
 - b. Access doors and panels for concealed electrical items.
 - c. Emergency system boxes and enclosures.
 - d. Enclosed switches.
 - e. Enclosed circuit breakers.
 - f. Push-button stations.
 - g. Contactors.
 - h. Remote-controlled switches, dimmer modules, and control devices.
 - i. Monitoring and control equipment.
 - j. UPS equipment.

END OF SECTION 260553

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Conductors and cables.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Conductors and cables.
- B. Shop Drawings:
 - 1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Low Voltage Cabling.
 - 2. Interconnection diagrams showing field-installed wiring.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's warranties.

1.4 WARRANTY

- A. Special Extended Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control software.
 - b. Faulty operation of lighting control devices.
 - 2. Extended Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ELECTRONIC TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. Intermatic, Inc.
 - 3. Leviton Manufacturing Co., Inc.
 - 4. Schneider Electric USA, Inc.

2.2 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. General Requirements for Sensors:
 - 1. Hardwired connection to switch.
 - 2. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2.3 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

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- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WIRING

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's instructions.
- C. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by authorities having jurisdiction.
- B. Tests and Inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Nonconforming Work:
 - 1. Lighting control devices will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- D. Prepare test and inspection reports.
- E. Manufacturer Services:
 - 1. Engage factory-authorized service representative to support field tests and inspections.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 MAINTENANCE

- A. Software and Firmware Service Agreement:
 - 1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement include software support for two years.

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2. Upgrade Service: At Substantial Completion, update software and firmware to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Verify upgrading software includes operating system and new or revised licenses for using software.
 - a. Upgrade Notice: No fewer than 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.
3. Upgrade Reports: Prepare written report after each update, documenting upgrades installed.

END OF SECTION 260923

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. General-use switches, dimmer switches, and fan-speed controller switches.
 - 2. General-grade single straight-blade receptacles.
 - 3. General-grade duplex straight-blade receptacles.
 - 4. Locking receptacles.
 - 5. Special-purpose power outlet assemblies.
 - 6. Connectors, cords, and plugs.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260923 "Lighting Control Devices" for occupancy sensors, timers, control-voltage switches, and control-voltage dimmers.

1.2 DEFINITIONS

- A. Commercial/Industrial-Use Cord Reel: A cord reel subject to severe use in factories, commercial garages, construction sites, and similar locations requiring a harder service-type cord.
- B. UL 1472 Type I Dimmer: Dimmer in which air-gap switch is used to energize preset lighting levels.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Single straight-blade receptacles
 - 2. Duplex straight-blade receptacles.
 - 3. Duplex straight-blade receptacles with integral switching means.
 - 4. Receptacles with GFCI device.
- B. Shop Drawings:
 - 1. Wiring diagrams for duplex straight-blade receptacles with integral switching means.
- C. Field Quality-Control Submittals:
 - 1. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturers' Instructions: Record copy of official installation instructions issued to Installer by manufacturer for the following:
 - 1. Single straight-blade receptacles.
 - 2. Duplex straight-blade receptacles.
 - 3. Duplex straight-blade receptacles with integral switching means.
 - 4. Receptacles with GFCI device.
- B. Sample warranties.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Items: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. SPD Receptacles: Equal to 10 percent of quantity installed for each kind specified, but no fewer than one unit.

1.6 WARRANTY FOR DEVICES

- A. Special Manufacturer Extended Warranty: Manufacturer warrants that devices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.
 - 1. Extended Warranty Period: Three years from date of Substantial Completion; full coverage for labor, materials, and equipment.

WIRING DEVICES

PART 2 - PRODUCTS

2.1 GENERAL-GRADE SINGLE STRAIGHT-BLADE RECEPTACLES

A. Single Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour; Legrand North America, LLC.
2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
3. General Characteristics:
 - a. Reference Standards: UL CCN RTRT and UL 498.
4. Options:
 - a. Device Color: As indicated on architectural Drawings.
 - b. Configuration:
 - 1) General-duty, NEMA 5-20R.
 - 2) Heavy-duty, NEMA 14-30R (Dryer).
5. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.2 GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

A. Duplex Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour; Legrand North America, LLC.
2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
3. General Characteristics:
 - a. Reference Standards: UL CCN RTRT and UL 498.
4. Options:
 - a. Device Color: As indicated on architectural Drawings.
 - b. Configuration:
 - 1) General-duty, NEMA 5-20R.
5. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

B. Wired Full-Controlled Duplex Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Lighting; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. Pass & Seymour; Legrand North America, LLC.
2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
3. General Characteristics:
 - a. Reference Standards: UL CCN RTX1 and UL Subject 498B.
4. Options:

WIRING DEVICES

- a. Device Color: As indicated on architectural Drawings.
- b. Configuration: NEMA 5-20R.
5. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receptacles:

1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.2 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
4. Consult Architect for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES

A. Tests and Inspections:

1. Insert and remove test plug to verify that device is securely mounted.
2. Verify polarity of hot and neutral pins.
3. Measure line voltage.
4. Measure percent voltage drop.
5. Measure grounding circuit continuity: impedance must be not greater than 2 ohms.

B. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Assemble and submit test and inspection reports.

3.4 PROTECTION

A. Devices:

1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 262726

LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Luminaire-mounted photoelectric relays.
 - 2. Luminaire types.
 - 3. Materials.
 - 4. Finishes.
 - 5. Luminaire support components.
- B. Related Requirements:
 - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaire.
 - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - 5. Wiring diagrams for power, control, and signal wiring.
 - 6. Photoelectric relays.
 - 7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Luminaires.
 - 2. Structural members to which equipment and luminaires will be attached.
 - 3. Underground utilities and structures.
 - 4. Existing underground utilities and structures.
 - 5. Above-grade utilities and structures.
 - 6. Existing above-grade utilities and structures.
 - 7. Vertical and horizontal information.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

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- D. Product Certificates: For each type of the following:
 - 1. Luminaire.
 - 2. Photoelectric relay.
 - E. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.
 - F. Source quality-control reports.
 - G. Sample warranty.
- 1.6 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.
- 1.8 QUALITY ASSURANCE
- A. Luminaire Photometric Data Testing Laboratory Qualifications:
 - 1. Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
 - 2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
 - B. Provide luminaires from a single manufacturer for each luminaire type.
 - C. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.
- 1.10 FIELD CONDITIONS
- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
 - B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.
- 1.11 WARRANTY
- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including luminaire support components.
 - b. Faulty operation of luminaires and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance:
 - 1. Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 2. Luminaires and lamps shall be labeled vibration and shock resistant.

LED EXTERIOR LIGHTING

3. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. CRI of minimum 80 and CCT of 3000K.
- F. L70 lamp life of 50,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: 120 V ac.
- J. In-line Fusing: Separate in-line fuse for each luminaire.
- K. Source Limitations:
 1. Obtain luminaires from single source from a single manufacturer.
 2. For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton.
 2. Intermatic, Inc.
 3. Lithonia Lighting; Acuity Brands Lighting, Inc.
- B. Comply with UL 773 or UL 773A.
- C. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay.
 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 2. Adjustable window slide for adjusting on-off set points.

2.4 LUMINAIRE TYPES

- A. Bollard:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Lighting Solutions; Signify North America Corp.
 - b. Kim Lighting; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. Lithonia Lighting; Acuity Brands Lighting, Inc.

2.5 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Stainless steel. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- D. Diffusers and Globes:
 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

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- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- G. Housings:
 - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
 - 2. Provide filter/breather for enclosed luminaires.
- H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.6 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
 - 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
- D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

2.7 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

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- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

3.4 GROUND-MOUNTED LUMINAIRES

- A. Aim as indicated on Drawings.

3.5 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
 - a. IES LM-5.
 - b. IES LM-50.
 - c. IES LM-52.
 - d. IES LM-64.
 - e. IES LM-72.
 - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

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3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.9 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265619

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing existing vegetation.
 - 2. Clearing and grubbing.
 - 3. Stripping, stockpiling and disposal of topsoil.
 - 4. Stripping and stockpiling and disposal of rock.
 - 5. Contaminated or hazardous material.
 - 6. Disposal of surplus or waste material.
- B. Related Requirements:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Erosion Control Drawings.
 - 3. Section 015639 "Temporary Tree and Plant Protection" for tree protection fencing and requirements for clearing and grubbing within Root Protection Zones, in addition to protection of existing wetland areas.
 - 4. Section 024119 "Selective Demolition" for partial disconnecting, capping or sealing, and removing site utilities and removing above- and below-grade site improvements.
 - 5. Section 312000 "Earth Moving" for procedure to determine if soil is unsatisfactory or unsuitable for reuse as fill.

1.2 MEASUREMENT AND PAYMENT

- A. Lump sum price includes all Work described in this Section including incidental work necessary to achieve a clear dirt surface on the site, and all handling, recycling, hauling and disposal.
- B. Removal of existing stumps not resulting from tree removal operations, having trunk remainders larger than 12 inches will be paid for according to unit prices established in Construct Contract Document.

1.3 DEFINITIONS

- A. Boulder: As defined in Section 312000 "Earth Moving".
- B. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- C. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETING

- A. Preinstallation Conference: Conduct conference at Project site to review clearing limits, tree and plant protection requirements, and stockpiling and removal requirements.

1.5 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property.
 - 1. Remove from Project site and legally dispose of cleared materials.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

SITE CLEARING

1.6 SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed digital photographs or video recordings.
 - a. Date stamped.
 - b. Recorded at a resolution sufficient to show details.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
- B. Approved Application for Pesticide Use on Albany Parks Property.
- C. Topsoil stripping and stockpiling program.

1.7 QUALITY ASSURANCE

- A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

- A. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Owner.
- B. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- C. Utility locates: Call the Oregon Utility Notification Center at 811 for underground utility locations 48 hours in advance of removing soil materials.
- D. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Herbicide: As approved by Albany Parks and Recreation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Stake boundaries of horizontal clearing limits indicated prior to pre-installation meeting.
 - 1. Do not permit disturbance beyond staked clearing area.
- B. Protect and maintain benchmarks and survey control points from disturbance during construction.
- C. Verify that protection measures are in place, including:
 - 1. Perimeter fencing.
 - 2. Erosion control measures.
 - 3. Tree and plant protection fencing.
 - 4. Protect existing site improvements to remain from damage caused by settlement, lateral movement, undermining, washout or any other change caused by operations of this Section.

3.2 CLEARING AND GRUBBING

- A. Remove trees, shrubs, and other living or dead vegetation, boulders, incidental refuse and obstructions to permit installation of new construction. Clearing includes removing or salvaging downed timber and removal of fences, gates, sign posts and other incidental improvements.
 - 1. Do not disturb any portion of the delineated wetland area.
 - 2. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - a. Prune minor roots and branches of trees and shrubs indicated to remain that will conflict with new construction according to requirements of Section 015639 "Tree and Plant Protection."
 - 3. Stumps: Grind down stumps, whether existing or resulting from tree removal operations, and whether indicated on Drawings or not.

SITE CLEARING

- a. Remove roots larger than 2 inches in diameter.
4. Use only hand methods or air spade for grubbing within protection zones.
5. Remove sod to a depth of 2 inches.
6. Chip removed tree branches and dispose of off-site.
7. Obstructions, refuse and debris, including boulders: remove to a depth of 18 inches below exposed subgrade.

3.3 TOPSOIL STRIPPING

- A. Remove herbaceous materials, including grasses and weeds, before stripping topsoil.
 1. Mow all sod or grassy areas to be cleared.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots larger than 1/2 inch, root mats, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 1. Limit height of topsoil stockpiles to 48 inches.
 2. Shape stockpiles to drain water.
 3. Prevent stockpiles from emitting wind-blown dust.
 4. Do not stockpile topsoil within root protection zones.
 5. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.4 CONTAMINATED OR HAZARDOUS MATERIAL

- A. Should any asbestos-containing material, underground storage tank, toxic or contaminated soil or questionable material that is not already indicated in the contract documents be encountered during the Work, perform the following in addition to the provisions of the General Conditions of the Contract:
 1. Immediately notify Owner, Oregon Department of Environmental Quality and all other Authorities Having Jurisdiction.
 2. Do not proceed with Work in the affected area before allowing Owner sufficient time to determine extent of condition.
- B. If corrective measures are required, authorized additional work will be paid for according to Contract provisions for changes in the Work.

3.5 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil and rock material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Excavating and filling for rough grading the Site.
 2. Preparing subgrades for slabs-on-grade, walks, pavements, play surfacing, turf and grasses, and planting areas.
 3. Drainage course for concrete slabs-on-grade.
 4. Subbase and base course for concrete walks and pavements.
 5. Subsurface drainage backfill for walls and trenches.
 6. Excavating and backfilling for utility trenches.
 7. Excavating and backfilling for electrical and irrigation trenches.
- B. Related Requirements:
1. City of Albany Standard Construction Specifications.
 2. Erosion Control Drawings.
 3. Section 015639 "Temporary Tree and Plant Protection" for excavation around and within the Root Protection Zones (RPZs) of trees and planting areas to remain.
 4. Section 024119 "Selective Demolition" for removal of selected above- and below-grade utilities and site improvements.
 5. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil.
 6. Section 320523 "Pervious Concrete Paving" for aggregate bases of pervious concrete pavements.
 7. Section 321313 "Standard Concrete Paving" for standard concrete pavements.
 8. Section 329200 "Seeded Lawns" for finish grading in lawn and grass areas, including preparing and placing planting soil for lawn areas.
 9. Section 329113 "Soil Preparation" for requirements for topsoil suitable for amending into planting soil.
 10. Section 329300 "Trees, Plants and Ground Covers" for finish grading in planting areas and tree and shrub pit excavation and planting.
 11. Section 331100 "Water System" for requirements related to water system installation.
 12. Section 334100 "Storm Drainage System" for requirements for drain rock related to storm drainage systems.
 13. Section 334600 "Subdrainage Systems" for requirements related to subsurface drainage.

1.2 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength 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. Backslope: In soft surface trail installation, the cutbank uphill of the trail tread.
- C. Base Course: Structural layer immediately beneath a paving installation, footing or other structure.
- D. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- F. Boulder: A single fragment of rock with a nominal size greater than 2 feet in diameter.
- G. Drainage Course: Compacted aggregate layer supporting concrete slab-on-grade that also minimizes upward capillary flow of pore water.
- H. 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 Owner.
 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.

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- I. Fill: Soil materials used to raise existing grades.
- J. Full Bench: In soft surface trail installation, used to describe a trail in which the full width of the tread and base course are constructed on native subsoil.
- K. Match Point: In trail or path installation, the point at which graded surfaces meet undisturbed surfaces.
- L. Rock: Natural deposit of solid material composed of one or more minerals occurring in large masses or fragments.
- M. Sideslope: In soft surface trail installation, the undisturbed slope of a hillside.
- N. Subbase Course: Course placed between subgrade and base course.
- O. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill on which subbase, drainage course, bedding, base, tread or topsoil materials are to be placed. Subgrade soils refers to soils originating from layer below topsoil.

1.3 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO M 43, Sizes of Coarse Aggregate.
 - 2. AASHTO M 288, Standard Specification for Transportation Materials and Methods of Sampling and Testing.
- B. American Society of Testing and Materials (ASTM):
 - 1. ASTM D 698, Maximum Dry Density and Percent of Maximum Dry Density at Optimum Moisture Content for Cohesive Soils: Determined by Standard Proctor Test.
 - 2. ASTM D 1557, Maximum Dry Density and Percent of Maximum Dry Density at Optimum Moisture Content for Cohesive Soils: Determined by Modified Proctor Test.
 - 3. ASTM D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 4. ASTM D 3740, Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 5. ASTM D 4253, Standard Test Methods for Maximum Dry Density and Unit Weight of Soils Using a Vibratory Table.
 - 6. ASTM D 4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - 7. ASTM D 4355....(about geotextile UV stability.....)
 - 8. ASTM D 4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - 9. ASTM D 4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 10. ASTM D 4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - 11. ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - 12. ASTM D 4833, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
 - 13. ASTM E 96-A, Standard Test Methods for Water Vapor Transmission of Materials.
 - 14. ASTM E 329, Standard Specification for Agencies Engaged in Construction Inspection, Testing or Special Inspection.
- C. Oregon Occupational Safety & Health Administration (OR-OSHA).

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct pre-excavation conference at Project site.
 - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Review of erosion control requirements.
 - c. Coordination of Work with utility locator service.
 - d. Coordination of Work with electrical, irrigation and utility subcontractors.
 - e. Coordination of sequencing, locations and elevations for sleeves and conduits.
 - f. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
 - g. Extent of trenching by hand or with air spade.
 - h. Field quality control.

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1.5 ACTION SUBMITTALS

- A. Product Data: For each type manufactured product required, including but not limited to:
 - 1. Geotextiles.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Warning tapes.
 - 4. Tracer wire.
- B. Samples for Verification, in sizes indicated below:
 - 1. Geotextile: 12 by 12 inches.
 - 2. Warning Tape: 12 inches long; of each color.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 698.
 - 3. Submit with each soil and aggregate test report a written statement indicating the source and character of each sample tested.
- C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.7 QUALITY ASSURANCE

- A. Contractor shall employ testing agency for all inspections and testing.
 - 1. Geotechnical Testing Agency Qualifications: Qualified according to ASTM D 3740 for testing indicated.
- B. Comply with requirements of the geotechnical report.
 - 1. Testing agency shall inspect and test subgrades and each fill or backfill layer. Proceed with subsequent activities only after test results for previously completed work comply with requirements.

1.8 FIELD CONDITIONS

- A. Temperature Requirements:
 - 1. Do not excavate, fill, backfill, compact soils, or place or grade base courses, unless ambient air temperature is above 35 degrees F.
- B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
- C. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Owner.
- D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in the Erosion Control Drawings and Section 015639 "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. Owner makes no guarantee or representation by implication or otherwise that any material available on the site is satisfactory for incorporation into any portion of the Project.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487; free of rock or gravel larger than 2 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.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

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2. Unless otherwise approved by Owner in writing, all contaminated soils are unsatisfactory soils.
3. No material will be considered unsatisfactory solely because special or additional processing or handling is required to make it suitable for incorporation into the Project.

2.2 AGGREGATES

- A. Aggregates are granular soil materials.
- B. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- C. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- D. Medium Aggregate: Washed angular crushed rock, 100 percent passing a 3/4" sieve, and not more than 12 percent passing a 200 sieve (washed analysis).
- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-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/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- 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 zero to 5 percent passing a No. 8 sieve.
 1. Refer to Section 33 4100 "Storm Drainage System" for aggregates related to storm drainage systems and drywells.
- H. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.
- I. Sand: ASTM C 33/C 33M; fine aggregate.
- J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.3 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 1. Survivability: Class 2; AASHTO M 288.
 2. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 3. Permittivity: 0.2 per second, minimum; ASTM D 4491.
 4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 1. Survivability: Class 2; AASHTO M 288.
 2. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 3. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.4 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 as follows:
 1. Red: Electric.

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2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water or irrigation systems.
5. Green: Sewer or drainage systems.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that erosion and sedimentation, tree and plant protection and other temporary controls specified are in place and approved before beginning work.
- B. Review locate marks.
- C. Examine subsoil and existing site conditions for compliance with requirements and for conditions affecting performance of Work of this Section. Do not proceed with work until unsatisfactory conditions have been corrected.
- D. Examine subsoil for moisture content, density, contamination and existing site drainage conditions.

3.2 PREPARATION

- A. Conduct Preinstallation conference.
- B. 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.
 1. Protect existing surfaces from wheel and track damage by covering with heavy timber dunnage and temporary soil materials.
- C. Protect and maintain erosion and sedimentation, tree protection and other temporary controls during earth-moving operations.
- D. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.3 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Do not pump or reroute water into storm or sanitary sewer drains, streets or natural drainageways without written permission from City of Albany.

3.4 WATERING

- A. Furnish and apply water when required to apply water in order to achieve optimal moisture content and for alleviation of dust nuisance.

3.5 EXCAVATION, GENERAL

- A. Excavation is Classified as earth and rock. Additional Contract Sum and, if applicable, Contract Time will be authorized for excavation of rock or obstructions.
 1. Excavate to subgrade elevations. Do not excavate rock until it has been classified and measured by Owner.
 2. Earth excavation includes excavating soil, rock fragments up to 2 feet in diameter and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 3. Rock excavation includes removal and disposal of rock and boulders. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.

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- d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
- e. 6 inches beneath bottom of concrete slabs-on-grade.
- f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.6 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand or using excavating equipment with electronic grade control systems to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - a. Remove all surface silt soils from footing and foundation excavations.
 - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
 - 3. Tree- and Plant-Protection Zones:
 - a. Refer to requirements of Section 015639 "Temporary Tree and Plant Protection".
 - b. Do not break, tear, or chop exposed roots.
 - c. Do not use mechanical equipment that rips, tears, or pulls roots.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.8 UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 - 2. Provide trench walls and bottoms free from rocks, debris or protruding objects.
- B. Excavate trenches to uniform widths to provide the following clearances 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: As indicated on the Drawings.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - 1. In rock or other unyielding bearing material, excavate trenches 6 inches deeper than elevation required to allow for bedding course.
- D. Trenches in Tree- and Plant-Protection Zones:
 - 1. Refer to requirements of Section 015639 "Temporary Tree and Plant Protection".
 - 2. Do not use mechanical equipment that may break, tear, or chop exposed roots.

3.9 EXCAVATION FOR IRRIGATION AND ELECTRICAL TRENCHES

- A. Prior to trenching or installation, field stake proposed irrigation lines wherever they pass under existing tree canopies. Stake proposed new tree planting and sign locations as well prior to any trenching or installation. Call for inspection a minimum of 48 hours prior to anticipated trenching.
- B. Trench Depths: Provide minimum cover as indicated in the Drawings or as directed by Owner.
- C. Trench Widths: Provide minimum clearances as indicated in the Drawings.
- D. Trench Bottoms:
 - 1. Provide smooth, level trench bottoms free of rocks or sharp-edged objects.
 - 2. Keep trenches free of debris during construction.

3.10 SUBGRADE INSPECTION

- A. Notify Owner when excavations have reached required subgrade.

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- B. If Owner determines that unsatisfactory soil is present in the subgrade, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Do not proof-roll wet or saturated subgrades.
 - 2. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner, and replace with compacted backfill or fill as directed.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner, without additional compensation.

3.11 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 Owner.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner.
- B. If trenches are over excavated or experience sloughing or overbreak, restore to indicated dimensions as directed by Owner.

3.12 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 stockpiles from emitting windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.13 BACKFILL, GENERAL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Recording locations of underground utilities for record documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring, bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.14 UTILITY TRENCH BACKFILL

- A. 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.
- B. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete".
- C. Backfill voids with satisfactory soil while removing shoring and bracing.
- D. Initial Backfill:
 - 1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
 - a. 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.
 - 2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

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- E. Final Backfill:
 - 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Warning Tape: Install detectable warning tape directly above utilities, as indicated below finished grade, except 6 inches below subgrade under pavements and slabs.

3.15 IRRIGATION AND ELECTRICAL TRENCH BACKFILL

- A. Backfill trenches only after required inspection and testing, and after receiving written approval from Owner. Notify Owner a minimum of 48 hours in advance when requesting inspection.
- B. Electrical trench backfill:
 - 1. Interior trenches: Sand or pea gravel.
 - 2. Exterior trenches: 3 inches Sand, then excavated material with final 8 inches of clean soil.
- C. Stones larger than 1 inch in diameter are not allowed in backfill material.
 - 1. Place and compact bedding course on trench bottoms as indicated to provide continuous support for pipe, cable, sleeve or conduit.
- D. Irrigation Backfill: Completely fill trench with backfill material.
 - 1. Fill all voids and tamp thoroughly in compacted layers of 6 inches at a time. Place and compact soil to prevent settling of final trench grades.
 - 2. Compact to 85 percent of maximum density at optimum moisture.
- E. Location Devices:
 - 1. Tracer Wire: Install tracer wire directly above pressurized piping and specified nonmetallic pipes as indicated below finished grade, except 6 inches below subgrade under pavements and slabs.
 - 2. Electrical Trenches: Install detectable warning tape above high voltage cable or conduit runs 12 inches below finished grade.

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.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.17 SOIL MOISTURE CONTROL

- A. Mass earthwork is prohibited during periods of wet weather, except as recommended in the field by the geotechnical engineer.
- B. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Wet and mix as directed material that does not contain sufficient moisture to obtain proper compaction. Dry by manipulation, aeration, drainage or other means material containing an excess of moisture for proper compaction.
 - 2. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 3. Perform aeration work in dry weather.
 - 4. Scarify and aerate or remove and replace otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified density.

3.18 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 12 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 density according to ASTM D 698:

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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 95 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, electrical and irrigation trenches, compact each layer of initial and final backfill soil material 85 percent.

3.19 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.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 1. Soft surface trail, lawn or unpaved areas: Plus or minus 1 inch.
 2. Concrete slabs, curbs, footings, walks and pavements: Plus 1/4 inch above or minus 1/2 inch below.
 3. Asphalt Concrete Pavements: Plus or minus 1/2 inch.

3.20 SUBSURFACE DRAINAGE

- A. Subsurface Drain: install per the requirements of Section 334600 "Subdrainage Systems".
 1. Compact each filter material layer to 95 percent of maximum dry density according to ASTM D 698.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 1. Compact each filter material layer to 85 percent of maximum dry density according to ASTM D 698.

3.21 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase and base courses on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course, if indicated, and base course under pavements and walks as follows:
 1. Place base course material over subbase course.
 2. Shape subbase and base courses to required crown elevations and cross-slope grades.
 3. Subbase and base courses 6 inches or less in compacted thickness: Place in a single layer.
 4. Subbase and base courses that exceed 6 inches in compacted thickness: Place in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 5. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry density according to ASTM D 698.
 - a. Finish grade top of base courses below concrete slabs, curbs, footings and walks to plus 1/4 inch above or minus 1/2 inch below elevations indicated.
 - b. Finish grade top of aggregate base courses below asphalt concrete paving to plus or minus 1/2 inch elevation indicated.
- C. Pavement Shoulders:
 1. Place shoulders along edges of subbase and base course to prevent lateral movement.
 2. Construct shoulders, at least 6 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry density according to ASTM D 698.

3.22 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

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1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Drainage course 6 inches or less in compacted thickness: Place in a single layer.
3. Drainage course that exceeds 6 inches in compacted thickness: Place in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry density according to ASTM D 698.

3.23 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor shall engage a qualified inspector to perform the following special inspections:
 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 2. Determine that fill material classification and maximum lift thickness comply with requirements.
 3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. 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.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Owner.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, 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 every 150 feet or less of trench length but no fewer than two tests.
- F. 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.

3.24 PROTECTION

- A. Do not allow trucks with water seeping or draining from truck beds to leave site.
- B. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- C. 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.
 1. Scarify or remove and replace soil material to depth as directed by Owner; reshape and recompact.
- D. 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.

3.25 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Owner.
 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

PERVIOUS CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY:

- A. This Section includes pervious concrete pavement for pedestrian areas, as follows:
 - 1. Site Design Requirements.
 - a. Pervious pavements should be isolated from sediment sources by impervious structures or grade separation.
 - 1) Drain adjacent impervious surfaces away from the pervious pavement to minimize sediment exposure.
 - 2) If draining impervious vehicular paved surfaces onto a pervious pavement is unavoidable, install a cleanable trench drain, back up drainage, or other sediment isolating feature between impervious and pervious surfaces.
 - 3) Do not use narrow strips of pervious as a trench drain.
 - 4) Asphalt pavements with traffic exposure shall not be allowed to drain onto pervious because of known asphalt tailing issues that cause difficult to remove clogging issues.
 - b. Use "Shed Roof" pavement configuration, instead of "Valley" or Crowned pavement details. Valleys and crowns are asphalt designs that are not recommended for pervious pavements due to difficulty in construction, increased maintenance, and decrease useful life of the valley area due to sediment concentration.
 - c. Fine-grain pervious concrete is designed primarily for pedestrian applications. Except for residential driveway approaches, vehicular applications require increased sediment control, increased depth for structural strength, and should not be attempted without contacting Evolution Pervious Resources (manufacturer) for more complete details and limitations.
 - 2. Sub-grade preparation.
 - 3. Installation of Pervious Concrete Pavement.
- B. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Erosion Control Drawings.
 - 3. Section 312000 – Earth Moving
 - 4. Section 321313 – Standard Pedestrian Concrete Paving
 - 5. Section 321373 – Concrete Joint Sealants

1.2 REFERENCES

- A. Use the latest revision of each reference.
- B. Annual Book of ASTM Standards, American Society for Testing and Materials (ASTM) Standards, Material References:
- C. ASTM C 29 "Test for Unit Weight and Voids in Aggregate."
- D. ASTM C 33 "Specification for Concrete Aggregates".
- E. ASTM C 94 "Specification for Ready-Mixed Concrete".
- F. ASTM C 150 "Specifications for Portland Cement" (Types I or II only).
- G. ASTM C 172 "Specification for Sampling Freshly Mixed Concrete
- H. ASTM C 494 "Specification for Chemical Admixtures for Concrete."
- I. ASTM C 595 "Specifications for Blended Hydraulic Cements" (Types IP or IS only).
- J. ASTM C1688 "Standard Test for Density and Voids Content of Freshly Mixed Pervious Concrete".
- K. ASTM C1701 "Standard Test Method for Infiltration Rate of In Place Pervious Concrete".
- L. ASTM C 1692 Clean Potable Water
- M. NRMCA Pervious in Practice Design Guidelines dated 2016 or newer.
- N. NRMCA Pervious Qualified Contractors Manual 2016 or newer.
- O. Evolution Paving Resources 'Pervious Concrete Owner's Manual and Maintenance Guide' 2020 or newer.
- P. NRMCA Pervious Maintenance Guide Manual dated 2016 or newer.

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- Q. ACI 522-20 with multiple exceptions when using Evolution fine-grain pervious concrete.
- R. ACI 306R "Cold Weather Concreting"
 - 1. With specific exceptions pertaining to pervious concrete as noted in Paragraph 1.4.D.1, below.

1.3 SUBMITTALS

- A. Submit under provisions of Section 013300 – Submittal Procedures.
- B. Submit the following for review and approval by the design professional in time for approval and corrections if necessary.
 - 1. Aggregate gradations, unit weight and specific gravity. Fine-Grain is defined as at least 95 percent passing the 3/16" fine-aggregate (sand) sieve. This is NOT a 1/4" coarse aggregate.
 - 2. Mix design as specified in Section 2.
 - 3. Certificates of Qualifications for Pervious Contractors per ACI 522-20 or newer.
 - 4. 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 5 Inspections, Testing, and Acceptance.
 - 5. One (1) permeability test result from the proposed mix mockup placement: In inches per hour as determined by ASTM C 1701 or an approved equal permeability test. Also, provide conversion to permeability in inches and mm per day if requested.
 - 6. Jointing plan, if not specified or different from the plans. Spacing shall be 10' on center or less.
 - 7. An owner's manual for cleaning, repair, and maintenance for installed pervious pavement. Evolution Pervious or NRMCA Pervious Maintenance Guide Manuals dated 2017 or newer.
 - 8. One-Year Limited Warranty for installed pervious pavement.

1.4 QUALITY ASSURANCE

- A. Perform work in this section in accordance with qualifications for consultants, concrete suppliers, installation contractor and testing companies shown in 1.6 below unless otherwise authorized by the design professional of record.
- B. Be advised, this document is based on ACI 522.1-20, "Specifications for Pervious Concrete Pavements".
- C. Advancements in pervious pavement site designs, mix designs and the evolution of pervious new installation techniques, and tools are included in this "2021 Specification. Some tools and practices have from older pervious specifications have been eliminated due to poor performance. Fine-Grain pervious mixes differ from coarse grain-mixes so if this specification conflicts with ACI 522.20, this specification takes precedence.
- D. Follow recommendations of ACI 306R when concreting during cold weather.
 - 1. Sections within 306R related to Heated Water, Slump, Compressive Strength, Walls, Maturity meters, Cement content, and Accelerators do not apply to pervious concrete.

1.5 QUALIFICATIONS: CONSULTANTS, INSTALLERS, PRODUCT SUPPLIERS

- A. Qualifications for Approved Pervious Consultants:
 - 1. Must hold a certification from NRMCA, CPG, or NPCPA "Pervious Craftsman Certificate" and show references for pervious job supervision and be approved by design professional of record.
- B. Qualifications for Pervious Contractors.
 - 1. The Pervious contractor must have one of the following qualified personnel options on site for all preconstruction meetings, mockup installations and during all pervious placements.
 - 2. One currently Certified Pervious Craftsman with experience placing fine-grain pervious.
 - 3. Or three currently Certified Pervious "Installers with experience installing fine-grain pervious.
 - 4. If the pervious installer does not employ qualified certified personnel, at their expense, they may hire a qualified Pervious Craftsman with fine-grain experience to be present during all placements & required preconstruction meetings and mockup pours.
- C. Pervious Concrete Supplier
 - 1. The pervious concrete supplier must be authorized in writing or have a manufacturer representative on site for all preconstruction meetings, and at the beginning of each day's pour to inspect and confirm the pervious mix is the specified mix approved for the project.

1.6 PROJECT CONDITIONS

- A. Protection of Existing Improvements.

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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 because of construction work, to their original condition or repair as directed to the satisfaction of the design professional of record.
 4. Contractor shall document the site with photos or video prior to starting any work. Copies of the photos and/or video shall be provided to the engineer and owner prior to starting work.
- 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. The standard installation temperature range for pervious concrete is between 40°F and 80°F. Lower or warmer temperatures are allowable if the contractor provides written details what will be done to prevent damage caused by installing in warmer or colder conditions and the design professional of record signs off on these alternate mix or placement adjustments.
 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.
 3. Do not place fine-grain pervious in the rain, unless the fresh mix can be completely isolated from rain during placement, finishing and curing.

1.7 CHANGES TO THIS SPECIFICATION PROHIBITED WITHOUT AUTHORIZATION

- A. Changes that cut or paste from other pervious specifications or from standard concrete specification requirements, such as tooling, timing, testing, installer qualifications are strictly prohibited without written comments from an NRMCA Pervious Craftsman familiar with fine-grain pervious concrete.

PART 2 - PRODUCTS

2.1 Concrete Mix Design

- A. Contractor shall furnish to the design professional of record a fine-grain mix design for approval prior to the sample pour being placed. The mix design shall include:
1. Mix identification name or number.
 2. Cementitious materials by amount and type.
 3. Water cement ratio.
 4. Aggregate void content as determined by ASTM C29.
 5. Admixtures 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 C1688.
 8. Integral color, if used, shall include brand, color, and dosage rate.

2.2 MATERIALS

- A. Pervious Concrete:
1. Cement: Type 1-2 Portland cements used locally to produce standard concrete are acceptable with engineer's approval.
 2. Slag at 30 percent maximum, or Fly Ash Type C, or F at 20 percent maximum replacement for Portland Cement is allowed. Be aware the use of Fly Ash or Slag can significantly retard set time in temperatures below 50 degrees F.
 3. Aggregate:
 - a. Aggregate must have a specific gravity of 2.60 or higher unless authorized by manufacturer.
 - b. All aggregate approved for use in pervious concrete must be washed rock, free of coatings or other contaminants, unless otherwise approved by the design professional of record.

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- c. The fine-grain aggregate specified is a washed, fine crushed aggregate (specifically graded manufactured sand).
 - 1) The gradation must have at least 95 percent passing 3/16-inch sand sieve and 16 percent or less passing the #30 sand sieve, unless otherwise approved by the manufacturer and permeability minimums are met.
 - 2) Aggregate containing a minimum void content of 40 percent, as determined by ASTM C29, is preferred. If the coarse sand exceeds 43 percent voids, standard ASTM C 33 concrete sand may be blended with the coarse sand to reduce voids.
- d. Alternate void content is allowable if the supplier can demonstrate the mix design proposed allows at least a 0.34 water cement ratio, 15 to 25 percent mix voids, and still meet permeability requirements.
- 4. Admixtures.
 - a. Internal curing required. Use HydroMax® Internal curing admixture. "Internal Curing" is defined as water held in suspension within the mix via super absorbent polymers. Use of saturated lightweight sand is prohibited.
 - b. Use of Hydration set extending/stabilizing admixtures like BASF MasterSet/Delvo® or approved equal is required to extend the delivery and unloading time limit in accordance to manufacturers recommendation of set delay. Set extending admixtures may be used to extended delivery and discharge time longer than 120 minutes if used as prescribed by manufacturers dosage charts. This is a change in 522-20 that used to limit time to 60 minutes 120 minutes with set extending admixtures.
 - c. All admixtures shall be used per manufacturer's recommendations.
 - d. Retarders are not an approved equal.
- 5. Water: Clean potable water shall be used per ASTM C 1602.
- 6. Proportions
 - a. Total cementitious material of fine-grain pervious shall not be less than 550 lbs. per CY unless otherwise approved by the manufacturer and the engineer.
 - b. Slag cement and Fly ash are not recommended but are allowed.
 - c. The volume of aggregate, cement, water, and admixture per cubic yard calculated as a function of the unit weight as determined by ASTM C1688 Standard Test for Density and Voids Content of Freshly Mixed Pervious Concrete and must be adjusted to result in a yield of 27 cubic feet per cubic yard
 - d. The unit weight per CY of the concrete shall be +/- 5 lbs. of the design unit weight.
 - e. 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. After accounting for free water on the aggregates, the water cement ratio required should be at least .34 and may be has high as .41.
 - f. Voids in the mix must be adjusted if necessary, to maintain voids between 15 and 25 percent as tested by ASTM C1688. Ideal void content: 20 percent +/- 5 percent.

2.3 TRANSPORTATION & BATCHING METHODS:

- A. Standard Ready-Mix Concrete Trucks
 - 1. All mix trucks shall rinse and flush the barrel prior to loading regardless if the last load hauled was pervious.
 - 2. Hot water (defined as temperatures more than the water temperature coming out of a well or municipal source) is not to be used in the mix or in the side tanks on the mixers, unless the supplier and installer can demonstrate the mix does not set up too fast to properly place, strike off, finish and cure before the wet metallic sheen on the rocks is lost.
 - 3. Trucks that have difficulty discharging dry mixes shall not be used to deliver pervious concrete.
 - 4. Pervious concrete delivered via ready mix truck must be treated with hydration stabilizing admixture to allow for minimum of two hours of working time after loading. This time may be extended for a longer time if treated with MasterSet/Delvo hydration stabilization according to the manufacturer's recommendations.
 - 5. All fine-aggregate and cement shall be batched into the truck (even if multiple batches are required) before adding any water or admixtures. Failure to follow this requirement will result in excessive balling of the mix during discharge.

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6. After loading:
 - a. Each load shall be visually inspected for conformity to specifications.
 - b. Water adjustments at the plant are preferred to onsite adjustments.
 - 1) Until properly trained, drivers should not make water adjustments without certified fine-grain assistance.
 - 2) Water may be added at the jobsite to obtain the specified mix consistency. Water adjustments at the jobsite shall be approved by the certified pervious concrete installer.
 - c. Loads that cannot be adjusted on-site to meet allowed unit weight range specified shall be rejected.
 - d. Concrete shall be deposited as close to its final position as practicable such that fresh concrete enters the mass of previously placed concrete.
 - e. Minimize the practice of discharging onto sub-grade and pulling or shoveling to final placement.
- B. Volumetric (Truck Mounted Mobile Mixers), are commonly used for delivery and mixing fine-grain pervious concrete. Volumetric suppliers are required to check and adjust material calibrations unless they have successfully mixed fine-grain within the last 6-months. The certified pervious installer must approve water adjustments during placement to maintain the mix water within specified tolerances.

PART 3 - EXECUTION

3.1 Installation

- A. Pavement Tolerances:
 1. Comply with tolerances of ACI 117 and as follows:
 - a. Elevation: 1/4-inch.
 - b. Thickness: Plus 3/8-inch, minus 1/4-inch.
 - c. Surface: Gap below 10-foot long, unlevelled straightedge not to exceed 1/4-inch.
 - d. Lateral Alignment and Spacing of Tie Bars and Dowels: 1-inch.
 - e. Vertical Alignment of Tie Bars and Dowels: 1/4-inch.
 - f. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2-inch.
 - g. Alignment of Dowel-Bar End Relative to line Perpendicular to Pavement Edge: Length of dowel 1/4-inch per 12-inches.
 - h. Joint Spacing: 1/2-inch.
 - i. Control Joint Depth: Plus 1/4-inch, no minus.
 - j. Joint Width: Plus 1/8-inch, no minus.
- B. Notification Requirements:
 1. The design professional of record shall be notified forty-eight (48) business hours in advance of sub-grade 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 sub-grade preparation, recharge bed installation, and all pervious concrete pours.
 2. A pre-paving conference shall be scheduled held prior to installation of the sample panel. Two weeks' notice preferred but shorter notice allowed if approved by the design professional of record. The following individuals are required to attend:
 - a. Concrete Supplier.
 - b. Certified pervious concrete contractor. If not certified, the contractor's hired Craftsman must be there either physically or via live video link.
 - c. Site work contractor.
 - d. Project Manager.
 - e. Design Professional of Record or authorized representative of design professional of record.
- C. Pervious Base Aggregate: Specification, Installation and Review of Installed Base
 1. Base Aggregate Specifications
 - a. Base material is used under pervious concrete for water storage, it shall be composed of uniform sized aggregate. The aggregate should have at least 40 percent voids unless otherwise specified by civil or geotechnical contract documents. Use of local aggregates that provide 40 percent voids are allowable and should be approved by the engineer. Crushed rock is required if delivery trucks will be driving on the base. Mix trucks can drive on the base rock. If soft spots are observed, remove the soft spot prior to placement.

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2. Before placement of the pervious concrete begins, the pervious concrete contractor shall inspect the in-place aggregate base for compliance to the plans and specifications with written approval of the design professional of record, as follows:
 - a. If required, a nonwoven filter fabric, Marifi 140 or approved equivalent, must be properly secured as recommended by fabric manufacturer.
 - b. When the pervious concrete abuts a building face or interfaces 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 placed 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. If not permeable, remove and replace the base rock unless authorized otherwise by the project professional of record.
 - 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 as needed 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 other elements of the design (i.e. conduits, drainage pipe(s), utilities, irrigation sleeves, etc.) on plans to determine placement of all elements prior to placing concrete.
 - g. All joints are to be clearly marked on the forms or base rock prior to placement. Radius joints between forms shall be painted on the base rock before placement begins.
 - 1) Contractor must follow the "jointing plan" as per the plans unless approved in writing by the design professional of record.
 - 2) Joints should not exceed ten (10) feet in either direction on pavements with vehicle traffic.
 - 3) Panel dimensions shall not exceed 125 percent of square.
- D. Pervious Concrete Placing Equipment:
1. Powered spinning-tube, "Roller" Screeds are recommended for placing pervious.
 2. Placement using vibrating truss screeds is not allowed for fine-grain pervious use.
 3. A hand operated straight edge may be used to place the pervious concrete if roller screeding is not practical due to access or other practical obstacles.
 4. A slipform paver may be used to place fine-grain pervious concrete approved by the design professional of record.
- E. Approved Hand Tools:
1. A "Riser Strip" (shim) may be required during screeding. This is required if the elevation after "cross rolling," is below the specified finished elevation.
 2. An approved pervious concrete "Cross" roller such Lura™ or Bunyan brand or approved equal capable of applying a minimum weight of 30 Lbs./LF. Defined as roughly 30 inches wide, weighing 60-78 pounds, with clip on handles and tapered ends.
 3. "Static" rollers are no longer recommended. Defined as a steel pipe that spans the full width of the pavement bay and fitted with handles on both ends. These weighed 30 to 40 pounds per lineal foot and were very difficult to work with.
 4. Use of asphalt rollers or plate compactors are not allowed, unless they can be demonstrated not to seal the surface, they 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 "Fresno" or Magnesium float or other tools may be used to remove roller marks and improve the appearance of the pavement surface provided it does not seal the surface or reduce 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 infiltration rates or result in a slippery surface texture.
 7. Powered trowels, fitted with a pan, are not allowed.
 8. Tightly tool all edges with walking edgers or hand edgers with a minimum 1/2-inch radius.

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9. "Pizza Cutter" Roller Style Deep Groovers are not recommended but allowable if the cut is touched up with a steel "butterfly" style groover that leaves a tight radius edge with no tearing or gaps.
- F. Placing, Compaction, Jointing and Finishing Process
1. Pervious materials shall be placed as on the ground as close as possible to its final location. Avoid piling and dragging into place when possible.
 2. Except when compacting edges, minimize walking on mixture prior to screeding, described in E.3.
 3. Immediately after placement, before screeding, workmen shall compact the edges within four (4) inches of the edge by stepping on fresh pervious. Avoid contaminating the surface with dirty boots. If dirt is transferred to the compacted edge, remove the contaminated mix from the grade.
 4. If necessary, strike off the surface slightly high using a "riser strip" to compensate for compaction to final grade.
 5. If a riser is used, compact to final grade using an approved pervious cross roller or power pan float immediately after striking off surface.
 6. While saw cutting contraction joints are now preferred, if wet cuts are used, they must be installed immediately after compaction. Time is of essence. Jointing without delay aids in the ease of installation and the durability of the tooled edge.
 - a. If a "pizza cutter" deep groover is used, the deep groove shall be cut in one direction only.
 - b. If ragged edges or surface tears are created while using the pizza cutter, immediately touch up these edges with steel radiused, "butterfly, torpedo or other steel groover designed to leave the tooled pervious edge tightly compacted and free of ragged or torn appearances. Avoid the use of wood or aluminum tools unless you can demonstrate the ability to do so without tearing the edge.
 7. All edges and cold joints must be edged unless otherwise specified. A tooled radius edge is also required next to curbs.
 8. Spraying a mist of hydration stabilizers like BASF Confilm or approved equal on the surface and on tooled radius edges can help tighten torn surfaces. Do not dilute the paste!
 9. After cross rolling the surface, a weighted Fresno or other finishing tool as needed may be used to remove roller marks (if any) and to touch up the surface. Demonstration of all final finishing tools should be included in the mockup placement for owner approval.
 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, recompact and refinish as needed.
 11. Cold joints should be avoided.
 - a. If a delay occurs long enough the concrete is no longer workable, (metallic sheen lost), install a header and create a transverse construction joint, compact the tool the edge.
 - 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 edge 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 like BASF Confilm or approved equal, is encouraged during delays. Stabilizers may be reapplied if the paste is not diluted or damaged.
 12. Sawed joints (Recommended):
 - a. Are the preferred jointing method to reduce joint raveling. Saw cutting should begin as soon as the pavement has hardened sufficiently to prevent raveling and uncontrolled cracking.
 - b. A delay in saw cutting fresh pervious may be allowed up to seven days if the pavement is placed or wet cut in sections 20 feet by 40 feet on center or smaller.
 - c. If curing plastic is used for surface curing, and it is removed for cutting before the seven days curing time is complete, soak the surface of the pavement after cutting and before replacing the plastic to complete the curing time.
 - d. Dust created by dry cut pavements should be removed within a few feet behind cutting. Failure to remove dust quickly can lead to clogged voids and stain the surface.
 - e. Slurry created by wet cutting must be immediately and thoroughly flushed or vacuumed from the surface before the water in the slurry drains out.
- G. Curing Materials and Procedures
1. Surface curing pervious pavements is always required, even when internal curing methods are used.

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2. Time between placement and curing has been updated in 522-20. The new requirement says curing must start 10 minutes or less after placement unless admixtures or other methods are used to extend the finishing time. Approved admixtures for extending time are BASF MasterSet Delvo and WRG (formerly Grace Chemicals) Recover. HydroMax internal cure admixture. Retarders are specifically prohibited for use in fine-grain pervious concrete.
 3. This fine-grain specification requires HydroMax internal curing admixture or approved equal and MasterSet/Delvo or approved equal, set extending hydration stabilization. Using these two admixtures allow installers up to 15-minutes or 20-feet of finishing (whichever comes first) to complete all compaction, finishing and jointing before applying curing plastic or spray placement.
 - a. In hot, dry, or windy conditions, curing must be applied sooner than 15 minutes or 20-feet.
 - b. Securely anchor the edges of the plastic to protect from the wind. Do what is necessary to prevent the plastic from "billowing" in the wind for during the 7-day cure time.
 - c. If the wet metallic sheen on the mix cannot be maintained long enough to complete all compaction, finishing, and curing, placing should be suspended until conditions improve.
 4. Curing options for internally cured mixes. Internally cured pervious mixes may use other curing options if those options successfully protect the surface from raveling.
 - a. Covering the surface and all unprotected edges with 1 to 6 mil polyethylene plastic sheeting for 7 days is approved.
 - b. Covering with 1 mil plastic topped with 6 mil plastic for 24 hours, then spraying curing compounds on the surface and removing the plastic sheeting may be used as an alternative to plastic curing for 7 days.
 - 1) Evaporative spray cure like Meadows 1100 or approved equal, must be applied per manufacturers recommendation immediately after plastic is removed.
 - 2) The contractor must be able to demonstrate that the curing compound and timing used to apply the cure is adequate to prevent surface raveling within the first year after opening to traffic.
 - 3) If the surface raveling the installer must remove and replace the raveled areas.
 - 4) Minor raveling of a few random stones does not qualify for removal or replacement.
 5. If plastic sheeting is used, black or white (opaque) sheeting is preferred over clear. If possible, maintain the same plastic color throughout the project.
 6. The sheeting shall overlap all exposed edges at least fifteen 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.
 7. Sheeting with unrepaired holes or rips will not be allowed.
 8. A fog or light mist may be sprayed using CONFILM or approved equivalent (surface hydration-stabilizing agent). Apply with a pressure sprayer above the surface as needed during high temperature, high wind, and low humidity. Do not allow so heavy the paste is diluted.
 9. Protection from Salts and Deicers.
 - a. Use of salt or other deicing chemicals on pervious concrete is not recommended. This especially true during the first one year after installation is prohibited. But since this prohibition is routinely ignored, at this time, the following practices have helped minimize damage:
 - 1) For additional protection from chemical damage, ensure mix is adequately hydrated. Water cement ratio must be at least 0.35.
 - 2) Application of penetrating concrete sealers after the initial set has occurred and annual reapplication may provide protection from deicing chemicals.
 - b. In cold zones where salt and deicing chemicals are heavily used, pavement damage can be severe. Instead of chemicals the use of snow blowers to remove snow.
 - c. Using 1/4"-10 crushed asphalt aggregates for traction control is also a recommended alternative to salt or deicers. This information must be provided to owner.
 - d. No warranty is offered from salt or deicer damage.
- H. Cure Time:
1. Curing times shown are based on temperatures remaining at or above 55°F for the duration of the listed curing time. At temperatures below 55°F, curing time must be extended before opening to traffic. The amount of added time to be determined by the design professional of record. In very cold regions the curing time extension can be very long if temperature remains low.

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2. HydroMax treated mixes may shorten the time sheet plastic is required, but the shortened surface curing time does not shorten the cure time required before opening to traffic.
3. Foot traffic allowed in 24 hours. Passenger car traffic can be allowed after seven days.
4. Truck traffic (HS-20) loaded or un-loaded shall be not be allowed for at least ten days.

3.2 Protection, Repairs, Maintenance and Cleaning

A. Pavement Protection: During Construction/Before Acceptance

1. The general contractor must inform all trades; especially landscapers, not to dump fine materials such as dirt or bark on the pervious concrete.
 - a. The general contractor must protect the pavement from other trades who use the pavement for staging, storage, or other reasons.
 - b. 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.
 - c. 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.
2. 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.
 - a. A water hose to flush the loose material, using a high volume, low pressure water flow, is the preferred way to clean the pavement.
 - b. Remove loose material on the pavement surface before painting lines or other symbols on the pavement.
3. 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.

B. Repairs

1. Remove and replace pavement sections that fail to meet standards established and approved by the owner. Unless otherwise authorized by design professional of record, remove the entire section at no expense to the owner at the nearest joint.
2. 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.
3. 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 to the nearest joint.
4. Milling and replacing the surface of clogged or raveling surfaces is allowed instead of full depth removal and replacement if approved by the owner.
 - a. Overlaying pervious concrete is an advanced technique. Do not attempt unless under supervision of someone experienced in this repair method. Recommend contacting Scott Erickson Evolution Pervious Resources to determine if the practice is recommended.
 - b. Overlay sample pour required.
 - c. Base mix must be thoroughly cleaned and nearly dry before placing overlay layer. Pre-wetting just prior to placement will result in delamination.
 - d. Thin overlays require joints (sawn or wet cut) 2 x thickness (in feet).
 - 1) Example: A 2-inch overlay requires jointing at 4 feet on center or less.
 - e. Fiber recommended in overlays is recommended at least 1.5 pounds per yard.

C. Maintenance /Cleaning After Construction and Acceptance of Work.

1. The owner is responsible for all Maintenance after construction and project work acceptance. The contractor must supply the owner with a copy of, "Evolution Pervious Paving Resources 'Pervious Concrete Owner's Manual and Maintenance Guide 2020 or newer" or the NRMCA Pervious Maintenance Manual dated 2016 or newer.

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3.3 Inspections, Testing, and Acceptance

A. Mockup and Inspections

1. The design professional of record shall approve a site cast sample mockup of the specified pavement before paving begins. The following criteria for the sample shall be used:
 - a. At a location approved by the contracting agency contractor shall construct a sample on site using the same design requirements required for the substantial portion of the project.
 - 1) The sample test panel should be a minimum of 225 square feet and should be installed using the same tools and qualified personnel required for project installation.
 - 2) The fresh concrete used in the test panel shall be tested for voids and unit weight as per ASTM C1688 and permeability ASTM C1701 or approved equal.
 - 3) If the sample panel is accepted, it may remain in place as part of the finished pavement.
 - 4) Repeat placing additional mockups as needed until a mockup meets specifications and is approved by the owner.
 - 5) The surface appearance of the sample must be approved for texture, finish and should have minimal surface tearing or raveling. The finished product must match the approved sample.
 - b. Accepted sample panels, in like new condition, may be used in the contract work.
 - c. Thickness. No measured sample may be less than 3/8-inch of specified thickness.

B. Testing

1. If testing is specified, it shall be completed by an accredited laboratory who has experience using ASTM C 1688 and ASTM C 1701 or as approved by the design professional. All tests must be completed in accordance with the referenced standards as outlined in 1.3. If this level of experience is not available, the contractor shall hire an NRMCA Pervious Craftsman with experience using ASTM C 1688 or C 1701 to supervise the testing lab in testing.
2. Fresh Pervious Concrete:
 - a. 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.
 - b. Any time the unit weight is found to be more than +/- 5-pounds from the approved mix weight, the installer and supplier shall be notified immediately, and the pour shall be suspended until the mix is corrected and further testing confirms the mix now complies with specified tolerances.
 - c. Compressive strength testing shall not be used for acceptance or rejection of the pervious pavement since no ASTM or ACI approved compressive test has been adopted. If the pavement meets permeability requirements and does not ravel it shall be accepted.
3. Hardened Pervious Concrete
 - a. Permeability shall be tested using ASTM C 1701 or an approved equal.
 - 1) Must be tested on clean, level pervious pavement upon removal of the curing plastic and accepted before opening the pavement to traffic.
 - 2) Permeability of fine-grain pervious shall be tested at least 60 inches per hour within 21 days of placement. Typically, fine-grain pervious permeability ranges between 200 and 400 inches per hour exceeds 100 inches per hour but the lower (60) inches per hour is allowed even though it is lower than 522-20 standards. This lower permeability rate is allowed based on sitework design requirements described in 1.1 A. which limit sediment exposure to this fine-grain pervious pavement.
 - 3) 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.
 - 4) An approved equal to ASTM 1701 permeability testing.
 - 5) Evolution Pervious abbreviated permeability test is approved for initial permeability testing. If permeability using the abbreviated method are accepted by the professional of record, ASTM 1701 is not required.
 - 6) The design professional of record is authorized to determine permeability on slopes.
 - b. Core Testing

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- 1) Core testing fine-grain pervious is not allowed for any reason other than thickness confirmation. Coring fine-grain mixes is extremely difficult without damage to the core therefore cores shall not be used for acceptance or rejection of the product.
 - 2) The average of all cores shall not be less than the specified thickness with any individual core being more than 3/8" inch less than the specified thickness.
- C. Acceptance.
1. Completed work that meets the standards approved in the sample panel shall be approved.

END OF SECTION

PEDESTRIAN CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes standard exterior portland cement concrete pavement for pedestrian areas.
 - 1. See Section 320523 for Pervious Concrete Paving.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 015639 – Tree Protection.
 - 3. Section 033300 – Cast-in-Place Concrete.
 - 4. Section 129300 – Site Furnishings.
 - 5. Section 312000 – Earth Moving.
 - 6. Section 320523 – Pervious Concrete Paving.
 - 7. Section 321373 – Concrete Joint Sealants.
 - 8. Section 328400 – Irrigation.
 - 9. Division 26 – Electrical.
 - 10. Division 33 – Utilities.

1.2 REFERENCES

- A. American Association of State Highway Transportation Officials (AASHTO) specifications.
- B. American Concrete Institute (ACI): ACI 301 – Specifications for structural concrete for buildings.
- C. American Society for Testing and Materials (ASTM): ASTM a185 – Welded Steel wire fabric for concrete reinforcement.
- D. ASTM D1751 – Performed expansion joint fillers for concrete paving and structural construction.
- E. ASTM A615 – Deformed and plain billet-steel for concrete reinforcement.
- F. ACI 318 – Building Code Requirements for Reinforced Concrete
- G. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice.”
- H. ASTM C2600 – Air entraining admixtures for concrete.
- I. ASTM C309 – Liquid membrane forming compounds for curing concrete.
- J. ASTM C979 – Pigments for Integrally Colored Concrete.

1.3 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Included alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Samples:
 - 1. Expansion Joint Material: Submit one 12-inch length.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials.
- E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
 - 1. Cementitious materials and aggregates.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Admixtures.
 - 4. Curing compounds.
 - 5. Joint fillers.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent of that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

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- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certifications Program.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- E. ACI Publications: Comply with ACE 301, "Specifications for Structural Concrete," unless modified by the requirements of the Contract Documents.
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

1.5 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Standard Pedestrian Concrete Paving: standard impervious pedestrian concrete paving.
 - 1. Finish: light broom finish.

2.2 FORMS

- A. Form Materials: Plywood, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves of a 100-foot or less radius.
- B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affected concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars and Tie Bars: ASTM 615, Grade 60, deformed.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 775 with ASTM A 615, grade 60 deformed steel bars.
- C. Plain, Cold-Drawn Steel Wire: ASTM A 82.
 - 1. Furnish in flat sheets, not rolls, unless otherwise acceptable to Architect.
- D. Deformed-Steel Welded Wire Fabric: ASTM A 497.
- E. Fabricated Bar Mats: Welded or clip-assembled steel bar mats, ASTM A 184. Use ASTM A 615, grade 60 steel bars, unless otherwise indicated.
- F. Joint Dowel Bars: Plain steel bars, ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs.
- G. Epoxy-Coated Joint Dowel Bars: ASTM A 775 with ASTM A 615, Grade 60 plain steel bars.
- H. Hook Bolts: ASTM A 307, grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- I. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels. In place. Use wire bar-type supports complying with CRSI specifications.
 - 1. Use supports withstand plates or horizontal runners where base material will not support chair legs.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.

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1. Use one brand of cement throughout project unless otherwise acceptable to Landscape Architect.
- B. Fly Ash: ASTM C 618, Type F.
- C. Normal-Weight Aggregates: ASTM C 33, Class 4, and as follows. Provide aggregates from a single source.
 1. Maximum Aggregate Size: 1-1/2-inches.
 2. Do not use fine or coarse aggregates that contain substances that cause spalling.
 3. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Landscape Architect.
- D. Water: potable.

2.5 ADMIXTURES

- A. Provide concrete admixtures that contain no more than 0.1 percent chloride ions.
- B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- C. Water-Reducing Admixture: ASTM C 494 Type A.
- D. High-Range Water-Reducing Admixture: ASTM C 494 Type F or Type G.
- E. Water-Reducing and accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and retarding Admixture: ASTM C 494 Type D.

2.6 CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 ounces per square yard., complying with AASHTO M 182, Class 2.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 1. Waterproof paper.
 2. Polyethylene film.
 3. White burlap-polyethylene sheet.
- C. Clear Solvent-Borne Liquid Membrane-Forming Curing Compound: ASTM C 309, Type I, class A or B, wax free.
- D. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type I Class B.
 1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
- E. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

2.7 RELATED MATERIALS

- A. Expansion Joint Material: ASTM D 1751, 1/2-inch thick.
- B. Irrigation Sleeves and related materials: as specified in Section 328400 "Irrigation".

2.8 CONCRETE MIX

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
 1. Do not use Owner's field quality-control testing agency as the independent testing agency.
- C. Proportion mixes to provide concrete with the following properties:
 1. Compressive Strength (28 Days): 3500 psi.
 2. Maximum Water-Cementitious Materials Ratio: 0.45
 3. Slump Limit: 3 inches.
- D. Cementitious Materials: Limit percentage by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete deicing chemicals.
- E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.

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2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.
 - 1. When air temperature is between 85 degrees F and 90 degrees F, reduce mixing and delivery time for 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that aggregate base has been correctly placed as specified in Division 31 - Earthwork.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.
 - 1. Top of Forms: Not more than 1/8-inch in 10 feet.
 - 2. Vertical Face on Longitudinal Axis: Not more than 1/4-inch in 10 feet.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

- A. General: Construct contraction, construction, and expansion joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.
 - 1. Provide pre-formed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.
 - 2. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
 - 3. Provide tie bars at sides of paving strips where indicated.
 - 4. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Expansion Joints: Form expansion joints of pre-formed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints as detailed.
 - 2. Extend joint fillers full width and depth of joint.

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3. Terminate joint filler not less than 1/2-inch or more than 1-inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is indicated.
 4. Furnish joint fillers in one-piece. Where more than one length is required, lace or clip joint-filler sections together.
 5. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary pre-formed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Control Joints: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least 1/4 of the concrete thickness, as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 2. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - a. Radius: 1/4-inch.
- E. Install dowel bars and support assemblies at joints where indicated. Lubricate one half of dowel length to prevent concrete bonding to one side of joint.
- F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces. Radius: 1/4-inch.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, 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 reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.
- C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement.
- F. 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.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Screed paved surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations or spreading dry-shake surface treatments.
- I. Formed Concrete Curbs: Produce curbs to required cross section, lines, grades, finish, and jointing as indicated on Drawings.
- J. Cold-Weather Placement: Comply with provisions of ACI 306R 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 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.

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3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- K. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
 1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees F. Mixing water may be chilled 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 reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed water sheen has disappeared and the 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 within a tolerance of 1/4-inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.
 1. Light-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 finish, unless indicated otherwise on Drawings
- C. Final Tooling: Tool edges of paving, gutters and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
 1. Radius: 1/4-inch, or as indicated on the drawings.
 2. After final floating, apply a hand-trowel finish to the concrete followed by a light broom finish, or other finish as indicated on the drawings. Cure concrete with curing compound recommended by dry-shake material manufacturer. Apply curing compound immediately after final finishing.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
- B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

3.8 CURING

- A. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 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 a 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.

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3. Curing compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 PATCHING

- A. Projections: Remove projecting fins, bolts, wire, nails, etc., not necessary for the Work, or cut them back 1-inch from the surface and patch in an inconspicuous manner.
- B. Voids:
 1. Fill holes with an accepted patching material the same color as the adjoining concrete.
 2. Mix and place patching material and finish flush with the adjacent surface.
- C. Corrective Patching:
 1. Correct defects in concrete Work.
 2. Chip voids to a depth of at least 1-inch with the edges perpendicular to the surface and parallel to form markings.

3.10 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: 1/4-inch.
 2. Thickness: Plus 3/8-inch, minus 1/4-inch.
 3. Surface: Gap below 10-foot long, unlevelled straightedge not to exceed 1/4-inch.
 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1-inch.
 5. Vertical Alignment of Tie Bars and Dowels: 1/4-inch.
 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
 7. Alignment of Dowel-Bar End Relative to line Perpendicular to Pavement Edge: Length of dowel 1/4-inch per 12-inches.
 8. Joint Spacing: 1/2-inch.
 9. Control Joint Depth: Plus 1/4-inch, no minus.
 10. Joint Width: Plus 1/8-inch, no minus.

3.11 FIELD QUALITY CONTROL TESTING

- A. Testing Agency: Engage a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article:
- B. Testing Agency: The Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article:
- C. Testing Services: Testing shall be performed according to the following requirements:
 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
 3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
 4. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each set of compressive-strength specimens.
 5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Cylinders shall be molded and stored for laboratory cured test specimens unless field-cured test specimens are required.
 6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cubic yards but less than 25 cubic yards, plus one set for each additional 50 cubic yards. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.

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7. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- D. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- F. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.12 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.
- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Cleaning:
1. Efflorescence: Remove efflorescence as soon as practical after it appears and as part of final cleaning.
 2. Use least aggressive cleaning techniques possible
 3. If proprietary cleaning agents are used, pre-wet surface, test cleaning agent on small, inconspicuous area, and check effects prior to proceeding. Thoroughly rinse surface afterwards with clean water. Follow cleaner manufacturer's instructions.
 4. Do not use muriatic or hydrochloric acid on integrally colored concrete.
- E. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION

CONCRETE JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included in this Section: Furnish labor, material and equipment required to install concrete paving joint sealants as shown on the Drawings and as specified herein.
- B. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 320523 – Pervious Concrete Paving.
 - 3. Section 321313 – Standard Concrete Paving.

1.2 SUBMITTALS

- A. Submit product data in accordance with Division 1 – Submittal Procedures with materials list and color cards, before ordering materials.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver sealant to job in manufacturer's original, unopened dated containers.

1.4 PROJECT CONDITIONS

- A. The installer must examine the joint surfaces, backing, and the conditions under which the sealant work is to be performed, and notify the Contractor of conditions detrimental to the proper and timely completion of the work and performance of the sealants.
- B. Do not proceed with the sealant work until unsatisfactory conditions have been corrected.
- C. Weather Conditions:
 - 1. Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
 - 2. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.
 - 3. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Colors: For exposed materials, provide color as indicated or if not indicated, as selected by Architect from manufacturer's standard colors.
- B. Hardness: As recommended by manufacturer for application shown, unless otherwise indicated.
- C. Modulus of Elasticity: Provide the lowest available modulus of elasticity which is consistent with exposure to weathering, indentation, vandalism, abrasion, support of loading, and other requirements.
- D. Compatibility: Before purchase of each required material, confirm its compatibility with each other material it will be exposed to in the joint system.
- E. Size and Shape: As shown or, if not shown, as recommended by the manufacturer for the type and condition of joint, and for the indicated joint performance of movement.
- F. Grade of Sealant: For each application, provide the grade of sealant (non-sag, self-leveling, no-track, knife-grade, preformed, etc.) as recommended by the manufacturer for the particular condition of the installation (locations, joint shape, ambient temperature, and similar conditions), to achieve the best possible overall performance. Grades specified herein are for normal conditions for installation.

2.2 PAVEMENT JOINTS

- A. Provide traffic-bearing surface joints at locations where vehicular or pedestrian traffic is anticipated on concrete pavement and at all locations shown on Drawings.

CONCRETE JOINT SEALANTS

- B. Provide polyurethane-based, 2-part elastomeric sealant, complying with FS TT-S-00227E, Class A, Type 1 (self-leveling) unless Type 2 (non-sag) is recommended by the manufacturer for applications shown.
- C. Acceptable Product and Manufacturer: Subject to compliance with the requirements, provide one of the following products, or approved equal.
 - 1. Sonolastic SL-2, as manufactured by Sonneborn.
 - 2. Dynatred, as manufactured by Pecora Corporation.

2.3 MISCELLANEOUS MATERIALS

- A. Joint Cleaner: Provide the type of joint cleaning compound as recommended by the sealant manufacturer for the joint surfaces to be cleaned.
- B. Joint Primer/Sealer: Provide the type of joint primer/sealer recommended by the sealant manufacturer, for the joint surfaces to be primed or sealed.
- C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by the sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean joint surfaces as recommended by sealant manufacturer. Provide bond breaker between sealant and joint filler, wherever recommended by manufacturer and wherever sealant is not compatible with joint filler.
- B. Prime or seal the joint surfaces wherever shown or recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3.2 INSTALLATION

- A. Do not use sealants after compounds have "set" or when discharge is not continuous.
- B. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces.
- C. Install sealants to depths shown, or if not shown, as recommended by the sealant manufacturer.
- D. Remove excess and spillage of compounds promptly as work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- E. Repair or replace sealants which fail to perform as air-tight and water-tight joints; or fail in joint adhesion, cohesion or abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in another manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

END OF SECTION

PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood fiber loose-fill surfacing.
- B. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 116816: Play Structures, for play structures installed in area of protective surfacing.
 - 3. Section 312000: Earth Moving, for excavation, grading, filling, and geotextile drainage fabric.
 - 4. Section 321313: Standard Pedestrian Concrete Paving, for perimeter paving.
 - 5. Section 334600: Subdrainage System, for playground subsurface drainage.

1.2 DEFINITIONS

- A. Critical Height: Standard measure of shock attenuation.
 - 1. Defined by CPSC No. 325 as: "the fall height below which a life-threatening head injury would not be expected to occur."
- B. Fall Height:
 - 1. Defined by ASTM F 1487 as "the vertical distance between a designated play surface and the protective surfacing beneath it."
- C. Use Zone:
 - 1. Defined by ASTM F 1487 as the "area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment."

1.3 SUBMITTALS

- A. Product Data, for each type of product indicated.
- B. Shop Drawings: For each playground surface system, include materials, plans, cross sections, drainage, installation, and edge.
- C. Coordination Drawings: Scaled Drawings showing types and locations of playground equipment and play structures, coordinated with each type of protective surfacing specified, and the following:
 - 1. Extent of surface systems and Use Zones for equipment.
 - 2. Critical Heights for playground surfaces.
 - 3. Fall Heights for equipment.
- D. Samples:
 - 1. Submit one cubic foot sample of engineered bark mulch.
- E. Qualification Data, for installers of each type of protective surfacing specified.
- F. Material Test Reports: Based on evaluation of comprehensive tests performed by an independent testing agency, for each loose-fill playground surface system.
 - 1. Engineered Bark Mulch: Submit independent testing laboratory test report for impact attenuation of new and 5-year-old materials in accordance with ASTM F 1292, Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by an independent testing agency, for each unitary synthetic playground surface system.
- H. Manufacturer's Material Certificates: For each type of loose-fill playground surface system.
- I. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Company using workers who are trained and experienced in necessary crafts and familiar with requirements and methods needed for proper performance of Work of this section.
- B. Standards and Guidelines: Comply with CPSC No. 325, "Handbook for Public Playground Safety;" ASTM F 1292; and ASTM F 1487.

PLAYGROUND PROTECTIVE SURFACING

1.5 SITE CONDITIONS

- A. Existing Conditions:
 - 1. Locate existing site improvements, underground utility systems, and other below grade site improvements in area of surface excavations.
 - 2. Call the Oregon Utility Notification Center at 811 for underground utility locations 48 hours in advance of removing soil materials and boring post holes.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit playground surface system installation to be performed according to manufacturers' written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 WOOD FIBER SURFACING

- A. Engineered wood fibers consisting of the following:
 - 1. Random-sized wood fibers, for depths of 2, 6 and 10 inches, in manufacturer's standard fiber size, approximately 10 times longer than wide; containing no bark, leaves, twigs, or foreign or toxic materials according to ASTM F 2075; graded according to manufacturer's standard specification for material consistency for playground surfaces and for accessibility according to ASTM F 1951.
- B. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following.
 - 1. Northwest Playground; Engineered Wood Fiber.
 - 2. The Fiber Group LLC; Fibar.
 - 3. Game Time, a PlayCore, Inc. company; GT Impax Fiber.
 - 4. New England Bark Mulch & Playground Surfacing, Division of Supreme Forest Products, Inc.; Playground Safety Fiber.
 - 5. SofSolutions Inc.; SofFall.
 - 6. Zeager Bros., Inc.; Wood Carpet.

2.2 ACCESSORIES

- A. Geosynthetic:
 - 1. Geotextile Fabric: Drainage Fabric specified in Section 312000, "Earth Moving."
- B. Play Surfacing Edge:
 - 1. Anchored-in-place, weather-resistant containment barrier designed to minimize sharp edges, protractions, tripping hazards, hold surfacing in the play equipment use zone.
- C. Drain Lines: Minimum flow rate of 10 gpm/ft.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, subgrade and substrate conditions, drainage, and other conditions affecting performance of the Work.
- B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary playground surface system installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to playground surface system manufacturer's written requirements for cross-section profile.
 - 1. Concrete Substrates:
 - a. Verify that substrates are dry, free from surface defects, and free of laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with playground surface system or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by playground surface system manufacturer.
 - 2. Drain Rock Substrates:
 - a. Verify that substrates are dry, free from surface defects, and free of laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with playground surface system.

PLAYGROUND PROTECTIVE SURFACING

3. Aggregate Base Substrates:
 - a. Verify that substrates are dry, free from surface defects, and free of laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with playground surface system
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare substrates to receive surfacing products according to playground surface system manufacturer's written instructions. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
- B. Concrete Substrates: Provide sound surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with playground surface system.
 1. Repair unsatisfactory surfaces and fill holes and depressions.
 2. Saw cut concrete for terminal edges of playground surface systems as indicated .
 3. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through playground surface system.
- C. Drain Rock Substrates: Provide sound surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with playground surface system.
 1. Repair unsatisfactory surfaces and fill holes and depressions.
 2. Lightly compact drain rock substrate to ensure uniform installation and solid placement.
 3. Place and secure geotextile fabric.
- D. Aggregate Base Substrates: Provide sound surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with playground surface system.
 1. Repair unsatisfactory surfaces and fill holes and depressions.
 2. Compact aggregate base according to requirements of Section 312000 "Earth Moving."
 3. Place and secure geotextile fabric.

3.3 INSTALLATION - GENERAL

- A. Grade and compact subsoils according to requirements in Section 312000, "Earth Moving."
- B. Comply with playground surface system manufacturer's written installation instructions. Install playground surface system over area and in thickness indicated.
 1. Apply moisture to dry substrate soil prior to placing geotextile.

3.4 INSTALLATION - GEOSYNTHETIC

- A. General: Install geotextile according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions.
 1. Completely cover subgrade indicated, overlapping sides and edges a minimum of 8 inches with adhesively bonded seams.
 2. Adhere edges on all sides to top of perimeter curb, edging, or footing.

3.5 INSTALLATION – LOOSE-FILL WOOD FIBER SURFACING

- A. Loose-Fill Edgings: Place as indicated, and permanently secure in place and attach to each other according to edging manufacturer's written instructions.
- B. Wood Fiber Surfacing Loose-Fill: Place wood fiber loose-fill to specified depth that includes excess material to account for natural compaction over time.
- C. Grading: Uniformly grade loose-fill according to manufacturer's written instructions to an even surface free from irregular surface changes.
- D. Finish Grading: Hand rake to a smooth finished surface to required elevations.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing agency to perform tests and inspections.
 1. Agency will test and inspect completed applications of playground surface system according to ASTM F 1292.
- B. Remove and replace playground surface system where test results indicate noncompliance with requirements.

PLAYGROUND PROTECTIVE SURFACING

1. Perform additional testing and inspecting of replaced surface system at no expense to the Owner.

END OF SECTION

CHAIN LINK FENCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, material, equipment and services required for the installation of chain link fencing materials. All fence material including posts, fabric and hardware to be vinyl coated.
- B. Include all gates, rails, braces, fittings, and concrete footings necessary for the complete installation.
- C. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 015639 – Tree Protection
 - 3. Section 024119 – Selective Demolition.
 - 4. Section 033000 – Cast-in-Place Concrete.
 - 5. Section 312000 – Earth Moving.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A120, Pipe, Steel, and Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
 - 2. ASTM A123, Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.
 - 3. ASTM A153, Zinc Coating (Hot Dip) on Iron and Steel Hardware.

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section “Submittal Procedures.”
- B. Shop drawings indicating fence heights, sizes of posts, rails, braces, gates, accessories, and footings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS FOR NEW PRODUCT

- A. Fencing Products:
 - 1. Pacific Fence and Wire Co., 503-233-6348.
 - 2. Outdoor Fence, 503-399-1934
 - 3. Other Manufacturers: Submit Substitution Request prior to bid date in accordance with Division 1 Section “Product Requirements.”

2.2 MATERIALS FOR NEW FENCE PRODUCT

- A. Framework: Line, terminal and pull posts; top, middle and bottom rails or braces; and gates shall be Type I or Type II galvanized steel pipe.
 - 1. Type I Schedule 40 pipe with 1.8 oz./s.f. zinc coating conforming to the standard specifications for hot-dip zinc coated (galvanized welded and seamless steel pipe for ordinary uses), ASTM F1083.
 - 2. Type II pipe manufactured from steel conforming to ASTM A569, cold-formed, electric welded and triple coated per ASTM F1234, Type B and Type D with 1.0 oz ±0.1 oz./s.f. zinc, 30 ±15 micrograms chromate, 0.5 ±0.2 mils clear cross-linked polyurethane acrylic exterior coating. The internal surface shall be given corrosion protection by zinc-rich based organic coating with a 91% minimum zinc powder coating, capable of providing galvanic protection.
 - 3. All coating to be applied inside and outside after welding.
 - 4. Pipe shall be straight, true to section and conform to the following weights:

<u>Pipe Size</u> <u>Outside Diameter</u>	<u>Type I</u> <u>Weight Lbs./Ft.</u>	<u>Type II</u> <u>Weight Lbs./Ft.</u>
1-5/8 inches	2.27	1.84
2 inches	2.72	2.28
2-1/2 inches	3.65	3.12
3 inches	5.79	4.64
3-1/2 inches	7.58	5.71
4 inches	9.11	6.56
6-5/8 inches	18.97	--

CHAIN LINK FENCING

5. Roll-Formed Steel: Hot-rolled steel shape H-section with a minimum yield strength of 45,000 psi conforming to ASTM F669, Group III. Protective coating system according to ASTM F1234, Type A, hot-dip galvanized with a minimum of 2.0 oz./s.f. zinc according to ASTM A123, or 4.0 oz./s.f. zinc according to ASTM A525.

B. Fabric:

1. Standard Fabric - Zinc coated fabric shall be galvanized after weaving with a minimum 1.2 oz. of zinc per square foot of surface area and conform to ASTM A392, Class 1. Fabric to be 9 gauge wire woven in a 2-inch diamond mesh. Top selvage twisted and knuckled. Bottom selvage knuckled.
2. Black fabric, locations as noted on drawings – Black vinyl coated fabric, zinc coated fabric shall be galvanized after weaving with a minimum 1.2 oz. of zinc per square foot of surface area and conform to ASTM A392, Class 1. Fabric to be 9 gauge wire woven in a 2-inch diamond mesh. Top selvage twisted and knuckled. Bottom selvage knuckled.

C. Posts:

1. Standard Posts Powder Coated Posts/ Chain Link. Contractor to provide galvanized posts, hardware and fencing/wiring. Fabric to be a minimum 9 gauge wire
2. Powder Coated Posts/ Chain Link, at locations noted on drawings as black vinyl coated. Contractor to provide powder-coated posts, hardware and fencing/wiring. Color of Vinyl Coating and Powder Coating shall be black. Fabric to be a minimum 9 gauge wire. Powder coating for all posts and hardware to be applied by an electrostatic spray process. The base coat shall be a thermosetting epoxy coating with a minimum coating thickness of 2-4 mils. The top coat shall be a mar-resistant TGIC polyester powder coating with a minimum coating thickness of 2-4 mils.

2.3 CONCRETE MIX

- A. ASTM C94 Portland cement concrete with maximum 3/4 inch aggregate having a minimum compressive strength of 3000 psi at 28 days.

2.4 COMPONENTS

A. Fence Posts:

<u>Fabric Height</u>	<u>Line Post o.d.</u>	<u>Terminal Post o.d.</u>
Under 6-feet	2-inches	2-1/2-inches
6-feet to 9-feet	2-1/2-inches	3-inches
9-feet to 12-feet	3-inches	4-inches

B. Gate Posts:

<u>Single Gate Width</u>	<u>Double Gate Width</u>	<u>Post o.d.</u>
Up to 6-feet	Up to 12 feet	3-inches
7-feet to 12-feet	12-feet to 25-feet	4-inches

C. Rails and Braces: 1-5/8 inches o.d

D. Gates: Frame assembly of 2 inch o.d. pipe with welded joints. Weld areas repaired with zinc rich coating applied per manufacturer's directions. Cover gate frame with same fabric as fencing, attaching with stretcher bars at vertical edges and tie wire at top and bottom. Provide diagonal cross bracing of 3/4 inch diameter adjustable length truss rods where necessary to provide frame rigidity against sag or twist.

E. Gate Hardware:

1. One pair pressed steel or malleable iron, non-lift-off type, offset hinges of size to suit gate size.
2. Provide fork type latch with padlock eye for single leaf gates. Each leaf shall have a flip-style catch, so that it can be held in an "Open" position. Provide gate stops for all double gates of mushroom or flat plate type, set in concrete to engage in center drop rod or plunger bar. Include locking device with padlock eyes as integral part of the latch

F. Fittings:

1. Post Caps: Pressed steel, cast iron, or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Supply cone type caps for terminal posts and loop type for line posts. All fittings to conform to ASTM F626.

CHAIN LINK FENCING

2. Rail and Brace Ends: Pressed steel, cast iron or cast aluminum alloy, cup-shaped to receive rail and brace ends.
 3. Top Rail Sleeves: Tubular steel, 0.051-inch thickness by 7 inches long, expansion type.
 4. Bottom Rail Sleeves: Tubular steel, 0.051-inch thickness by 7 inches long, expansion type (For Ballfield Fences Only).
 5. Tension Bars: Steel strip, 5/8-inch wide by 3/16-inch thick.
 6. Tension Bands: Pressed steel, 14 gauge thickness by 3/4-inch wide.
 7. Brace Bands: Pressed steel, 12 gauge thickness by 3/4-inch wide.
 8. Truss Rods: Steel rod, 3/8-inch diameter merchant quality with turnbuckle
- G. Tension Wire: Marcellled 7 gauge steel wire with minimum coating of 0.80 oz. of zinc or 0.40 oz. of aluminum per square foot of wire surface and conforming to ASTM A824
- H. Tie Wires: Aluminium, 9 gauge, alloy 1100-H4.
- I. Hog Rings: Steel wire, 11 gauge, with a minimum zinc coating of 0.80 oz./s.f. of wire surface.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

- A. All installation work performed by experienced, skilled workers approved by the manufacturer, in conformance with the Chain Link Fence Manufacturer's Association and ASTM F567.

3.2 INSTALLATION

- A. Connection to existing fencing:
1. Examine conditions and locations of existing fencing to remain. Coordinate installation of new posts and fencing to connect to existing fencing so that all fence runs are straight and true between corner posts.
- B. Fence and Gate Height: Provide height as indicated on Drawings.
- C. Post Spacing: Space line posts at intervals not exceeding 10 feet.
- D. Post Setting: After final grading is complete, set terminal, gate, and line posts plumb in concrete footings. In landscape areas top of footing to be 2-inches above grade and sloped to direct water away from posts. In paving areas, top of footing to be directly below thickness of paving section.
- E. Bracing: Brace gate and terminal posts back to adjacent line posts with horizontal brace rails and diagonal truss rods.
- F. Top Rail: Install through line post loop caps connecting sections with sleeves. One coupling in each five to have expansion spring. Top rail to fasten securely to each gate, corner, pull and end posts and form a continuous brace on each run of fence. ALL FENCING TO HAVE A TOP AND BOTTOM RAIL.
- G. Middle Rail: See Details for fence heights requiring middle rail.
- H. Bottom Tension Wire: Stretch between terminal posts 6 inches above grade and fasten to outside of line posts with tie wires.
- I. Fabric: Pull fabric taut with bottom selvage 2 inches above grade. Fasten to terminal posts with tension bars threaded through mesh and secured with tension bands at maximum 15-inch intervals. Tie to line posts and top rails with tie wires spaced at maximum 12 inches on posts and 24 inches on rails. Attach to bottom tension wire with hog rings at maximum 24-inch intervals.
- J. Gates: Install gates plumb, level, and secure for full opening without interference. Anchor center stops and keepers in concrete.
- K. Fasteners: Install nuts for fittings, bands, and hardware bolts on inside of fence

3.3 COMPLETION

- A. The area of installation shall be left free of debris caused by the installation of the fence.

END OF SECTION

IRRIGATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The Contractor shall furnish all labor, supervision, and materials to install a complete irrigation system as described by and implied in the Contract Documents.
- B. System description:
 - 1. A new irrigation system for Meadow Ridge Park, including a new irrigation point-of-connection, controller, valves, piping, sprayheads and rotors, and other irrigation components.
 - 2. The south portion of the site was previously part of the Timber Ridge School track and field property, and includes existing irrigation that will be affected by park construction. The extents of the existing system are not known. The Work includes demolishing existing irrigation in accordance with Section 024119 and repairing the irrigation system on Timber Ridge School property affected by construction activities as a design-build effort.
 - 3. Existing irrigation requirements:
 - a. Existing irrigation components on Timber Ridge School property shall be protected throughout construction. The Contractor is responsible for providing uninterrupted irrigation service for landscape areas outside the project boundaries at a minimum between May 1 and September 15, or earlier or later as directed by the Owner's Representative.
 - b. Existing irrigation zones affected by construction activities shall be repaired and restored to good working order by the Contractor. This portion of the Work is Design Build.
 - c. Design Build requirements are as follows:
 - 1) 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.
 - 2) The Landscape Architect'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.
 - d. Design Build components include:
 - 1) Provide new valves if existing valves are impacted by construction activities, including wiring connections to new or existing controllers. Valves shall match the make and model of existing valves, and shall be sized according to the size of the zone.
 - 2) Provide new piping and fittings as required.
 - 3) Rotors and sprayheads must have 100 percent head-to-head coverage. Manufacturer and model shall match the existing components in the zone as closely as possible.
 - 4) Pressure-regulating devices shall be used as required where pressure exceeds manufacturer's recommended operating levels.
 - 5) Spray nozzles must have a distribution uniformity of at least 0.70.
- C. 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.
- D. Coordination:
 - 1. Work under this division shall be conducted in a manner to cooperate with other trades and contracts involved with this project.
 - 2. 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.

IRRIGATION

3. Consult the drawings of all other divisions to avoid conflicts with cabinets, equipment, structural members, etc.

E. Related Sections:

1. City of Albany Standard Construction Specifications.
2. Section 015936 – Tree and Plant Protection.
3. Section 312000 – Earth Moving.
4. Section 320523 – Pervious Concrete Paving.
5. Section 321313 – Standard Concrete Paving.
6. Section 329113 – Soil Preparation.
7. Section 329200 – Seeded Areas.
8. Section 329300 – Trees, Shrubs, and Groundcovers.
9. Division 26 – Electrical.
10. Section 331100 – Water System.

1.2 SUBMITTALS

- A. The Contractor shall make all submittals in accordance with Section 013300 – 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 Record Drawings and shall include all approved variations or changes, indicating all sleeve, main line, lateral line, valve, quick-coupler, controller, wire and cable runs, irrigation heads, and other irrigation component locations to be located by field dimensions to the nearest permanent landmark, as approved by the Project Engineer.
 2. The Contractor shall maintain a current record of all pipe, wire, cable, and equipment placement and shall record all variations or changes approved by the Project Engineer. 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.
 3. The Record Drawings shall be submitted as electronic files in AutoCAD, most current version, on a compact disc format and hard copy.
 4. The Contractor shall provide a color coded Irrigation Valve Schedule, which shall be a printed layout of the irrigation system showing the as-built locations of all piping and valves, laminated on both sides with plastic, for placement inside the appropriate controller cabinet.
 5. The Contractor shall provide 3 copies of all equipment operation instructions, parts lists, service manuals, specification sheets, warranty information, precipitation rates for irrigation heads, and circuit operating time for each zone; properly collated, punched and bound in a 3 ring binder. Each binder shall be clearly marked with the following information:

PROJECT MANUAL

“Project Name” (from Contract Documents)

Date of Project Completion

Contractor’s Name and Address

6. Submit project manuals to Project Engineer for review and approval.
7. The Contractor shall be responsible for providing up to 8 hours of training and orientation to the Owner’s staff covering the adjustment and maintenance of the irrigation system. This training session shall be video recorded by Owner.

IRRIGATION

8. Provide 5 percent additional supply of each spray head used on project.

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, Drip Line, 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 drip line and 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 Landscape Architect.
- 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 Landscape Architect 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 Landscape Architect.

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 Landscape Architect. 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 Landscape Architect 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 Landscape Architect 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 Landscape Architect's decision will be final.

1.9 WARRANTIES

- A. Manufacturer's Warranty: Provide equipment manufacturer's standard warranties for factory-assembled equipment and products. The Contractor shall agree to correct, repair or replace defective materials/equipment at no additional cost to the Owner.

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- 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 correction of defective workmanship found at any time during guarantee period.
 3. Guarantee shall include one full winterization and spring startup of the irrigation system, including training and orientation to Owner for those procedures at that time.
 4. Guarantee shall include repair of trench backfill that settles more than 1/2-inch or of plantings, paving, and walk materials damaged by settlement of trench backfill soils during the guarantee period.
 5. Guarantee shall include setup and configuration of the Controller, as well as system adjustments over the course of the guarantee period to optimize system efficiency.

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-inch and smaller shall be Schedule 40 PVC. All main line pipe size 4-inch 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 PVC PIPE FITTINGS

- A. All PVC fittings shall be PVC 1220, Schedule 40, type 1, normal impact, I.P.S., N.S.F. approved and meeting the requirements of ASTM D-2466.
- B. All PVC nipples shall be standard weight Schedule 80, with molded threads.
- C. All PVC fittings for electrical conduits shall be sweep fittings.

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 VALVES

- A. Automatic Control Valves:
1. Spray zones: Rainbird PEB remote control valves with latching solenoid. Size as shown on drawings. Provide PRS adjustable pressure regulators at no extra cost to Owner if operating pressure at the valve for spray zones exceeds 45psi.
- B. Master Valve: Rainbird PEB remote control valve, normally closed, with latching solenoid and 2-wire sensor decoder.
- C. Flow Meter Valve: Rainbird UFS150 Flow Meter Valve with 2-wire sensor decoder.
- D. Exterior Gate (Isolation) Valves: Nibco T-113, line size.
- E. Quick-Coupling Valves: Rainbird 44-LRC quick coupling valves. Provide 2 matching Hunter keys and swivels.

IRRIGATION

2.7 VALVE BOXES AND VALVE BOX COVERS

- A. Valve Boxes for Control Valves: Highline Model #1419 with bolt-down lid and extensions as needed to facilitate required installation. Verify all valves, unions and other equipment will fit fully within box and allow access and servicing of all components. At no extra cost to Owner, install larger boxes if necessary to achieve this.
- B. Valve Boxes for Isolation and Quick-Coupling Valves: Highline Model #910 with bolt-down lid and extensions as needed to facilitate required installation.
- C. Bolts for Locking Valve Box Lids: where bolt-down lids are required, the Contractor shall provide stainless steel "penta" bolts (5-sided) and stainless steel washers. Bolts shall be of appropriate size and length for the specified valve box lid.
- D. All boxes, extensions and lids to be black color.

2.8 IRRIGATION HEADS AND SPRINKLERS

- A. Irrigation Heads: Rainbird 1800-PRS sprayheads, 6-inch or 12-inch as indicated on Drawings.
- B. Irrigation Nozzles: Hunter MP Rotator, size and coverage as indicated on Drawings.

2.9 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: For quick coupling valves, all threaded nipples to be Sch. 80 PVC and all threaded fittings shall be 40 PVC.

2.10 CONTROLLER AND CONTROLLER ACCESSORIES

- A. Controller: Rainbird ESP-LXD 2-wire decoder controller.
- B. Accessories:
 - 1. FD-TURF: 2-wire decoders.
 - 2. FD-401 Field Decoder
 - 3. FD-601 Field Decoder
 - 4. SD-211TURF: 2-Wire Sensor Decoders.
 - 5. LSP1TURF: 2-wire line surge protection.
 - 6. DPU-210: 2-wire decoder programming unit.
 - 7. ESPLXD-M50 2-Wire Decoder Module
 - 8. LSP-1 Lightning Surge Protector
- C. Cabinet: Rainbird LXMMSSPED stainless steel cabinet and pedestal.
- D. Sensors:
 - 1. Rainbird WR2-RFC Wireless Rain and Freeze Combination Sensor.
 - 2. Flow sensor: see Paragraph 2.06.C, above.

2.11 WIRE, CABLE AND ELECTRICAL CONNECTORS

- A. Irrigation 2-wire system wiring: Rainbird Maxi-Cable irrigation control wiring
 - 1. Conductor: Tin coated, soft drawn bare copper (ASTM Spec. 33)
 - 2. Two (2) conductors Solid (14awg and 12 awg)
 - 3. Insulation: Polyvinyl Chloride (PVC)
 - 4. Outer Jacket: Polyethylene (PE)

IRRIGATION

5. Colors: Red, White, Black, Orange, Blue, Yellow, Purple, Brown, Pink, Grey, & Green
 6. Temperature: 60°C
 7. Voltage: 600 volts
- B. Electrical Connectors for Remote Control Valve Wires: watertight electrical connectors "3-M DBY/DBR", "Rainbird Snap-Tite", or "Pen-tite PVC Socket and Sealing Plus".
 - C. Tracer Wire: single strand insulated copper wire designed for 24 volts or greater, Type UF, Underwriter's Lab (UL) approved for direct burial in NEC Class II circuits, continuous #14 gauge, single strand tracer wire, with yellow color coating.

2.12 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 ¼-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 Landscape Architect.
- 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 Landscape Architect any conflicts between the manufacturer's written specifications and recommendations, local and state, and the Contract Documents. The Landscape Architect may require the Contractor to correct to the Landscape Architect'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 Landscape Architect. Minor changes necessary to conform to ground conditions may be made by the Contractor without the Landscape Architect's prior consent in order to ensure the smooth progress of the work. However, all such changes are subject to approval by the Landscape Architect and must be recorded on the Record Drawings.
- D. Permission to shut off any water lines must be obtained in writing from the Landscape Architect 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:
- B. All lateral lines shall have 18-inches minimum and maximum 18-inches depth of cover.
- C. All main lines shall have 18-inches minimum and 24- inches maximum depth of cover.
- D. Where multiple pipes are laid in common trench, the Contractor must maintain a minimum separation of 2-inches in any direction between all pipe.
- E. All sleeves and conduits shall have 24-inches minimum and 30-inches maximum depth of cover.
- F. 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.
- G. Before back-filling trenches, all pipe shall be flushed clear and clean of all dirt and foreign material.
- H. 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.

IRRIGATION

- I. 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.
- J. 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. Do not use Teflon tape on Marlex type fittings.
- D. Install the specified tracer wire on the top side of main line and lateral pipes, except for drip irrigation header and exhaust pipes. Tape tracer wire to the pipe at not less than 10' intervals. All sections of tracer wire shall be spliced together with watertight splice connectors, to provide a continuous run. Tracer wire shall be taped at intervals of no less than 10 feet and at all Tee's and turns in the pipe. A minimum of 2 feet of tracer wire shall be looped in each valve box unless otherwise directed by the Landscape Architect.
- E. Snake pipe in trenches to allow for expansion and contraction as recommended by the manufacturer.
- F. At all installed joints cut pipe ends square and remove all burrs.

3.4 BACKFLOW UNITS

- A. See Civil drawings and Division 33 - Utilities.

3.5 VALVES

- A. Install complete with fittings and covers as detailed.
- B. Verify locations with Owner prior to installation.

3.6 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. 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, recommendations, and all applicable local and state codes.
- D. Contractor shall meet on-site with the controller manufacturer's representative, prior to commencement of installation of controller.

3.7 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 Landscape Architect 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.

3.8 IRRIGATION SLEEVES AND CONDUITS

- 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.

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- 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.
- F. Conduits and sweep fittings as required to route wires and cables from the controller shall be installed per Division 26-Electrical. All wires and cables shall be routed within electrical conduits securely fastened to the wall. Coordinate with other trades as required.

3.9 IRRIGATION WIRING AND CABLES

- A. Install 2-wire system in compliance with manufacturer's written installation instructions.
- B. Tape 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.
- C. 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 36-inches of coiled slack between all wire splices.
- 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. Two-wire path shall be surge protected and grounded every 500 feet or every 8 decoders, whichever is smaller. Surge protection is provided by FD-401 and FD-601 field decoders. If FD-401 and FD-601 field decoders are not used, install LSP-1 Line Surge Protectors.
- F. 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.
- G. For control wires, cables and tracer wires, provide 36-inches loop of extra wire in all valve boxes.
- H. 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.
- I. Label all installed wires on each end with waterproof tags for all wires including those for future use.

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 Landscape Architect 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 Landscape Architect at least 24-hours in advance and complete another test in the presence of the Landscape Architect for approval. All testing shall be done with a certified pressure gauge supplied by the Contractor.

IRRIGATION

- 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 Landscape Architect at least 24 hours in advance, and perform another coverage test in the presence of the Landscape Architect 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 Landscape Architect and found to be acceptable. The Contractor shall credit the Owner, against the contract amount, at the rate of \$75.00/hr. for reinspection 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, project manuals, and provide training to Owner as described in Paragraph 1.2 D.
- B. The Contractor shall be responsible for one full winterization and one spring activation of the irrigation system, and shall conduct these operations as part of the Owner's training and orientation procedures.

END OF SECTION

SOIL PREPARATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnish labor, material and equipment required for soil preparation of areas to receive shrubs and trees, and groundcovers.
- B. Coordinate Work with installation of other site work including but not limited to installation of site elements including curbs, edgers, and other site features, irrigation, seeding and planting.
- C. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 015639 – Tree Protection
 - 3. Section 312000 – Earth Moving.
 - 4. Section 320523 – Pervious Concrete Paving.
 - 5. Section 321313 – Standard Concrete Paving.
 - 6. Section 329200 – Seeded Areas.
 - 7. Section 329300 – Trees, Shrubs and Groundcovers.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. Definitions:
 - 1. Topsoil is defined as ASTM 5268, fertile, friable, natural fine sandy loam, very fine sandy loam, loam or silt loam surface soil with pH range of 5.5 to 7, 4 percent organic material minimum. Topsoil shall be free of subsoil, stones or hard earth 1-inch or larger, noxious weeds (including quack grass and horsetail), roots, sticks or other extraneous material.
 - 2. RPZ: Root Protection Zone, as specified in Section 015639 – Tree Protection.

1.3 SUBMITTALS

- A. The Contractor shall make all submittals in accordance with Section 013300 – Submittal Procedures.
- B. Contractor shall perform and submit a complete soil test for existing on-site topsoil, subject to the following conditions:
 - 1. Analysis and Testing shall be performed by an Independent Testing Laboratory (ITL): The Soil and Plant Laboratory, Inc., A&L Western, or approved equal.
 - 2. Laboratory Instructions: Obtain from the ITL instructions for submission of samples and minimum sample sizes.
 - 3. Laboratory Analysis Requirements for each sample submitted: Complete Soil Test for New Planting, including evaluation of chemical suitability, available nutrients, texture, and organic matter content.
 - 4. Amendment recommendations per laboratory analysis.
- C. 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.
- D. Submit product data for fertilizers and herbicides.
- E. Furnish 1/2 cubic foot of each of the following, including supplier's name and location of supply to Owner's Representative for approval before delivering to job site:
 - 1. Garden Compost.
 - 2. Aggregates.
- F. Closeout submittals: When the project has been deemed substantially complete, but before final approval, submit copies of invoices showing soil quantities delivered to the site.

1.4 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.

SOIL PREPARATION

1. 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.
- 1.5 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 frozen soil is on site.
 - C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Owner's Representative 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.
- 1.6 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 that 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 TOPSOIL

- A. Amended Native Topsoil:
 1. Amended native topsoil shall be used for planting areas as shown on the Drawings.
 2. Contractor shall test native topsoil according to the requirements of Paragraph 1.3.B, above.
 3. Native topsoil shall be amended according to the results of the soil test and shall meet the requirements stated in Paragraph 1.2.B.1.
 4. Use of unamended native topsoil is prohibited.

2.2 SOIL AMENDMENTS

- A. Calcium Carbonate Limestone: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 sieve and a minimum 75 percent passing a No. 60 sieve.
- B. Dolomite Limestone: Provide lime in the form of dolomite limestone.
- C. Other amendments including Gypsum (calcium sulfate), Ammonium nitrate, Copper sulfate, Zinc Sulfate, Laundry Borax (10 percent elemental boron).
- 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. 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 material must pass through a ½-inch screen
 2. The pH of the materials 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 percent
 7. Stability shall be 5-7
 8. Carbon/nitrogen ration shall be less than 25:1
 9. Trace metals test result = "pass".
- E. Sand: Clean, washed, natural or manufactured sand, free of toxic materials.

SOIL PREPARATION

2.3 OTHER MATERIALS

- A. Mycorrhizal treatment for tree and shrub planting pits: Endo/Ecto plus mycorrhizal granular inoculums as available from Mycorrhizal Applications (541) 476-3985.
- B. Fertilizer: as recommended in soils report.
- C. Herbicide: TriMec, Round-up, or other herbicides as approved.
- D. Water: Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plantings for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until satisfactory conditions have been corrected, including adequacy of preinstalled irrigation system. Verify that subgrades and slopes of planting bed areas are acceptable to Owner's Representative prior to commencing work of this section.

3.2 PREPARATION

- A. Prepare soil at a time when moisture conditions will permit proper cultivation.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Remove stones over 1-inch diameter, sticks, mortar, concrete, rubbish, debris and all materials harmful to plant life.
- D. Remove or spray as required to eradicate noxious weed growth and roots.
- E. Achieve complete removal or kill of all weeds within all areas receiving new plantings.
- F. Kill achieved by working soil is permissible for annual non-noxious broad leaf type weeds, except within
- G. Locate and securely mark or flag irrigation sprinkler heads, area drains, catch basins, cleanouts, manholes, valve boxes, and other site improvements not extending above finish grade.
- H. Request inspection and allow observation by Owner's Representative of prepared soils before planting.

3.3 SOIL PREPARATION, GENERAL

- A. This section pertains to planting beds as shown on the drawings, except for planting areas within RPZ's of existing trees.
 - 1. Excavation within tree RPZ's shall comply with the requirements of Section 015639 – Tree Protection.
- B. Excavation for tree planting pits: excavate and remove soil, debris, rock and other material to 36-inches below adjacent finish grade, a minimum of 3x the size of the tree rootball.
- C. Thoroughly till subgrade in planting areas to a 6-inch depth for approval. Remove any rock or debris over 1-inch in diameter within the 6-inch subgrade area. Do not proceed with application of topsoil until subgrade scarification and removal of rock or debris has been approved by the Owner's Representative.
- D. Soil placement, general planting areas: place 6-inches of amended topsoil and then rototill into the subgrade to a depth of 6-inches.

3.4 SOIL PREPARATION FOR PLANTING PITS OF TREES

- A. This section pertains to the amended topsoil mix for the plant pits of individual plants.
- B. Thoroughly mix approved amended topsoil with approved 14/18/12 slow release fertilizer and approved mycorrhizal treatment.
 - 1. Fertilizer rates:
 - a. Trees, shrubs, and groundcovers spaced at 18-inches on center or more: 4 oz per plant.
 - 2. Mycorrhizal inoculate rate:
 - a. Trees: 1 oz per caliper size (e.g., 2 oz for 2-inch caliper tree, 3 oz for 3-inch caliper tree, etc.).
- C. Place amended topsoil mix in planting pits as specified in Section 329300 - Trees, Shrubs and Groundcovers and as shown the Drawings.

SOIL PREPARATION

- D. Grade smooth to elevations shown on Contract Documents.

3.5 FINE GRADING

- A. Finish grade after full settlement including mulch, shall be 1-inch below tops of curbs, walks, or existing grades in shrub areas, or as otherwise indicated on the drawings. Contractor may be required to adjust the amount of topsoil to bring the finish soil elevation to grades shown on plans.
- B. Slope all areas to prevent puddling and drain surface water toward catch basins, drains, curbs, or off site, as detailed.
- C. Soil in all areas shall be thoroughly settled, with a smooth surface free of humps and hollows, and shall be firm enough to resist undesirable impressions when stepped upon.
- D. Use levels, screens, drags, or any other equipment necessary to establish and verify grades and surfaces.
- E. Schedule inspection 48 hours in advance with Owner's Representative for review of fine grading operations.

3.6 CLEAN-UP

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

END OF SECTION

SEEDED AREAS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hydro seeding.
 - 2. Dry seeding.
 - 3. Lawn and seeded area maintenance.
- B. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 312000: Earth Moving, for preparation of subsoils.
 - 3. Section 329113: Soil Preparation, for topsoil, soil fertilizer, and amendments.
 - 4. Section 329300: Trees, Plants, and Groundcover, for other landscape work not included in this Section.
- C. Definitions:
 - 1. Weeds include the following:
 - a. Blackberry, Canada Thistle, Dandelion, Horsetail, Morning Glory, Nut Sedge, Poison Oak, Rush Grass, Annual Bluegrass, Bermuda Grass, Brome, Crabgrass, Johnson Grass, Nut Grass, Quack Grass, Shiny Geranium, Garlic Mustard, Nutsedge and Lesser Celandine.
 - b. Other plants designated as a noxious weed by authorized State, County and City officials.

1.2 SUBMITTALS

- A. Qualification data for firm and supervisor proposed to perform Work of this Section. Provide information to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses along with the names, phone numbers, and address of Landscape Architects and owners.
- B. Product information:
 - 1. Each seed mix specified in the Contract Documents, including proposed seeding rate.
 - 2. Hydroseeding mulch.
- C. Submit an approved Application for Pesticide Use on Park Property.
- D. Submit planting schedule indicating anticipated dates and locations for each type of planting.
- E. Maintenance instructions recommending procedures to be established by Owner for maintenance of lawns, grasses, and other seeded areas during an entire year.
- F. With application for final payment, submit duplicate copies of delivery invoices, labels, or other acceptable proof of quantities of materials used.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with all local, municipal and state laws and rules and regulations governing or relating to any portion of the Work of this Section, including the Owner's Integrated Pest Management Policy.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store seed at the site in dry area.

1.5 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Apply seed when wind velocity is less than 5 miles per hour at the site.
 - 2. Do not plant lawns when the air temperature is below 40 degrees F or above 80 degrees.

1.6 COORDINATION AND SCHEDULING

- A. Perform seed work after soil preparation, planting, irrigation, and other work affecting ground surface has been completed.
- B. Plant seeded areas after April 15 and before September 15, unless otherwise approved by Owner.
 - 1. Apply seed within 4 hours after final preparation of seeding areas.
 - 2. Do not seed within 2 feet of base of trees.

SEEDED AREAS

1.7 WARRANTY, MAINTENANCE AND ACCEPTANCE

- A. All seeded areas installed by the Contractor shall be guaranteed and maintained for a period of 1 year, beginning at Substantial Completion.
- B. Begin maintenance immediately after seeding. Maintenance shall continue through the duration of the warranty period.
- C. Lawn Maintenance:
 - 1. The maintenance described in this section applies only to lawns, and does not apply to other seeded areas such as meadow areas, seeded stormwater facilities, or native shrub seeded areas.
 - 2. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and mulch to produce a uniformly smooth lawn.
 - a. Seeded Grass: Maintain for a minimum of 45 days after seeding is completed for each new grass area.
 - 1) Irrigate new seeded lawn areas at a maximum rate of 0.5 inches of water per hour to keep soil materials moist.
 - 2) When required by dry winds, apply pre-soaked peat moss at 1/8 inch to 3/16 inch thick and roll to a smooth surface.
 - b. If the seeding construction is performed outside the permanent seeding dates, the establishment period will end 45 calendar days after acceptance of any reseeding that is necessary due to the installation dates.
 - 3. Do not walk on lawn areas for the first 30 days to irrigate, weed, or replace grass seed, without using plywood protection boards to walk over prepared lawn areas.
 - 4. Mowing and Edging:
 - a. Mow lawns as soon as there is enough top growth to cut with mower set at height of 1-1/2 to 2 inches, removing no more than 1/3 of the grass leaf with each mowing. Repeat mowing at least once a week and as required to maintain specified height. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.
 - b. Mow grass only when ground is sufficiently firm to prevent rutting depressions in excess of 1/8 inch caused by mowing equipment wheel loads.
 - 1) Reduce or temporarily terminate watering as necessary to allow mowing machinery to be used without rutting depressions in excess of 1/8 inch.
 - c. Remove excess accumulations of grass clippings within 2 hours after mowing and legally dispose of off Project site.
 - d. Edge lawns at the same time as the first mowing. Thereafter edge with every other mowing. Edge along walks, curbs, pavements, planting bed edges, and mulch circles around trees in lawn.
 - 5. Postfertilization: Apply fertilizer and thoroughly water lawn areas after first mowing and when grass is dry, or on the 14th day after seeding, or sodding, whichever comes first.
 - a. Use fertilizer that will provide actual nitrogen of at 1 lb. per 1000 sq. ft. of lawn area.
 - 1) Apply Top Dress Fertilizer with mechanical rotary or drop type distributor.
 - 2) Water fertilizer into soil.
 - b. Apply fertilizer at least once every 60 days.
 - 6. Weeding:
 - a. Keep all lawn areas clean and weed free.
 - b. Treat lawns as needed to eliminate weeds and keep weed free per the approved Application for Pesticide Use on Park Property.
- D. Maintenance of non-lawn seeded areas:
 - 1. Maintain and establish non-lawn seeded areas by watering, weeding, and reseeding as necessary. Roll, regrade, and replant bare or eroded areas. Do not mow or fertilize in non-lawn seeded areas. Use of herbicides that do not adversely affect the plants in the specified seed mixes is allowed with approved submittal and written permission from the Owner.
 - a. Seeded Meadow and Native Shrub Areas: Maintain for a minimum of 45 days after seeding is completed for each area.
 - b. If the seeding construction is performed outside the permanent seeding dates, the establishment period will end 45 calendar days after acceptance of any reseeding that is necessary due to the installation dates.

SEEDED AREAS

2. Do not walk on newly seeded areas for the first 30 days to irrigate, weed, or replace seed, without using plywood protection boards to walk over prepared lawn areas.
- E. Cleanup:
1. Keep all buildings, pavements, and other exterior improvements clean and free of soil and debris.
 2. Police and cleanup entire site at least once a week and additionally as needed to collect seasonal debris (leaves).
 3. Dispose of collected materials off site.
- F. Repair of Seeded Lawn Areas:
1. Apply grass seeds to bare areas which occur in lawn areas within the 90 day installers guarantee period.
 2. Reseed lawn areas where soil erosion or poor germination causes bare areas.
 3. Immediately remove and replace seeded areas showing excessive growth of perennial and annual weeds, deficient grass growth, and damage.
 4. Completely remove weeds including weed roots according to the approved Application for Pesticide Use on Park Property.
 5. Remove and replace excessively weeded, grass growth deficient, and damaged areas in accordance with requirements in this Section.
- G. Maintenance Results and Acceptance:
1. Notify Owner's Representative in writing 5 days minimum prior to Owner assuming maintenance responsibility for lawn areas.
 2. Acceptance of seeded lawn areas is contingent meeting the requirements of this Section and the establishment of a healthy, thick, weed-free stand of grass, uniform in thickness, texture, color, and height.
 3. Acceptance of non-lawn seeded areas is contingent meeting the requirements of this Section and the establishment of a healthy, thick, weed-free meadow or native planting area, as applicable.
 4. Weed-free Tolerance: One broadleaf or narrowleaf weed for each 50 square feet of seeded area.
 5. Provide maintenance beyond the required maintenance period as necessary to achieve specified results.

PART 2 - PRODUCTS

2.1 SEEDED MATERIALS

- A. Grass Seed Mixture: Sunmark Seeds "Diamond Green Turf Mix".
 1. Seeding rate: 8 lbs per 1,000 sf.
- B. Meadow Seed Mixture: Sunmark Seeds "Meadow Mix".
 1. Seeding rate: 2 lbs per 1,000 sf.
- C. Native Seed Mixture: Sunmark Seeds "Oak Savanna Seed Mix".
 1. Seeding rate: 2 lbs per 1,000 sf.

2.2 TOPSOIL, SOIL AMENDMENTS, AND FERTILIZER

- A. Topsoil, soil amendments, and fertilizers are specified in Section 329113, "Soil Preparation."

2.3 HERBICIDE

- A. As listed on the approved Application for Pesticide Use on Albany Parks Property.

2.4 HYDRO MULCH

- A. Material: Virgin wood cellulose fiber containing no growth or germination inhibiting factors.
- B. Application Metering Material: Green dye to facilitate visual metering.
- C. Performance Characteristics: Forms a homogenous slurry upon agitation for rapid and even dispersal.
- D. Acceptable Wood Fiber Mulches; One of the following, or approved:
 1. Weyerhaeuser; Silva-Fiber.
 2. Conwed Corp.; 1000 Hydro Mulch.
 3. Spray Mulch Industries; Spray Mulch.

SEEDED AREAS

2.5 EQUIPMENT

- A. Hydro Seeding Equipment:
 - 1. Hydraulic Equipment: Continuous mixing and agitating action to mix water, seed, fertilizer, and mulch and distribute the mixture on lawn areas.
- B. Temporary Fence:
 - 1. Plastic Construction Fence 36 inches minimum height.
 - 2. Warning Signs: 8-1/2 by 11 inches, wrapped in plastic or waterproof, with one inch high letters.
 - 3. Sign Copy: THANK YOU FOR NOT WALKING ON GRASS
- C. Dry Seeding Equipment:
 - 1. Type: Rotary or drop distributor.

2.6 ACCESSORY MATERIALS

- A. Seed Lawn Fertilizer: Commercial mix, 16-4-8, not less than 50 percent cold water insoluble nitrogen derived by incorporating a minimum of 800 pounds urea formaldehyde per ton of fertilizer.
- B. Ammonium Sulfate: 21-0-0 composition.
- C. Peat Moss: Pre-soaked, natural, shredded or granulated peat moss, fine texture, with pH of 4 to 6 water capacity of 1,100 to 2,000 percent.
- D. Vapor Retarder: 6 mil thick, black polyethylene sheet, ASTM D 2103.
- E. Water: Free of weed seed and chemicals harmful to plant growth.

PART 3 - EXECUTION

3.1 SUBGRADE AND TOPSOIL PREPARATION

- A. Subgrade preparation is specified in Section 312000, "Earth Moving."
- B. Topsoil preparation is specified in Section 329113, "Soil Preparation."

3.2 PREPARATION - GENERAL

- A. Examine areas to receive lawns for compliance with requirements and for conditions affecting performance of Work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 1. Verify completion of underground utility lines in lawn areas.
- B. Protect existing utility systems, paving, walks, curbs, and other site improvements from damage during seeding and sodding.
- C. Seeding Preparation:
 - 1. Remove hard or soft topsoil areas and adjust grade of topsoil where required.
 - 2. Lightly irrigate dry planting soil.
 - 3. Allow time for free surface water to drain prior to seeding.
- D. Hydro Seeding Preparation:
 - 1. Install 10 feet minimum width vapor retarder sheet cover at perimeter of hydro seeding area to prevent hydro seeding drift on adjacent surfaces.
 - 2. Lap joints 6 inches minimum.

3.3 SEEDING NEW LAWNS AND SEEDED AREAS

- A. Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
 - 2. Do not seed within 2 feet from base of trees.
 - 3. Adjust method of seeding application only after written request, and receiving approval from the Owner.
- B. Sow seed at rates specified herein.
- C. Apply 3 pounds ammonium sulfate for each 1000 square feet.

SEEDED AREAS

- D. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray. Keep area moist, but not soggy, until grasses become firmly rooted.

3.4 HYDRO SEEDING NEW LAWNS AND SEEDED AREAS

- A. Apply seed, mulch, fertilizer and water uniformly in one application with hydraulic equipment to prepared lawn areas.
 - 1. Apply seed mixture at rates specified herein.
 - 2. If approved by Owner to seed after September 15th, increase grass seed mixture by one pound per week per 1000 square feet up to a total of 14 pounds per 1000 square feet.
- B. Apply 35 pounds (dry weight) wood fiber mulch for each 1,000 square feet for slopes 8 to 1 or less and 50 pounds (dry weight) wood fiber mulch for each 1,000 square feet for slopes steeper than 8 to 1.
- C. Apply 3 pounds ammonium sulfate for each 1,000 square feet.
- D. Apply mixture through a pressure spray distribution system providing a continuous, nonfluctuating discharge of mixture in the above quantities uniformly on lawn areas.
- E. Apply seed and mulch mixture using a sweeping, horizontal motion of spray distribution system.
- F. Do not seed within 2 feet from base of trees.

3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. During landscaping, keep pavements clean and work area in an orderly condition.
- B. Protect lawns from damage due to other landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.
 - 1. Install temporary fence at perimeter of lawn areas.
 - a. Install posts at 10 feet on center maximum, to a depth of 12 inches.
 - b. Install warning signs on posts at 50 foot intervals with minimum of one sign on each side of each lawn area.
 - c. Remove fence when lawn areas are established.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

TREES, SHRUBS, AND GROUNDCOVER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Install trees, shrubs and groundcovers as detailed and specified herein.
 - 2. Secure and maintain all plant material to have minimum 1-year acclimation in a similar climate to project site.
 - 3. Establish a coordination schedule for supplying and installing plants and related materials.
 - 4. Provide an allowance for additional plant material to be selected by Owner or Owner's Representative.
- B. Related Sections:
 - 1. City of Albany Standard Construction Specifications.
 - 2. Section 015639 – Tree Protection.
 - 3. Section 328400 – Irrigation.
 - 4. Section 329113 – Soil Preparation.
 - 5. Section 329200 – Seeded Areas.

1.2 REFERENCES

- A. Standards: Comply with botanical names, sites, and conditions provided in:
 - 1. Botanical Names: American Joint Committee on Horticulture Nomenclature, "Standardized Plant Names" or "Hortus Third".
 - 2. Sizes and Conditions: American National Standards Institute (ANSI) Z60.1, "American Standards for Nursery Stock", latest edition.

1.3 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 landscape establishment, with 5 years minimum experience.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress. 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. Submit certificate of inspection of plant material by State or Federal authorities if required.
- B. All plant material is to be grown from cuttings or seed. Collected plants are not acceptable.
- C. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1, "American Standard for Nursery Stock".
 - 1. Plant sizes indicated shall be the size of the plant at installation.
- D. Measurements: Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6-inches above ground for trees up to 4-inch caliper size, and 12-inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
- E. Pre-installation conference: Conduct conference at Project site to comply with requirements.

1.4 QUALITY CONTROL

- A. Inspection:
 - 1. All trees shall be inspected and tagged by the Owner's Representative at the growing or holding site. All trees tagged by the Owner's Representative shall have a unique tree tag and ID number. Any trees delivered to the project site without the unique tree tag shall be rejected.
 - 2. All other plants shall be subject to inspection by the Owner's Representative at the growing or holding site or on the job site. Plants not conforming to specifications shall be rejected.
 - 3. Approval of material at a growing or holding site is a qualified endorsement of general quality only, and does not certify a compliance with the specifications in all particulars; such approval does not preclude the right of rejection on the job site.

TREES, SHRUBS, AND GROUNDCOVER

- B. The presence of noxious weeds in plant balls shall be cause for rejection of any or all plants from that source.

1.5 SUBMITTALS

- A. The Contractor shall make all submittals in accordance with Section 013300 – Submittal Procedures.
- B. Submit list of growers for each plant species to be installed within 30 days after the award of Contract. List to include plant sizes and conditions. Certify, in writing, confirmed orders for plants and provide the quantity, location, phone number, and address of the grower who has agreed to provide any plant material. Verify that the sizes of plants indicated will be available at the time of installation. Each plant species shall be supplied by 1 grower only unless approved by Owner's Representative.
 - 1. All trees must be secured before the end of digging season.
- C. Substitutions:
 - 1. Requests for substitutions of plants not available in size, quantity or type specified must be made within 30 days after the award of bid. Submit proof on non-availability to Owner's Representative.
 - 2. Where evidence is submitted that a specified plant cannot be obtained, substitutions in kind, size and grade will be made only upon written approval by the Owner's Representative.
 - 3. Provide a minimum of (2) substitution options for each plant for review by Owner's Representative. Proposed substitutions shall be similar to the specified plant in growing conditions, habit, size at installation, size at maturity, and color (leaf and flower). Different varieties of the same species are preferred.
 - 4. The plant search shall not be limited to Oregon, and shall include sources of supply in California, Washington State, and British Columbia, as allowed by local and federal regulations.
- D. Contractor shall inspect plants at growing or holding area and send letter of confirmation of plant quantities and conditions to Owner's Representative 100 days before planting time.
- E. Product submittals:
 - 1. Submit a 1/2 cu.ft. sample of bark mulch for approval prior to delivery.
 - 2. Submit product data for fertilizer tablets.
 - 3. Submit product data for tree stakes and ties.
- F. Submit planting schedule indicating anticipated dates and locations for each type of planting.
- G. With application for final payment, submit duplicate copies of delivery invoices, labels, or other acceptable proof of quantities of materials used.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in manufacturer's unopened containers, fully identified by name, brand, type, weight and analysis.
- B. Store materials to prevent damage or intrusion of foreign matter.
- C. Plant Materials: Deliver trees and shrubs after preparations for planting have been completed. Protect trunks and branches from damage. Protect root systems from drying out. Label 1 of each tree and shrub species with securely attached waterproof tag bearing botanical name and suppliers name.
- D. Heel-in plants immediately upon delivery if not planted within 4 hours.
- E. Store plants in shade and protect from harmful weather until planted.
- F. Water, maintain, and protect stored material from drying or other injury or damage.
- G. Store plants in upright position and allow sufficient ventilation.
- H. Do not drop plants.
- I. Do not pick up containerized or balled plants by stems or trunks.
- J. Deliver seed in original sealed, labeled, and undamaged containers. Ship and store seed, compost and fertilizer with protection from weather or other conditions that would damage or impair the effectiveness of the product.

1.7 INSPECTIONS

- A. Notify Owner's Representative 48 hours in advance for the following reviews of work:
 - 1. Review of plant stock upon arrival to site or at nursery as determined by Owner's Representative.

TREES, SHRUBS, AND GROUNDCOVER

2. Review of plant materials located in position for planting, but not yet planted.
3. Schedule inspection to take place during the last weeks of the 60-day establishment period.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate planting of trees and shrubs during normal planting seasons for such work in location of Project.
 1. Plant frost-tender trees and shrubs only after danger of frost is past or before frost season to allow establishment before first frost. Do not plant in frozen ground.
- B. Coordinate delivery, placement, and installation of specimen trees with other trades.

1.9 WARRANTY, MAINTENANCE AND ACCEPTANCE

- A. All plant materials installed by the Contractor shall be guaranteed and maintained for a period of 1 year, beginning at Substantial Completion.
- B. Remove and replace trees, shrubs, or other plants found to be dead or in unhealthy condition during warranty period. Make replacements during growth season following end of warranty period. Replace trees and shrubs, which are in doubtful condition, at end of warranty period; unless requested by Owner's Representative, it is advisable to extend warranty period for a full growing season.
- C. Another inspection will be conducted at end of extended warranty period, if any, to determine acceptance or rejection. Only 1 replacement (per tree, shrub or plant) will be required at end of warranty period, except for losses or replacements due to failure to comply with specified requirements.
 1. All tree stakes and ties shall be removed at the 1-year warranty walkthrough.
- D. Maintenance:
 1. Begin maintenance immediately after planting. Maintenance shall continue through the duration of the warranty period.
 2. During the warranty period the Contractor is responsible for watering, weeding, spraying, replacement of plants, mowing, edging, cleanup and other Work to keep the landscaped areas in a neat and clean condition. Maintain trees, shrubs and other plants by pruning, cultivating and weeding as required and needed for healthy growth. Restore planting basins. Adjust and repair stake supports and reset trees and shrubs to proper grades or vertical position as required. Spray as required to keep trees, shrubs, and other plantings free of insects and disease. Replace mulch as required.
 3. At the end of the 1-year warranty period walkthrough, remove all tree stakes and ties.

PART 2 - PRODUCTS

2.1 TREE, SHRUBS AND GROUNDCOVER MATERIAL

- A. Trees, shrubs and groundcover shall conform to the following requirements:
 1. Well rooted in the container but not root bound.
 2. No encircling, girdling, or potentially binding roots.
 3. The top of rootball must be within 3-inches of the top of the container.
 4. No weeds may be growing in the container.
 5. Single trunked, not headed or topped.
 6. No bark in the crotches of any main branches.
 7. No branches can be larger than 2/3 the trunk diameter.
 8. The trunk of the tree must have a visible taper. No portion of the trunk above 6-inches can be larger than the portion below this point. The bottom of the trunk must be of greater diameter than all other portions of the trunk.
 9. Free of insects or diseases at time of acceptance.
- B. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Owner's Representative, with a proportionate increase in size of roots or balls.
- C. Label at least 1 tree and 1 shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
 1. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

TREES, SHRUBS, AND GROUNDCOVER

2.2 CONTAINER-GROWN STOCK

- A. Provide healthy, vigorous, well-rooted trees or shrubs established in container. Provide balled and burlapped stock when required trees or shrubs exceed maximum size recommended by ANSI Z60.1 for container-grown stock.
 - 1. Established container stock is defined as a tree or shrub transplanted into container and grown in container long enough to develop new fibrous roots, so that root mass will retain its shape and hold together when removed from container.
- B. Containers: Rigid containers that will hold ball shape and protect root mass during shipping. Provide trees and shrubs established in containers of not less than minimum sizes recommended by ANSI Z60.1 for kind, type, and size of trees and shrubs required.

2.3 BACKFILL SOIL MIXTURE

- A. See Section 329113 - Soil Preparation.

2.4 TREE STAKES AND TIES

- A. Tree Stakes to be 2-inch diameter by 8-foot Doug Fir stakes.
- B. Tree ties to be thick plastic chain tie.

2.5 MULCH

- A. Mulch: Organic fine ground well-aged dark hemlock bark, free from deleterious materials and suitable as a top dressing of trees, shrubs, and groundcover areas.

2.6 ANTI-DESICCANT

- A. Commercially available spray protective coating, designed to reduce plant transpiration loss, which produces a moisture-retarding barrier not removable by rain or snow.

2.7 WATER

- A. Potable, free from ingredients harmful to plant life.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive trees and shrubs for compliance with requirements and for conditions affecting performance of Work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Fine grading and Soil Preparation: Verify that fine grading and soil preparation work is complete.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

3.3 ANTI-DESICCANT/TRANSPIRATION TREATMENT

- A. Treat all plants delivered to project site from June 1st through September 15th. Apply anti-desiccant/transpirant immediately prior to or upon delivery to project site.
- B. Follow manufacturer's recommendations and precautions. Apply in spray form to foliage, branches, limbs and trunks of plants.

3.4 PLANT PITS

- A. Stake locations of trees and shrubs for approval prior to digging. Field place trees and shrubs in locations shown on Contract Drawings. Placement must meet approval of Owner's Representative prior to backfilling. Owner's Representative may request rotation or slight movement of tree to give a better appearance with respect to adjacent plants and structures.
- B. Size of Tree Pits: Minimum width three times the diameter of ball.
- C. Scarify bottom and sides of hole with shovel.

TREES, SHRUBS, AND GROUNDCOVER

- D. Set trees on unamended native soil where possible. This is not applicable where soil is imported in depths greater than depth of root mass. To prevent settling of trees and large shrubs, soil added to the bottom of hole is to be foot tamped and unamended.

3.5 PLACING

- A. Set top of deciduous rootballs no less than 1-inch above finish grade and conifers and rhododendrons no less than 3-inches above grade and mound; deep planting not permitted. If hole for trees is too deep, fill hole with native soil only where applicable or prepared soil to correct levels. Use unamended soil and foot tamp to prevent settling. Large rhododendrons and #20 containers or larger shall be 5-inches high.
- B. Set plants plumb and faced for best appearance.
- C. Remove wire baskets, burlap, fasteners from rootball completely if rootball will not be damaged. If damage is suspected, notify Owner's Representative for concurrence and remove tops and sides of baskets minimum. Use bolt cutters on wire if necessary to remove wire baskets. Bending back is not acceptable.
- D. Remove metal cans or plastic containers completely from rootball.
- E. Neatly cut off broken, girdling, or frayed roots and any root growth growing in a circular manner conforming to its container.

3.6 BACKFILLING

- A. Backfill half of plant pit around rootball with prepared planting soil, carefully tamp soil around rootballs. See Specification 329113 - Soil Preparation for planting soil mixture.
- B. Complete backfilling, firming to surface grade. Thoroughly hand-water each plant and entire bed immediately after planting. Adjust rootball and soil as necessary.
- C. Remove tree tags.
- D. When area is not to be immediately irrigated and dry conditions exist, holes are to be watered half full and again when backfilling is complete.

3.7 TREE STAKING

- A. Tree Stakes and Ties:
 - 1. Install stakes and ties as detailed on the Drawings.
 - 2. Trees shall be able to stand upright without support, and shall return to the vertical after their tops have been deflected horizontally and released.
 - 3. Trees shall remain plumb and straight from installation through the warranty period.

3.8 MULCH INSTALLATION

- A. Install medium fir bark mulch over tree-watering basins, shrubs, and ground cover areas. Do not place mulch against trunks or stems. Rake mulch surface smooth after installation.
 - 1. Do not install mulch in seeded areas.
- B. Mulch thickness:
 - 1. At-grade planting areas: install an average thickness of 2-inch medium fir bark mulch and finish level with adjacent finish grades.
 - 2. Raised planters and roof planting areas: install an average thickness of 1-inch medium fir bark mulch. Keep mulch 1-inch below top of walls.

3.9 PRUNING

- A. Prune plant material if necessary and as directed by Owner's Representative to balance root and top growth.
- B. Prune all dead and broken limbs after inspection by Owner's Representative.

3.10 CLEANUP AND PROTECTION

- A. During tree and shrub work, keep all work surfaces and pavements clean and work area in an orderly condition. Protect surfaces as required to prevent damage from installation activities. Ensure that any damage that occurs as a result of installation is appropriately and immediately repaired.

TREES, SHRUBS, AND GROUNDCOVER

- B. Protect trees and shrubs from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.
 - C. Following installation, remove all excess materials and tools from job site.
- 3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS
- A. Disposal: Remove subbase surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the property.

END OF SECTION

WATER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, according to the following:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- E. Protect flanges, fittings, and specialties from moisture and dirt.
- F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.7 COORDINATION

- A. Coordinate connection to water main with utility company, if required.
- B. Contractor shall pothole intended Point of Connection and confirm existing water pipe size, prior to any water system work. Notify Engineer of existing line material and diameter, prior to start of work.

PART 2 - PRODUCTS

2.1 COPPER TUBE 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.
 - 2. Copper, Pressure-Seal Fittings:
 - a. 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:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Viega; Plumbing & Heating Systems.
 - c. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
- B. Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.

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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.
 2. Copper, Pressure-Seal Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Viega; Plumbing & Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
 - D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- 2.2 PVC PIPE AND FITTINGS
- A. PVC, Schedule 40 Pipe: ASTM D 1785.
 1. PVC, Schedule 40 Socket Fittings: ASTM D 2467.
 - B. PVC, Schedule 40 Threaded Fittings: ASTM D 2464. Bronze Gate Valves:
 1. 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.
- 2.3 JOINING MATERIALS
- A. Brazing Filler Metals: AWS A5.8, BCuP Series.
- 2.4 GATE VALVES
- A. Bronze Gate Valves:
 1. Nonrising-Stem Gate Valves:
 - a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
 - 1) Standard: MSS SP-80.
- 2.5 GATE VALVE ACCESSORIES AND SPECIALTIES
- A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
- 2.6 WATER METERS
- A. Water meters will be furnished and installed by City of Albany.
- 2.7 BACKFLOW PREVENTERS
- A. Double-Check and double detector 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. Zurn Plumbing Products Group; Wilkins Water Control Products Div.
 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: 3" and 4"
 6. Configuration: Designed for horizontal, straight through flow.

WATER METER BOXES

WATER SYSTEM

2. Water meter boxes will be furnished and installed City of Albany.

PART 3 - EXECUTION

3.5 EARTHWORK

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

3.6 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, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 3/4 to NPS 3 shall be any of the following:
 1. Soft copper tube, ASTM B 88, Type K; copper, pressure-seal fittings; and pressure-sealed joints.
 2. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.

3.7 VALVE APPLICATIONS

- A. General Application: Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Use the following for valves in vaults and aboveground:
 - A. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.

3.8 PIPING INSTALLATION

- A. Make connections NPS 2 and smaller with drilling machine according to the following:
 1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
 2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 4. Install corporation valves into service-saddle assemblies.
 5. Install manifold for multiple taps in water main.
 6. Install curb valve in water-service piping with head pointing up and with service box.
- B. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
 1. Under Driveways: With at least 36 inches cover over top.
- C. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- D. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- E. See Division 22 Section "Domestic Water Piping" for potable-water piping inside the building.

3.9 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
 2. 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

WATER SYSTEM

pipe manufacturer's written instructions.

3. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 22 Section "Common Work Results for Plumbing" for joining piping of dissimilar metals.

3.10 VALVE INSTALLATION

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

3.11 CONNECTIONS

- A. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.
- B. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.12 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.

3.13 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 22 Section "Common Work Results for Plumbing" for identifying devices.

3.14 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - A. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - B. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - C. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - D. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION

STORM UTILITY DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
 - 1. Cleanouts.
 - 2. Overflow Drains for Stormwater Planters.

1.2 PERFORMANCE REQUIREMENTS

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

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 PIPING MATERIALS

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

2.3 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

- A. Pipe: ASTM A 716, for push-on joints.
- B. Standard Fittings: AWWA C110, ductile or grey iron, for push on joints.
- C. Compact Fittings: AWWA C153, for push on joints.
- D. Gaskets: ASTM C 111, rubber.

2.4 PE PIPE AND FITTINGS

- A. Corrugated PE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
 - 1. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
 - 2. Corrugated PE Pipe and Fittings NPS 12 and Larger: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
 - 3. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Available Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. NDS Inc.
 - f. Plastic Oddities, Inc.

STORM UTILITY DRAINAGE

2.6 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 - 1. Available Manufacturers:
 - a. Josam Company.
 - b. MIFAB Manufacturing Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Wade Div.; Tyler Pipe.
 - e. Watts Industries, Inc.
 - f. Watts Industries, Inc.; Enpoco, Inc. Div.
 - g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
 - 2. Top-Loading Classification(s): Heavy duty.
 - 3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.7 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.8 OUTFALL RIP-RAP

- A. General: Broken, irregularly sized and shaped, graded stone according to ODOT standard Spec section 00390

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
 - 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - 2. Unshielded flexible couplings for same or minor difference OD pipes.
 - 3. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - 4. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

STORM UTILITY DRAINAGE

- B. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range:
 - 1. NPS 3 to NPS 6: Hub-and-spigot, Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. NPS 3 to NPS 6: Corrugated PE drainage pipe and fittings, soiltight couplings, and coupled joints.
 - 3. NPS 8 to NPS 15: Hub-and-spigot, Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 4. NPS 8 to NPS 15: Corrugated PE drainage pipe and fittings, soiltight couplings, and coupled joints.

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
- E. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 - 1. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 - 2. Install piping with 36-inch minimum cover.
 - 3. Install piping below frost line.
 - 4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
- F. Clear interior of piping and drains of dirt and superfluous material as work progresses.

3.3 PIPE JOINT CONSTRUCTION

- A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 - 2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
 - 3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 - 2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
 - 3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

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- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.5 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 15 Section "Storm Drainage Piping."

3.6 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
- B. Alignment: Less than full diameter of inside of pipe is visible between structures.
- C. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
- D. Crushed, broken, cracked, or otherwise damaged piping.
- E. Infiltration: Water leakage into piping.
- F. Exfiltration: Water leakage from or around piping.
 - 1. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 2. Reinspect and repeat procedure until results are satisfactory.
- G. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
- H. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- I. Leaks and loss in test pressure constitute defects that must be repaired.
- J. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes subdrainage systems for foundations.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

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

2.2 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
 - 1. Couplings: Manufacturer's standard, band type.

2.3 SOLID-WALL PIPES AND FITTINGS

- A. Cast-Iron Soil Pipe and Fittings: ASTM A 74, Service and Extra-Heavy classes, hub-and-spigot ends, gray, for gasketed joints.
 - 1. Gaskets: ASTM C 564, rubber, of thickness matching class of pipe.
- B. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
 - 1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

2.4 SPECIAL PIPE COUPLINGS

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

2.5 CLEANOUTS

- A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

2.6 SOIL MATERIALS

- A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Section 312000 "Earth Moving"

2.7 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.
 - 1. Style(s): sock.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.2 PIPING APPLICATIONS

- A. Underground Subdrainage Piping:
 - 1. Perforated PE pipe and fittings, couplings, and coupled joints.
- B. Header Piping:
 - 1. PE drainage tubing and fittings, couplings, and coupled joints.

3.3 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:
 - 1. At Grade in Earth: Cast-iron cleanouts.

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2. At Grade in Paved Areas: Cast-iron cleanouts.

3.4 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. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 24 inches, unless otherwise indicated.
 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.

3.5 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.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.6 CLEANOUT INSTALLATION

- A. Cleanouts for Foundation Subdrainage:
 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in nonvehicular-traffic areas.
 3. In nonvehicular-traffic areas, use NPS 4 cast-iron pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches in depth. Set top of cleanout plug 1 inch above grade.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

3.8 FIELD QUALITY CONTROL

- A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.9 CLEANING

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

END OF SECTION