SECTION 024119

SELECTIVE DEMOLITION

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. Demolition and removal of selected site elements.
   2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

   1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
   2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
   3. Section 017300 "Execution" for cutting and patching procedures.
   4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

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

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

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

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. These items are to be protected during construction. If damaged, these items are to be replaced in kind by the contractor at no expense or additional cost to the owner.

1.4 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.

1.5 FIELD CONDITIONS

A. Owner will occupy building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

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

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

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

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

E. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

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

G. 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.

1.6 WARRANTY

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

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

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

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

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

1. Comply with requirements specified in Section 013233 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

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.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

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

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

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

3.3 PREPARATION

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

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

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

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

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

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area.
4. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

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

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

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

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

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

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

3.7 CLEANING

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

END OF SECTION 024119

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SECTION 055215
EXTERIOR HANDRAILS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Painted steel tube handrails.

B. This Section includes requirements for detailing and engineering of railing systems to fulfill performance requirements and conform to design intent indicated on Drawings.

1.2 RELATED SECTIONS

A. Section 033000 Cast-in-Place Concrete

1.3 PERFORMANCE STANDARDS

A. Delegated-Design: Install handrails and guardrails to resist the simultaneous application of a lateral force of 50lbs./LF and a vertical load of 100 lbs./LF, both applied to the top of the railing. The rail shall resist a total lateral force and total vertical load of at least 200 lbs. each.

B. Submit calculations and drawings signed and sealed by a Professional Engineer licensed in the Pennsylvania indicating that the railings can meet these performance criteria. Railings shall be fully coordinated with field measured conditions including but not limited to expansion joint locations.

C. Control of corrosion: prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Product Data: for each type of product indicated, including finishing materials and color chart for selection.

B. Shop Drawings: Indicate profiles, sizes, anchorage, and accessories. Indicate materials of each item. Provide plans, elevations, and details as required to clearly illustrate the full scope of work. Include material information, finishes, and types of joinery, fasteners, anchorages, and accessory items.

1. Include structural analysis data, signed and sealed by a qualified professional engineer responsible for analysis preparation.
2. Verify actual conditions by field measurements before fabrication and indicate measurements on shop drawings.

C. Samples

1. Submit one handrail sample, 12 inches long including a typical weld, indicating material and finish.

1.5 QUALITY ASSURANCE

A. Contractor shall have had experience with at least two (2) other projects of similar scope and complexity and shall perform work with personnel totally familiar with furnishings installation and construction techniques under the supervision of an experienced foreperson.

B. Manufacturer: Company specializing in the manufacture of products specified in this Section with a minimum of three (3) years of experience.

1.6 DELIVERY STORAGE AND HANDLING

A. Deliver, store, handle and protect all materials from damage.

1.7 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard 3-year limited warranty.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal surfaces: provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges and Anchors: Same metal and finish as supported rails, unless otherwise indicated.

2.2 TUBE RAILING MATERIALS

A. Steel Pipe: ASTM A53, Type S, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.

B. Steel tubing: ASTM A500, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes and Bars: ASTM A36/A36M.

D. Welding materials: AWS D1.1, type required for materials being welded.

2.3 FASTENERS

A. Unless otherwise indicated, provide Type 304 stainless steel fasteners.

B. Provide concealed fasteners for interconnecting components and for attaching rails to other work, unless otherwise indicated.

C. Anchors: provide chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.4 PAINTED FINISHES

A. Shop Painted Finish: Provide a uniform smooth finish on all railing surfaces using the following products, or approved equal. Fully prepare surfaces in accordance with the manufacturer's recommendations.

1. Primer: Rust-Oleum Commercial C740 System DTM Alkyd Enamel Primer.
2. Finish Coat: Rust-Oleum Commercial C740 System 400 VOC DTM Alkyd Enamel.
3. Color: Black.

2.5 ACCESSORIES

A. Grout: CE CRD-C621; Non-shrink type, premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 5,000 psi at 7 days.

1. Five Star Products, Inc.; Five Star Grout.
2. L&M Construction Chemicals, Inc.; Duragrout.
3. Euclid Chemical Company; NS Grout.

B. Cover Flange: Item # 637, Steel Flat Base Flange For 1-1/2" Pipe (1.90" Diameter) With No Mounting Holes and Set Screw, Unfinished, Kit as manufactured by R&B Wagner, Inc., Milwaukee, WI 53224, (888) 243-6914, or approved equal.

2.6 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finishes and anchorage, but not less than that required to support structural loads.

B. Fabricate connections that will be exposed to weather in a manner to exclude water; provide weep holes where water may accumulate and slip joints in handrails that span structure.

C. Cut, reinforce, drill and tap as indicated to receive finish hardware, screws and similar items.

D. Welded connections: finish exposed surfaces smooth and blended so not roughness shows after finishing and welded surface matches contours of adjoining materials.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

F. Close exposed ends of hollow railing members with prefabricated end fittings.

G. Provide inserts and other anchorage devices for connecting railings to concrete.

H. For railing posts set in concrete, provide steel sleeves not less that 6 inches long with inside dimensions not less than ½ inch greater than outside dimensions of post, with steel plate forming bottom closure.

I. Assemble railings in the shop to the greatest extent possible to minimize field splicing and

assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

J. Nonwelded connections: connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work. Notify Landscape Architect in writing of deviations from the manufacturer's recommended installation tolerances and conditions.

B. Commencement of installation constitutes acceptance of conditions.

3.2 PREPARATION

A. Supply items required to be cast into concrete.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Install expansion joints as required to accommodate thermal movement. Provide slip joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side and locate joint within 6 inches of post.

C. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.

D. Cover anchorage joint with flange of same metal as post either welded to post after placing anchoring material or attached to post with set screws.

E. Set railing in sleeves where indicated. Grout annular space between sleeves and railing posts.

F. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

G. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

H. Assemble with spigots and sleeves to accommodate tight, hairline joints and secure installation.

I. Provide anchorage devices and fittings to secure to in-place construction to adjacent construction. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.

J. Secure mounting brackets to building structure in a positive manner using manufacturer recommended reinforcement and anchorage methods for substrate conditions. Locate brackets and hardware at spacing required to support structural loads.

K. Installation of railing system shall be rigid and secure, installed by mechanics experienced in erection of architectural metal. Mounting hardware shall be drawn up tightly. Rails shall be set plumb and aligned.

3.4 ADJUSTING AND CLEANING AND PROTECTION

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum of 2.0-mil dry film thickness.

B. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

3.5 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch in 10 feet, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

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SECTION 116800

PLAY EQUIPMENT

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 freestanding and composite structure playground equipment.

B. Related Sections:

1. Section 321816.13 "Playground Protective Surfacing" for protective surfacing under and around playground equipment.

1.3 DEFINITIONS

A. Fall Height: According to ASTM F 1487, "the vertical distance between a designated play surface and the protective surfacing beneath it."

B. Critical Height: Standard measure of shock attenuation. According to CPSC No. 325, this means "the fall height below which a life-threatening head injury would not be expected to occur."

C. HDPE: High-density polyethylene.

D. IPEMA: International Play Equipment Manufacturers Association.

E. LLDPE: Linear low-density polyethylene.

F. MDPE: Medium-density polyethylene.

G. Use Zone: According to 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."

1.4 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For each type of playground equipment and structure indicated.

1. Manufacturer's color charts.
2. Include similar Samples of playground equipment and accessories involving color selection.

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. Extent of surface systems and use zones for equipment.
2. Critical heights for playground surfaces and fall heights for equipment.

B. Qualification Data: For qualified Installer manufacturer, and testing agency.

C. Product Certificates: For each type of playground equipment, from manufacturer.

D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.

B. Installer Qualifications: An employer of workers approved by manufacturer.

C. Safety Standards: Provide playground equipment complying with or exceeding requirements in ASTM F 1487 and CPSC No. 325.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLAY EQUIPMENT

A. Play Equipment: Subject to compliance with requirements, provide products by Kompan Inc. 605 W. Howard Lane Suite 101, Austin , TX 78753, or approved equal. Local contact: Matt Burns MatBur@Kompan.com (310) 775-5082

1. 2-5 Age Equipment:
   a. ELE400024 – Spinner Bowl, color: lime
   b. KSW924 – Swing with anti-wrap suspension;
      1) one (1) ADA accessible 'Made-for-Me' seat, color to be selected from manufacturer's range of custom colors
      2) three (3) SW99023-01 baby seats
   c. PCX200100 – Brooklyn Mega Deck, color: lime and light blue
2. 5-12 Play Equipment:
   a. ELE400024 – Spinner Bowl, color: lime
   b. KSW923 – Swing with anti-wrap suspension;
      1) one (1) ADA accessible 'Made-for-Me' seat, color to be selected from manufacturer's range of custom colors
      2) two (2) SW990011 swing seats
   c. GXY967 – Asterope, color theme: Terra

2.2 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" to produce normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3500 psi (20.7 MPa), 3-inch (75-mm) slump, and 1-inch- (25-mm-) maximum-size aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, site surface and subgrade drainage, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading required for placing protective surfacing is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Verify locations of playground perimeter and pathways. Verify that playground layout and equipment locations comply with requirements for each type and component of equipment.

3.3 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed heights of equipment and components with finished elevations of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set on Subgrade: Level bearing surfaces with drainage fill to required elevation.

D. Post Set with Concrete Footing: Comply with ACI 301, ACI 301M for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

2. Embedded Items: Use setting drawings and manufacturer's written instructions to ensure correct installation of anchorages for equipment.
3. Concrete Footings: Smooth top, and shape to shed water.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections: For playground and playground equipment and components during installation and at final completion and to certify compliance with ASTM F 1487, CPSC No. 325.

D. Prepare test and inspection reports.

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SECTION 116833

ATHLETIC EQUIPMENT

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 the mini-pitch system, basketball system and player bench.

B. Related Sections:

1. Section 321216 "Asphalt Paving" for surfacing under and around equipment.

1.3 ACTION SUBMITTALS

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

1.4 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. Mini-pitch System.
2. Basketball System.
3. Player Bench

B. Qualification Data: For qualified Installer ,manufacturer and testing agency.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For equipment and finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: To be approved by Philadelphia Parks and Recreation.

B. Installer Qualifications: An employer of workers approved by manufacturer.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ATHLETIC EQUIPMENT

A. Mini-Pitch: Subject to compliance with requirements, provide products by Musco, 100 1st Ave W, Oskaloosa, IA 52577, 1-800-825-6030 or approved equal. Local contact: Travis Scheffers, travis.scheffers@musco.com, 1-641-676-2342.
1. Mini-Pitch System, 50'x104'. Design details, colors, etc. will be determined during the submittal process.

B. Basketball System: Subject to compliance with requirements, provide products by Bison Inc., 603 L Street, Lincoln, NE, 68508, 1 (800) 247-7668, or approved equal.
1. Basketball System Item Single Model #BA873-BK, Double Model #BA872-BK. The Playground – 6" Sq. Pole with 66" Play Safe Area – 72" Acrylic Backboard, Fixed Goal, and Edge/Protector Padding.

C. Player Bench: Subject to compliance with requirements, provide furnishings manufactured by PW Athletic P.O. Box 1290, Salem, IL 62881, 866-563-3161, www.PWAthletic.com, or approved comparable product.
1. Aluminum Player Bench Item :Model: 1119-08, Material: Aluminum, Mount: As shown on player bench detail on drawing L-6.3. Finish: Powdercoat Black posts and hardware with raw silver bench top.

2.2 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" to produce normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3500 psi (20.7 MPa), 3-inch (75-mm) slump, and 1-inch- (25-mm-) maximum-size aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, site surface and subgrade drainage, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Verify locations of perimeter and pathways. Verify that equipment layout complies with requirements for each type and component of equipment.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of mini-pitch system where required.

B. Unless otherwise indicated, install mini-pitch after asphalt top coat has been completed, but before color coating has been installed.

C. Install basketball equipment in footings as per manufacturer’s recommendations.

D. Install equipment level, plumb, true, and **securely anchored** at locations indicated on Drawings, and as per Manufacturer.

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SECTION 129300

SITE FURNISHINGS

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. Bench
2. Trash Receptacle
3. Table

B. Related Requirements:

1. Section 321613 "Cast-in-Place Concrete" for installing equipment and/or anchor bolts cast in concrete footings.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Anchors, Fasteners, Fittings, and Hardware: Provide Stainless steel; commercial quality, tamperproof, vandal and theft resistant unless indicated otherwise on the Drawings.

B. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107; recommended in writing by manufacturer, for exterior applications.

C. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

2.2 BENCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide furnishings manufactured by Dumor, Inc., P.O. Box 142, Mifflintown, PA 17059, 717-436-2106 or 800-598-4018, www.dumor.com, or approved comparable product.

1. Model: 160-80 (Backed)
2. Finish / Color: Powdercoat / Black.
3. Length: 6’
4. With center arm and ‘Fairmount Park’ security panel.
5. Mount: As shown on Drawings.

2.3 TRASH RECEPTACLE

A. Basis-of-Design Product: Subject to compliance with requirements, provide furnishings manufactured by Dumor, PO Box 142, Mifflintown, PA 17059, 1-800-598-4018, or approved comparable product.

1. Model: 157-32-FTO
2. Finish / Color: Powdercoat / Black.
3. Mount: As shown on Drawings.

2.4 TABLE

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide furnishings manufactured by Dumor, Inc., P.O. Box 142, Mifflintown, PA 17059, 717-436-2106 or 800-598-4018, www.dumor.com, or approved comparable product.

1. Model: 76-34PL-S1
2. ADA Model: 76-33PL-S1
3. Material: Steel
4. Mount: As shown on drawings
5. Steel Finish/Color: Powdercoat/Black
6. Recycled Plastic Color: Redwood

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and **securely anchored** at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

E. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

3.3 CLEANING

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

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SECTION 220523

GATE VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze gate valves.
2. Iron gate valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE GATE VALVES

A. Bronze Gate Valves, NRS, Class 125:
   1. Description:

      a. Standard: MSS SP-80, Type 1.
      b. CWP Rating: 200 psig.
      c. Body Material: Bronze with integral seat and screw-in bonnet.
      d. Ends: Threaded or solder joint.
      e. Stem: Bronze.
      f. Disc: Solid wedge; bronze.
      g. Packing: Asbestos free.
      h. Handwheel: Malleable iron, bronze, or aluminum.

B. Bronze Gate Valves, RS, Class 125:

   1. Description:

      a. Standard: MSS SP-80, Type 2.
      b. CWP Rating: 200 psig.
      c. Body Material: Bronze wit integral seat and screw-in bonnet.
      d. Ends: Threaded or solder joint.
      e. Stem: Bronze.
      f. Disc: Solid wedge; bronze.
      g. Packing: Asbestos free.
      h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Use gate valves for shutoff service only.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. Pipe NPS 2 and Smaller: Bronze gate valves, **NR**, Class 125 with **soldered** ends.

3.4 COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze gate valves, **NRS**, Class 125 with **soldered** ends.

END OF SECTION 220523.15

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SECTION 220719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Water piping exposed to freezing conditions.

B. Related Sections:

   1. Section 220716 "Plumbing Equipment Insulation."

1.2 ACTION SUBMITTALS

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

B. Sustainable Design Submittals:

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General, "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Special-Shaped Insulation: ASTM C 552, Type III.
2. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
3. Preformed Pipe Insulation with Factory-Applied: Comply with ASTM C 552, Type II, Class 2.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 SEALANTS

A. Joint Sealants for Cellular-Glass Products:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Permanently flexible, elastomeric sealant.

2.4 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

B. Underground Direct-Buried Jacket: 125-mil thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.5 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 11.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe

insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.4 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.5 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

    a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping: Insulation shall be[one of] the following:

1. Cellular Glass: 2 inches thick.
2. Flexible Elastomeric: 2 inches thick.
3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
4. Polyolefin: 2 inches thick.

3.9 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. PVC: 20 mils thick.

D. Piping, Exposed:

1. PVC: 20 mils thick.

2. Painted Aluminum, Smooth: 0.016 inch thick.
3. <Insert jacket type>.

3.11 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

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SECTION 221113

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

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

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

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

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

C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NSF Compliance:

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

1.5 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 Architect days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Architect's or Construction Manager's written permission.

1.6 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. B 88, Type K ASTM B 88M, Type A and ASTM B 88, Type L ASTM B 88M, Type B, water tube, drawn temper.

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

2.2 JOINING MATERIALS

A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.

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

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

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

2.3 PIPING SPECIALTIES

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

B. Tubular-Sleeve Pipe Couplings:

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

a. Standard: AWWA C219.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Nonrising-Stem, Metal-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

1) Standard: AWWA C500.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

2. Nonrising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509
2) Minimum Pressure Rating: 200 psig .
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

3. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 250 psig.
3) End Connections: Push on or mechanical joint.
4) Interior Coating: Complying with AWWA C550.

B. Bronze Gate Valves:

1. OS&Y, Rising-Stem Gate Valves:

a. Description: Bronze body and bonnet and bronze stem.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig.
3) End Connections: Threaded.

2. Nonrising-Stem Gate Valves:

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

1) Standard: MSS SP-80.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, metal-seated gate valve with one raised face flange mating tapping-sleeve flange.

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

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

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 [CORPORATION VALVES] [AND] [CURB VALVES]

A. Manufacturers:

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem
   a. Registration: Flow in gallons.

2.7 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
4. Size: 1” NPS.
5. Design Flow Rate: 12 gpm .
6. Selected Unit Flow Range Limits: 3 gpm .
7. Pressure Loss at Design Flow Rate 3 psigfor NPS 1 and smaller; .
8. Body: Bronze for NPS 2 and smaller.
9. End Connections: Threaded for NPS 2 and smaller.
10. Configuration: Designed for horizontal, straight through flow.
11. Accessories:

   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:
1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications, unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
4. Size: 1” NPS.
5. Design Flow Rate: 12 gpm .
6. Selected Unit Flow Range Limits: <Insert gpm (L/s)>.
7. End Connections: Threaded for NPS 3/4”.
8. Configuration: Designed for [horizontal, straight through] <Insert configuration> flow.
9. Accessories: hose valves with threaded ends on inlet and outlet of NPS 3’4”.

2.8 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches square.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

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

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

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

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

E. Underground water-service piping NPS 3/4 to NPS 3 shall be soft copper tube, ASTM B 88, Type K ASTM B 88M, Type A, ASTM B 88, Type L, Type B; wrought-copper, solder-joint fittings; and brazed joints.

F. Water Meter Box Water-Service Piping [NPS 3/4 to NPS 2 (DN 20 to DN 50)] <Insert pipe size range> shall be same as underground water-service piping.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. 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.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

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

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

G. Install PE pipe according to ASTM D 2774 and ASTM F 645.

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

I. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration.

J. Extend water-service piping and connect to water-supply source and park water hose valve outside 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 park - water-piping systems when those systems are installed.

K. Sleeves are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

L. Mechanical sleeve seals are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

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

3.5 JOINT CONSTRUCTION

A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
4. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.6 VALVE INSTALLATION

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

B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. MSS Valves: Install as component of connected piping system.

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

3.7 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install displacement-type water meters, NPS 2 and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

3.8 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

3.9 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.10 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.11 CONNECTIONS

A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

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.

3.13 CLEANING

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

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

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

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

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
   Transition fittings.
2. Dielectric fittings.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping and water meters outside from source to the point where water-service piping enters the park.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

B. Sustainable Design Submittals:

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

F. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install PEX tubing with loop at each change of direction of more than 90 degrees.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

U. Install thermometers on[inlet and] outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

I. Joints for PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.

J. Joints for PEX Tubing: Join according to ASSE 1061 for push-fit fittings.

K. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.7 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.8 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

END OF SECTION 221116

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SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Backflow preventers.
   2. Strainers.
   3. Hose bibbs.

B. Related Requirements:
   1. Section 221116 "Domestic Water Piping" for water meters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G

2.2 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:

   1. Standard: ASSE 1011.
   2. Body: Bronze, nonremovable, with manual drain.

3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Rough bronze.

2.3 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: NPS 3/4.
4. Body: Bronze.
5. End Connections: solder joint.
6. Finish: Rough bronze.

B. Double-Check, Backflow-Prevention designation:

1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig , through middle third of flow range.
4. Size: 1”NPS.
5. Design Flow Rate: 12 gpm .
6. Body: Bronze for NPS 2 and smaller;
7. End Connections: Threaded for NPS 2 and smaller.
8. Configuration: Designed for horizontal, straight-through flow.
9. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers :

1. Pressure Rating 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved.
3. End Connections: Threaded for NPS 2 and smaller.
4. Screen: Stainless steel with round perforations unless otherwise indicated.

5. Drain: [Pipe plug] [Factory-installed, hose-end drain valve].

2.5 HOSE BIBBS

A. Hose Bibbs

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.

4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: perating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each nickel-plated hose bibb.

2.6 NON-FREEZE POST HYDRANTS

1. Standard: ASME A112.21.3M for exposed outlet, self-draining hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
9. Nozzle Polished nickel bronze.
10. Operating Keys.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to hydrant and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each double-check assembly backflow according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Copper tube and fittings.
3. ABS pipe and fittings.
4. PVC pipe and fittings.
5. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 PIPING MATERIALS

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

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

D. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 ABS PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

C. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

D. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

E. Solvent Cement: ASTM D 2235.

2.6 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

E. Adhesive Primer: ASTM F 656.

F. Solvent Cement: ASTM D 2564.

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:
    a. Standard: ASTM C 1173.
    b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.
    d. 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.

3. Shielded, Nonpressure Transition Couplings:
    a. Standard: ASTM C 1460.
    b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. 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.

B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: [Unshielded] [Shielded], nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment.".

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/: 84 inches with 3/8-inch.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12 : 12 feet with 7/8-inchrod.

I. Install supports for vertical steel piping every 15 feet.

J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 84 inches with 3/8-inch rod.
2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6: 10 feet with 5/8-inch rod.

K. Install supports for vertical stainless-steel piping every 10 feet.

L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

M. Install supports for vertical copper tubing every 10 feet.

N. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written `instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

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

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed [ABS] [and] [PVC] Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

D. Aboveground, vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Copper Type DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

E. Aboveground, vent piping NPS 5 shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221316

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PART 1 - SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.2 Related Requirements:

A. Section 260800 "Electrical Systems Commissioning" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Field quality-control reports.

C. Quality Assurance= Quality Standard for grounding and bonding materials and equipment: UL 467.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

B. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
Ground rods.

C. Field Quality Control Reports

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
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.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

B. 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.

C. Comply with UL 467 for grounding and bonding materials and equipment.

D. Bare Copper Conductors:

1. Solid conductors.
2. Stranded conductors.
3. Tinned conductors.
4. Stranded bonding conductors.
5. Copper tape braided bonding jumpers.
6. Tinned- copper braided bonding jumpers.

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. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

G. Conduit Hubs: Mechanical type, terminal with threaded hub.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

I. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

J. Straps: Solid copper, copper lugs Rated for 600 A.

K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

L. Water Pipe Clamps:

1. Mechanical type, two pieces with stainless steel bolts.

Material: Tin plated aluminum

Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 ft.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No.8 and smaller, and stranded conductors for No.6 and larger unless otherwise indicated.

B.Conductor Terminations and Connections:

Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
Underground Connections: Welded connectors except at test wells and as otherwise indicated.
Connections to Ground Rods at Test Wells: Bolted connectors.
Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors must be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
Flexible raceway runs.
Armored and metal-clad cable runs.

B. 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.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

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. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. 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.

3.5 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.

3.6 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.

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

C. Prepare test and inspection reports.

END OF SECTION 260526

SECTION-260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Type ERMC-S raceways, elbows, couplings, and nipples.
2. Type LFMC raceways.
3. Type PVC raceways and fittings.
4. Fittings for conduit, tubing, and cable.
5. Threaded metal joint compound.
6. Strut-type channel raceways and fittings.
7. Metallic outlet boxes, device boxes, rings, and covers.
8. Termination boxes.
9. Cabinets, cutout boxes, junction boxes, pull boxes, and miscellaneous enclosures.
10. Cover plates for device boxes.

1.2 ACTION SUBMITTALS

A. Product data.

B. Sustainable design submittals.

C. Shop Drawings: For custom enclosures and cabinets.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Manufacturer: Triangle, General Cable, General Electric, Anaconda or Phelps Dodge.

1. Standards: NEC Article No. 310.
2. Conductor: Copper, solid for No. 8 and smaller, stranded for No. 6 or larger.
3. Insulation: 600 volts; THWN/THHN for general use, THHN or TFN for lighting fixture use
4. Minimum size: No. 14 for control wiring, No. 12 for all other unless otherwise noted.
5. Other Types: As indicated or required.

2.2 RACEWAYS

A. Rigid Conduit: Conform to the following:

1. Manufacturer: Triangle, Spang, Youngstown, or Jones & Laughlin.
2. Standards: NEC Article No. 346; UL.
3. Material: Steel, heavy wall, hot dip galvanized inside and outside.
4. Joints: Standard pipe thread: furnished with coupling; shipped with thread protector through 2" size.
5. Minimum Size: 3/4".

B. Intermediate Metal Conduit (IMC): Conform to the following:

1. Manufacturer: Triangle, Spang, Youngstown.
2. Standards: NEC Article No. 345; UL.
3. material: Steel only, intermediate wall thickness, hot dipped galvanized.
4. Joints: Standard pipe thread, furnish with coupling, shipped with thread protector through 2" size.
5. Minimum Size: 3/4".

C. Electrical Metallic Tubing (EMT): Conform to the following:

1. Manufacturer: Triangle, Spang, Youngstown, Kaiser or Jones & Laughlin.
2. Standards: NEC Article No. 348; UL 797.
3. Material: Contractor's option: Steel, thin wall, electro-galvanized or aluminum, thin wall.
4. Minimum Size: 3/4".

D. Flexible Conduit: Conform to the following:

1. Manufacturer: Triangle, Spang, Youngstown or Jones & Laughlin.
2. Standards: NEC Article No. 350; UL1.
3. Material: Steel, hot dip galvanized.
4. Minimum Size: 1/2", and 3/8" where permitted by NEC.

E. Polyvinyl/Chloride Raceways (PVC)

1. Manufacturer: Johns-Manville, Can-Tex, Quazite.
2. Standards: NEC Article 347; UL. 651
3. Material: Heavy wall, Schedule 40 made of virgin polyvinyl chloride or material re-ground from the manufacturer's own products.
4. Fittings: Virgin PVC, Schedule 40
5. Joints: Solvent welded; watertight and pressure tight to 25 PSI.
6. Adapters: PVC to metallic conduit adapters designed for the purpose.
7. Minimum Size: 2" Diameter.

2.3 CAST CONDUIT FITTINGS

A. Manufacturer: Crouse-Hinds, Appleton, Pyle-National or Killark.

1. Standards: NEC Article No. 370.
2. Description: Cast body with gasketed screw cover and threaded hubs.
3. Material: Cast ferrous alloy, corrosion resistant finish for steel conduit: zinc alloy and similar soft metal castings not acceptable; Copper-free aluminum casting for aluminum conduit; formed PVC for plastic conduit.

2.4 CONDUIT CONNECTORS

A. Manufacturer: T & B, Appleton or OZ.

1. Standards: NEC Article No. 370.
2. Metal Conduit Materials: Cast malleable iron and pressed steel; rain tight and concrete tight; threaded for rigid steel conduit, intermediate metal conduit, and compression type or indentor type for EMT; corrosion resistant finish.
3. Not acceptable: Setscrew connectors and tamp-on types; zinc alloy and similar soft metal pressure castings.
4. Connectors for EMT Conduit 3" and larger shall be set screw or unicouple type.

2.5 EXPANSION FITTINGS

A. Manufacturer: Crouse-Hinds, Appleton or OZ.

1. Manufacturer's Designation: XJ and XJSA.
2. Material and Finish: Same as rigid conduit.
3. Description: Cast slip-joint fitting for conduit, with flexible bonding conductor for continuity of ground through metallic conduit.

2.6 SLEEVES

A. Material: Schedule 40 galvanized steel pipe.

1. Application: Floors, through exterior masonry walls, through roof, and underground.

B. Material: 18 gauge galvanized sheet metal.

1. Application: Areas not requiring schedule 40 pipe.

2.7 WIREWAYS

A. Manufacturer: Square-duct, Keystone or Hoffman.

1. Standards: NEC Article No. 362.

2. Material: Steel, baked enamel finish, with hinged cover; conduit knock- outs.
3. Size: Minimum 4" square; other sized as noted on drawings.
4. Accessories: Hinged connectors: elbows; fittings for changes in direction; cut-off fittings; hangers; closing plates; cabinet adapters; wire retainers; other modifications and accessories as required for project.

2.8 OUTLET BOXES

A. Manufacturer: Steel City, Race and Appleton.

1. Standards: NEC Article No. 370.
2. Material: Pressed steel, zinc coated.
3. Minimum size: 4" square or octagon; gangable 2" x 3" where used with cable; depth as required for project.
4. Extension rings: To suit various conditions.
5. Hardware: Grounding screw and cable wiring connectors as required by wiring method.
6. Other Types: As required by job conditions.

2.9 PULL AND JUNCTION BOXES - INTERIOR

A. Manufacturer: Hoffman, Keystone or Burns.

1. Standards: NEC Article No. 370; ASTM A-386.
2. Material: Galvanized steel, code gauge.
3. Cover: Same material as box, screw on type, maximum size 300 square inches in one piece.

2.10 PULL AND JUNCTION FOR UNDERGROUND WORK

A. Manufacturer: Quazite or equal

1. Standards: N.E.C.; UL; ASTM D-635
2. Material: Composolite non-concrete type enclosure; Reinforced Plastic Mortar designed and tested to temperatures of -50 degrees F.
3. Color: Grey for paved areas; Green for grassy areas.

4: Loading: "Light vehicular traffic" (5000# load over any 10" x 10" area).

5. Assembly: Cover, box and extension with solid base; cover shall be interchangeable with other manufacturers.
6. Fasteners: Pent-head, recessed type.
7. Hubs: Suitable for solvent welding of PVC raceways to box.

2.11 CONVENIENCE RECEPTACLES - INTERIOR

A. Manufacturer: P & S No. 26342, Arrow Hart, or Leviton

1. Standards: NEC Article 410L, and NEMA.
2. Type: Duplex, 2 pole, 3 wire, with U slot ground.
3. Construction: Heavy duty, totally enclosed back, specification grade.

4. Contacts: 20 amp., phosphor bronze, double wiping.
5. Wiring terminal type: Side or back
6. Body: Brown phenolic composition.
7. Plates: .035" Type No. 302 (18-8) stainless steel with satin finish. (Tamperproof hardware)

2.12 CONVENIENCE RECEPTACLES - EXTERIOR

A. Manufacturer: P & S, Arrow Hart, or Leviton

1. Standards: NEC Article 410L, and NEMA
2. Type: Duplex, 2 pole, 3 wire, with U-slot ground; Ground fault circuit interrupting protection.
3. Construction: Heavy duty, totally enclosed back, specification grade.
4. Contacts: 20 amp, phosphor bronze, double wiping.
5. Wiring terminal type: Side.
6. Body: Brown phenolic composition.
7. Cover plate: Gasketed, cast metal with cap over each receptacle opening; Caps permanently attached to cover plate by short length of bead chain or spring hinged flap. (Tamperproof hardware).

2.13 LOCAL SWITCHES - INTERIOR

A. Manufacturer: P & S No. 2602l, 26023, 26024, Arrow Hart, or Leviton.

1. Standards: NEC Article No. 380; NEMA.
2. Construction: Specification grade, 20A at 120/277 V., 2 HP at 240 V., l HP at 120 V.
3. Type: Flush, quiet, AC, totally enclosed brush tumbler, rocker type handle single pole, 3-way and 4- way as noted on drawings.
4. Modifications: Pilot light, key operation, interchangeable type as indicated.
5. Wiring Type: Side or back; Accept #10 wire, if required.
6. Body: Unit, brown phenolic composition.
7. Plates: .035" Type No. 302 (18-8) stainless steel with satin finish. (Tamperproof hardware)

2.14 SMALL WIRE CONNECTORS

A. Manufacturer: 3-M, T & B or Ideal.

1. Standards: NEC Article No. 110.
2. Application: Conductors No. 10 and smaller, solid and stranded, copper conductors.
3. Description: Twist-on solderless pressure connector, spiral metal spring in metal cup or crimped metal sleeve, plastic insulating cap with long flared skirt to cover un-insulated portion of conductor.

2.15 LARGER COPPER CONDUCTOR CONNECTORS

A. Manufacturer: T & B Series 54,000, Burndy or OZ.

1. Standards: NEC Article No. 110.
2. Application: Copper conductors No. 8 and larger, solid and stranded, wire and bus.
3. Material: Copper alloy, tin plated aluminum alloy, or other approved material.
4. Wire Connector: Long barrel compression type attached with hydraulic die.
5. Bus Connector: Compression type with multiple bolts, tin plated flat washer.
6. Applied insulation: Vinyl tape over insulating filler, heat shrinkable sleeves, or pre-molded plastic enclosure to fit each specific combination of connector and conductors.

2.16 FIRE RESISTANT SEALANT

A. Manufacturer: CTC PR:855

1. Standards: UL Classified; ASTM E119-73; ASTM E-8475.
2. Description: Silicone foam to prevent spread of fire and products of combustion through fire-rated, fire-resistant, and fire-stopped barriers by sealing interstitial spaces of penetrations.
3. Characteristics: Expand 2 to 3 times liquid volume; non-toxic and non-allergenic before and after cure; cure time 24 hours; flame spread number 20; fuel contributed factor 20; optical smoke density factor 235.

2.17 GROUNDING MATERIALS

A. Manufacturer: Chance, Hubbard, Steel City, Burndy, OZ, T & B, Cadweld or Blackburn.

1. Standards: NEC Article No. 250.
2. Materials: Non-ferrous copper and its alloys; aluminum not acceptable.
3. Grounding Conductors: Code gauge stranded copper wire, bare and with green insulation.
4. Ground bus, field installed: Copper minimum size 1/4" x 2".
5. Ground clamps and connectors: Multiple bolt type. Clamps for pipe, lugs for flat surfaces, saddle clamp or compression type for wire.
6. Conduit ground bushings: Galvanized malleable iron with screw pressure connector; insulated throat where required.

2.18 SPLICES AND TAPS

A. All splicing shall be done in outlet, panel and junction boxes, and not in conduits or equipment cabinets. Splices or taps in conductors shall be made with connectors and wrapped with rubber tape of a type and thickness equivalent to the original insulation and then covered with friction tape. When connecting stranded cables together, each strand shall be carefully cleaned before soldering or connecting. All taps and splices in branch circuit wiring shall be made with pressure type connectors.

B. Underground splices shall be avoided. Where necessary, use material and methods approved for submersed conditions.

2.19 PHOTOCONTROLS

A. Photocontrols for lighting shall provide a single-pole contact closure at a decreasing illumination level of one foot-candle. The contact shall open at an increasing illumination level adjustable between one and three foot-candles. On and off delays of a least 15 seconds shall prevent spurious operation due to transient lighting phenomena. The photocontrol shall be locking type with hermetically sealed element, and shall be rated a 1.8 KVA at 240 volts AC. The control shall be supplied complete with all-weather locking type receptacle with color-coded leads, and integral two-inch slipfitter, if required.

2.20 CONTACTORS AND REMOTE CONTROL SWITCHES

A. Contactors as manufactured by ASCO (ASCO 920 and 917), Square-D Company or ITE – Siemens, and Remote Control Switches shall be enclosed type: (NEMA 1 Enclosure), mechanically held with 120 or 240 volt coils, encapsulated. Number and rating of poles shall be as shown. Contacts shall be silver alloy, double break. Auxiliary relay shall be provided for 2-wire control, where indicated. No other manufacturers of contactors than those listed herein shall be accepted.

B. Control switches for contactors and remote control switches shall be two position (ON-OFF), momentary or maintained contact, Push button type, with pilot light, as required, specification grade, rated 20 amperes, 250 volts. Each switch or group of switches shall be provided with a laminated plastic nameplate indicating the sport and/or field controlled (See Identification, Nameplates and Tags).

2.21 TIME SWITCHES

A. Time switches shall be multi-pole or single pole, designed for operation on alternating current, rating as indicated on the drawings. Switches shall be equipped with astronomic 24-hour, 7-day dial, necessary tripping and omitting devices. Time switches shall provide reserve power for 16 hours operation. Unit shall be contained in NEMA-1 enclosure.

2.22 HARDWARE

A. All exposed fasteners shall be stainless steel, vandal proof type requiring special tools. Provide the number of special tools as required by the Department, upon completion of the project.

2.23 LOCKS AND KEYS

A. All locks for lighting and power panels, and all other electrical systems of locked apparatus shall have keys which are compatible with the existing system. The Department shall be consulted prior to ordering locks for equipment.

2.24 IDENTIFICATION, NAMEPLATES AND TAGS

A. Provide for each safety switch, panelboard and similar items of equipment, a laminated plastic nameplate of molded phenolic compound to indicate the device and equipment served.

Characters shall be white, not less than 1/4 inch high.

B. Provide approved tags for all feeders, at both ends, and at intermediate junction and pull boxes. Tag shall indicate feeder designation or equipment served, and state phase and voltage of feeder.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The equipment and materials shall be installed in accordance with the recommendations of the respective manufacturers.

B. If more than one trade is involved in the project, this Contractor shall cooperate and coordinate his work with the other trades. The locations of pipes, ducts, conduits, panelboards, lighting outlets, air outlets, motor controls and other equipment must be coordinated in order to avoid any interferences or placing services at the wrong locations. Exact locations of outlets, conduits and other materials and equipment must be coordinated with and approved by the Department .

C. The work shall be performed in an approved first class, workmanlike manner, and shall conform to the best practices of the trade, and to all requirements of the National Electrical Code.

D. The Electrical Contractor shall at all times protect and preserve all materials, equipment, fixtures and conduits from corrosion, dirt, paint, building materials, acid, tools, overload, freezing, theft and vandalism. This Contractor shall repair or replace all equipment and materials which are lost or damaged as the result of inadequate protection. Open ends of conduit and equipment shall be capped or plugged during the construction schedule and remain capped or plugged until wiring is ready to be installed.

E. All materials and equipment shall be properly isolated against the transmission of vibration or noise to any part of the building.

F. Where work is designated to be directed or performed by the General Contractor, and no General Contractor is involved in the project, the Electrical Contractor shall employ the proper trades to accomplish the work.

3.2 WIRING METHODS

A. Rigid steel conduit shall be used for all exposed exterior raceways. Rigid steel conduit shall also be used for raceways in or below slabs on grade, for underground raceways in locations regularly subject to vehicular traffic, and where shown. Exposed exterior raceways shall be installed only when specifically indicated on the plans or when specifically directed by the Department . Normally, exterior raceways shall be installed underground.

B. Intermediate metallic conduit shall be used for raceways in solid masonry walls and partitions, and for exposed interior raceways in locations where raceways may be subject to abuse or injury.

C. Electrical Metallic Tubing (EMT) may be used for all exposed interior branch circuit wiring in locations not subject to abuse or injury and for concealed wiring where conditions of heat or mechanical abuse preclude the use of PVC raceways.

D. Rigid steel conduit installed underground shall be provided with a 3-inch concrete envelope. Spacers shall be provided at the bottom of the trench at intervals not exceeding 4 feet, to assure that the envelope completely surrounds the conduit.

E. Rigid PVC conduit shall be used for all underground raceways in areas not regularly subject to vehicular traffic, for raceways in concrete walls, floors and ceilings, and for raceways to be run through cinder fill. Provide a separate, code-sized ground wire in each PVC conduit.

F. In underground raceways, rigid PVC conduit shall be snaked slightly to provide for soft spots in the trench.

G. All underground raceways shall be installed at least 30 inches below finished grade. In each trench containing underground raceways, provide a plastic warning tape, equal to Thomas & Betts, one foot below grade.

H. All underground raceways shall be laid staggered so that no joints are horizontally opposite one another. Where conduits enter hand-holes and/or manholes, they shall be provided with suitable bushings of the same size. The Electrical Contractor shall be responsible for checking grades and installing conduits with suitable drainage to manholes. Where conduits enter buildings, rigid galvanized conduit shall be used.

I. Exposed raceways shall be installed parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings.

J. All changes in direction of one-inch conduits and larger shall be made with standard elbows or cast metal fittings. Field- made bends and offsets in 3/4/inch conduit shall be made with an approved hickey or conduit-bending , machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided. Care shall be taken to prevent the lodgment of plaster, dirt or trash in raceways, boxes, fittings and equipment during the course of construction. Clogged raceways shall be entirely freed of obstruction or shall be replaced.

K. Conduits or pipes embedded in concrete slabs shall be spaced not closer than three diameters on centers and they shall be so placed as to avoid changing the locations of the reinforcement.

L. Except when plans of conduits and pipes are approved by the Engineer, embedded conduits, other than those merely passing through, shall be not larger in outside diameter than one-third the thickness of the slab, wall or beam in which they are embedded.

M. Raceways shall be securely supported and fastened in place at intervals of not more than 10 feet with pipe straps, wall brackets, hangers or ceiling trapeze. Fastenings shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs or studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine or wood screws. Threaded C-clamps shall not be used. Raceways or pipe straps shall not be welded to steel structure. Wooden plugs shall not be used.

N. No. 12 conductors and 3/4 in. raceways shall be the minimum used for power and lighting and No. 14 conductors and 3/4 in. raceways for control and signal systems. No conduit smaller than 3/4 in. shall be used.

O. Raceways shall be exposed in unfinished rooms unless otherwise indicated on drawings. Exposed conduit shall follow building lines.

P. Flexible metallic tubing shall be employed only where building construction does not allow use of rigid conduit, and in 18-inch lengths, for connection to lighting fixtures and to motors and other vibrating equipment.

Q. Running threads shall not be permitted and approved threaded couplings shall be used on full weight conduit. Conduit bends shall be the long radius type without kinks, flattening or crushing. Each end of any

Conduit terminating in a pressed steel box of any kind shall be provided with an approved insulating type bushing.

R. Conduit ends shall be square cut and reamed. Concealed conduits shall be run as straight and direct as possible. No more than four (4) 90 degree bends will be permitted in any run of conduit. Pull boxes shall be installed every 200 ft. which shall be reduced by 50 ft. for each 90-degree bend, unless otherwise indicated on drawings. In continuous runs of rigid PVC conduit of more than 90 ft., expansion joints shall be installed every 60 ft., and as required to compensate for linear thermal expansion and contraction of the conduit.

S. No wires shall be installed in conduits, until all conduit work is completed and closed in such a manner as to prevent the possibility of water getting into the conduits.

T. A separation of not less than 6 in. shall be maintained between all conduits and hot water or steam lines in the building, whenever possible. When it is not possible to provide the 6 in. separation an insulating pipe covering shall be installed on the electrical conduits.

U. Provide a minimum of two spare two (2) inch conduit stub outs from each panelboard installed on the project for future use. Conduits shall be extended at least 24 inches beyond adjacent paved areas or foundations and capped. Mark exact locations on as-built drawings.

V. No raceway smaller than 2-inch diameter shall be installed underground for field lighting circuits.

3.3 GROUNDING

A. Provide grounding in accordance with requirements of NEC Article No. 250.

B. Provide a reliable low impedance metallic ground path for short circuit currents, so that circuit protective devices can operate quickly and effectively. Route the ground path parallel to the circuit conductors and physically as close to them as possible, generally using the metallic conduit system as a conductor. Make the ground path continuous to each outlet and electrically operated device in the Project.

C. Ground frames of motors. Conduit system will be acceptable if connection box is bolted to motor frame. In other instances, provide grounding bushing on conduit and extend grounding conductor to a bolt on frame of motor. Where motor is part of apparatus, ground enclosure using connector furnished by manufacturer. Provide connector if none is furnished.

D. At convenience receptacles, extend ground wire from grounding screw of receptacle to grounding connector of box.

E. A code sized ground wire shall be provided in each feeder or branch circuit raceway installed on the project.

F. Connect branch circuit ground conductor to each luminaire housing.

G. Maximum resistance from a ground rod to ground shall not exceed three (3) ohms at any location.

3.4 CHASES, RECESSES AND OPENINGS

A. This Contractor shall provide all openings, chases or recesses in the construction as may be necessary for his work and as approved by the Engineer.

B. Where openings in masonry are required, they shall be made by coring only.

3.5 SLEEVES

A. Sleeves shall be installed in all new construction. Sleeves shall be 22-gauge galvanized steel. The pipe sleeves shall be sized for passing conduit and extend approximately 2" above concrete pads.

B. Sleeves shall be the proper design for waterproofing and flashing around the sleeves where required. The space between the piping and sleeve shall be caulked with an approved waterproof, high melting point sealing or asphalt compound.

C. This Contractor shall furnish the sleeves and set them in the new construction as required for the installation of his work.

3.6 FLASHING AND COUNTERFLASHING

A. This Contractor shall furnish and install the base flashing and the counter flashing materials for all work. This Contractor shall retain the services of an approved Roofing Contractor to perform this work.

3.7 FASTENINGS, SUPPORTS AND HANGERS

A. Support all material from the building structural members in an approved manner.

B. Where electrical equipment is mounted in suspended ceiling panels, provide support members to span between framing members of ceiling suspension system. Do not support electrical equipment from acoustical panels or other ceiling material; attach to this material for alignment only. Securely fasten support members to framing members.

C. Electrical outlet boxes, cables and conduit shall not be supported from suspension wires of the ceiling suspension system. Do not attach equipment directly to tee bars, where boxes could interfere with lifting ceiling panels.

D Where electrical lighting fixtures and other equipment is installed on tee bars of suspended ceilings, use appropriate twist clips or scissors clips with threaded studs attached directly to tee bars.

E. Provide mounting structures for electrical equipment where required. Use continuous slot channel or fabricate structure from galvanized structural steel angles and channels. Bolt or weld fabricated assemblies rigidly together, coat with suitable rust inhibiting primer and two finish coats of color as directed by Architect.

F. Provide 1/4" spacers behind cabinets of electrical equipment to permit circulation of air.

G. Provide racks of Continuous Slot Channel for parallel runs of conduit, and suspend on adjustable hangers. Use adjustable clevis hangers for individual runs of suspended conduit. Align suspended runs in horizontal plane for neat appearance. Perforated strap iron will not be permitted. Use approved beam clamps for connection to structural steel. Where structural steel has fireproof coating, cut coating as required to mount clamp and restore fireproofing to its original condition.

H. Do not support from steel roof decks, joist bridging, ductwork, piping, or floor slabs less than 4" thick.

I. Determine proper locations of anchors, inserts and supports, and maintain them in their proper locations during the period of construction.

J. Use supporting hardware suitable for the purpose intended. Use expansion shields with machine screws to fasten to solid masonry. Use toggle bolts to fasten to hollow masonry. Use lag bolts to fasten to wood surfaces. Use approved methods for other conditions as required. No wood, plastic or fiber plugs will be permitted. Use approved beam clamps.

K. Do not exceed manufacturer's load rating for mounting devices.

L. In cast concrete, use box inserts which allow lateral adjustment of the threaded member for proper alignment. Use continuous box inserts where required.

3.8 EXCAVATION AND BACKFILLING

A This Contractor shall be responsible for the excavation, backfilling, shoring and care for all ground water for the complete installation of his work.

B. This Contractor shall also provide suitable indemnity for all accidents to humans, animals or equipment caused by his excavation work. He shall provide suitable guards or barricades, red lanterns, flares and other precautions for an approved and safe installation.

C. Conduit shall be laid on undisturbed earth and not in fill. Cinder fill and stones or bricks beneath the conduit are prohibited. If the earth is not firm, the conduit shall be laid on concrete supports.

D. Backfill shall be well tamped in layers of not more than 6 inches. It shall consist of clean earth, as much as possible, but in no case shall it contain stones large enough to injure the installation.

E. After backfilling, this Contractor shall remove all excess materials from the premises and, if the surface was paved or sodded, repave and replace sod with material equal to, and level with, the adjacent surface.

F. Care should be taken to protect all existing trees, bushes and planting during the installation of all underground work.

3.9 EXPANSION FITTINGS

A. Provide expansion fittings where raceways cross building expansion and control joints. Maintain continuity of raceway grounding system by attaching bonding jumper as recommended by manufacturer.

B. Use manufactured expansion fittings for all conduit installed under the following conditions:

1. 1" and larger when exposed or above a suspended ceiling.

2. Grouped on racks where any of the group is 1" or larger.

C. Flexible conduit may be used for runs smaller than 1" where exposed, or concealed above suspended ceilings. Leave sufficient slack conduit for movement, and fasten on each side of joint.

3.10 OUTLET BOXES

A. Provide outlet box for each outlet shown in the wiring system. Use 4" minimum size with

conduit, of appropriate size and configuration. Provide interior partitions where required. Use octagon box for each individual lighting fixture and each continuous row of lighting fixtures in the ceiling. Provide fixture stud for box that supports lighting fixture. Provide other boxes as required.

B. Install boxes square with building lines, fasten securely in place, and grout or patch plaster if masonry or wallboard does not fit snugly on all sides.

C Provide extension rings and raised cover plates in plaster, masonry and tile walls. Plug unused openings.

D. Use sectional boxes with appropriate cable clamps for cable wiring. Provide green grounding screw for connection to ground wires.

E. Do no install boxes back-to-back in partitions. Separate boxes in adjacent rooms at least 12" to prevent transmission of sound.

3.11 PULL AND JUNCTION BOXES - INTERIOR

A. Provide pull boxes and junction boxes where required to facilitate installation of wiring, whether or not shown on drawings. Size boxes according to code, and provide interior partitions, insulated supports, hot dip galvanized angle iron braces, screw-on one-piece or split covers, ground connectors, and other accessories as required.

B. Mount boxes in accessible but unobtrusive locations, such as closets and mechanical spaces. Provide access panels for boxes otherwise concealed in building construction.

3.12 PULL AND JUNCTION BOXES FOR UNDERGROUND WORK

A. Install pull and junction boxes as detailed on the drawings.

3.13 WIRING DEVICES

A. Mount receptacles vertically unless otherwise noted.

3.14 MOTOR STARTERS (IF REQUIRED AND/OR SHOWN)

A. For installation of Manual and Magnetic Motor Starters, refer to DISTRIBUTION EQUIPMENT.

B. Install manual motor starter switch in accordance with manufacturers recommendations. Do not gang switches or combine with other wiring devices unless starter switches have been properly de-rated.

3.15 SUPPORTS AT DRYWALL CONSTRUCTION

A. Provide support members to carry weight of equipment; do not use drywall material to carry

any weight. Attach to drywall material for alignment purposes only. Pierce drywall material as required to mount equipment on support members.

B. Equipment normally supported from outlet box will require no additional support. Attach outlet boxes directly to studs of partitions. Provide support member to span between studs, if required, for location of box.

C. Where equipment on partitions cannot be supported by attachment to outlet box alone, coordinate supports with general construction. Limit weights as indicated below:

1. Recessed equipment, single stud: 100 pounds maximum.
2. Recessed equipment, double stud: 500 pounds maximum.
3. Recessed equipment, greater than 500 pounds: Provide independent mounting structure inside partition.
4. Surface mounted equipment, double stud (do not use single stud to carry weight): 1
   00-pound maximum.
5. Surface mounted equipment, greater than 100 pounds: Provide independent mounting structure outside partition.

3.16 WIRE INSTALLATION

A. Exercise care in storage and installation of wire and cable to avoid damage to conductors and their covering. Use an approved pulling compound as lubricant for pulling wires into raceway.

B. Numbering of circuits on drawings are intended panelboard connections. Make panel connections so that circuit protectors are in logical operating sequence, and so that loads are reasonably balanced across all phases.

C. Support conductors in vertical raceways in accordance with NEC requirements. provide manufactured clamps or compression fittings in bottom of panelboards if space permits, or provide separate pull boxes for such fittings where indicated.

3.17 SPLICES AND TAPS

A. Make splices electrically and mechanically secure. Install small wire connectors so that no bare conductor is exposed. Tighten bolts on large conductor connectors so that conductor is deformed, but do not break strands of wire. Use compression tool with proper die for compression connectors in accordance with manufacturer's recommendations, so that conductors are deformed but not broken. Apply insulation over splice so that insulation thickness is at least 1-1/2 times that on conductor. Lap applied insulation at least 1" over conductor insulation so that no bare conductor is exposed.

B. Terminate conductors on terminal strips in equipment where terminal strips are used. Provide appropriate connections, or hook conductors around terminal screws as required.

C. Connect each wiring device to its neutral conductor by means of short jumper, so that removal

of the device will not interrupt continuity of the neutral conductor feeding through the box.

D. Provide encapsulated splice kits for all splices in areas subject to moisture, including wet locations inside buildings and underground hand holes, manholes and buried junction boxes. Install splice kit in accordance with manufacturers recommendations, and make splice waterproof. Apply sealing putty to surround each cable. Install mold body so that resin covers each cable sheath by a minimum of one inch.

3.18 BRANCH CIRCUITS

A. Provide one neutral conductor for each single phase, 3 wire home run to a panelboard (or three phase, 4 wire home run, if applicable).

B. Avoid excessive voltage drop by using No. 10 wire for 120-volt circuits that exceed 75 feet to outlet at center of load. Use minimum No. 10 wire for emergency lighting circuits regardless of voltage.

C. Where home run indicates wire size larger than normal, continue this wire size throughout the circuit unless otherwise noted.

3.19 OVERSIZED WIRING

A. Where oversized wiring has been indicated to overcome voltage drop and does not fit properly into the equipment served, provide a suitable junction box adjacent to the equipment for the change of wire size.

B. Provide reduced wire size from junction box to equipment. Keep the reduced wire size as large as possible, but in no case use wire of ampacity less than that required by NEC to feed the equipment.

C. Where home run indicates wire size larger than normal, continue this wire size throughout the circuit unless otherwise noted.

3.20 IDENTIFICATION, NAMEPLATES AND TAGS

A. Identify and mark all electrical equipment to meet OSHA requirements, and as specified herein.

B. In every pull box, terminal box, and all places where wires may not be readily identified by name plate markings on the equipment to which they connect, identify each circuit with a tag or plastic label.

C. Mark all terminal boxes, safety switches, controllers, manual motor starters, push button switches and other control equipment with rigid laminated plastic legend plates having 3/16" lettering to clearly indicate the services or equipment for which they are provided.

D. Mark all equipment furnished under Division 16 and where it is related to equipment furnished under other Divisions. Use nomenclature that corresponds to the markings on that equipment.

E. Identify all panelboards with designation indicated on the drawings, and distribution voltage. Use rigid laminated plastic legend plates installed on the inside of the doors of flush mounted panels and outside of the doors of surface mounted panels with 1/4" lettering.

F. Indicate circuit number corresponding to panelboard circuit directory.

3.21 FIRE RESISTANT SEALANT

A. Apply sealant in compliance with manufacturer's recommendations. Clean surfaces before application, using primer where necessary. Install damming material to prevent undesirable flow, and remove after foaming action has stopped. Separate cables before injecting sealant to prevent voids. Provide sufficient thickness to equal fire rating of the barrier being penetrated

3.22 CONCRETE

A. Concrete for the encasement of underground raceways shall be provided by the Electrical Contractor. Spacers shall be provided to assure clearance between layers of raceways and between the lowest raceways and the bottom of the trench, to assure complete encapsulation.

B. Concrete shall have a minimum compressive strength of 3500 PSI. after 28 days.

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SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Outdoor occupancy sensors.
   2. Lighting Controller

1.2 ACTION SUBMITTALS

A. Product Data:

   1. For each type of product.

B. Shop Drawings:
   1. Show installation details for the lighting controller and all associated devices.
   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: minimum 2 year(s) from date of Substantial Completion.
   3. The MSC1 Controller shall be provided with a 5 year manufacturer warranty.

PART 2 - PRODUCTS

2.1 OUTDOOR OCCUPANCY SENSORS

A. List of Manufacturers
Leviton
Architectural Area Lighting
Hubbell
Substitutions shall be owner approved and reviewed by engineer

B. Description: Solid-state outdoor occupancy sensors.
1. 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**,** and must comply with latest Philadelphia Energy Code
2. PIR type, weatherproof. Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch (23 200 sq. mm). Comply with UL 773A.
3. Switch Rating:
   a. Luminaire-Mounted Sensor: 500 VA fluorescent/LED 120V.
4. Switch Type: automatic on and automatic "off."
5. Voltage: 120 V
6. Detector Coverage:
   a. Standard Range: 360-degree field of view, with a coverage area of 30 ft radius
7. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
8. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as "raintight" in accordance with UL 773A.

2.2 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

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

2.3 INSTALLATION OF SENSORS AND LIGHTING CONTROLLER

A. Coordinate layout and installation of devices with any type of construction or obstruction that interferes with installation of devices.

B. Lighting controller shall be installed in a suitably sized NEMA 3R enclosure as indicated on plans. Coordinate size and requirements with controller manufacturer.

C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's instructions.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is ¾” (21 mm).

B. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.

C. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.

1. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

3.3 FIELD QUALITY CONTROL

A. Field tests must be witnessed by the Architect and/or the Engineer.

B. Tests and Inspections:

1. Operational Test: After installing controller 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 supervise field tests and inspections and include all costs associated with this service.
2. Manufacturer shall provide a minimum of 2 hours of on-line instruction in controller operation to the owner’s maintenance personnel.

END OF SECTION 260923

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SECTION 262416
PANELBOARDS

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. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings.

4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Include evidence of NRTL listing for series rating of installed devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.

8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

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. Keys: Two spares for each type of panelboard cabinet lock to match owner standard.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407, NEMA PB 1.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C), 104 deg F (plus 40 deg C).

b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 1000 feet (300 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager no fewer than two days in advance of proposed interruption of electric service.

2. Do not proceed with interruption of electric service without Architect's, Construction Manager's written permission.

3. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways,

piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Damp Locations: NEMA 3, Type 3.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions;

3. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

4. Siemens ITE

5. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

6. Square D; a brand of Schneider Electric

7. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.

b. Back Boxes: Same finish as panels and trim.

8. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

9. Standards: NEC Article 384, UL, NEMA

10. Manufacturerer’s Dseignation: NQOB, NEHB, QMB

11. Description: Dead front automatic circuit braker type with enclosing cabinet

12. Circuit Breakers: Mold Case bolted to bus bars.

13. Line terminations: Single or double compression type lugs, main breaker, or other type of as shown on drawings; suitable for copper conductors.

14. Accessories and modifications: Contactors, split busses and other as noted in schedule and as required by Project.

15. All panelboard connections to main bussing for copper cables shall be with compression panelboards.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

3. Neutral Bus: Neutral bus rated 100 percent of phase bus and UL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Mechanical type.

3. Ground Lugs: Mechanical type.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 3, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVIC.

1. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
2. Square D; a brand of Schneider Electric.
3. Seimens ITE

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Standards: NEC Article 240; UL; NEMA.
2. Applications: Panelboards; individually mounted circuit protectors; switchboards.
3. Construction: Plastic housing; internal arc chutes; internal barriers between poles; internal linkage for simultaneous operation of all poles; on-off-trip indication by handle position.
4. Overload protection: inverse time mechanism using bimetallic tripping element. Circuit Breakers rated 200 amps and above shall be continuous rated.
5. Short circuit protection: Magnetic tripping element; adjustable instantaneous and interchangeable trip for frame sizes above 100 amperes in all main switchboards, or as noted on drawings.
6. Operation: Quick-make, quick-break; trip free from handle on automatic operation.
7. Rating: Voltage as required by system; overcurrent rating as noted in schedule; interrupting rating based on NEMA test procedures, 10,000 amp minimum RMS symmetrical or as indicated.
8. Accessories: As noted on drawings, including shunt trip; handle guards; handle breakers.
9. Not acceptable: External tie handles for multi-pole breakers; "Compact" breakers.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: Two normally open and normally closed contact(s) that operate with switch handle operation.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407, NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407, NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.

2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to panelboards.

5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Install filler plates in unused spaces.

H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

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SECTION 265619
LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SCOPE

A. This section includes all labor, equipment and materials required for the following:

1. Exterior LED light fixtures and poles.

2. Installation and connections

3. Tests

4. Spare parts.

1.2 RELATED SECTIONS

A. All work included in this section shall be coordinated with the requirements of the contract drawings, Division 0, Division 1, Division 3, and Division 26 specifications. Any discrepancies between sections shall be brought to the attention of the Owner.

1.3 GENERAL REQUIREMENTS

A. All materials and equipment furnished by this Contractor shall be new, the best in grade and quality, and manufactured in the United States of America with standards and ratings as specified herein. No substitution or deviation from the materials and equipment specified herein will be allowed except by written permission from the Engineer.

B. All materials and equipment shall be of the latest type and design and, where applicable, shall bear the label, stamp or seal of UL, NFPA, IEEE, NEMA, ASME, ASTM, ASA, IESNA, and other industry regulatory groups.

C. All items of the same kind shall be of the same make throughout the work.

D. All luminaires shall be controlled via photocell, however designer and contractor shall verify with Philadelphia Parks and Recreation (PPR) relative to lighting controls, lighting times, and security lighting. PPR may choose to have certain lights within a facility or site on a separate security circuit.

1.4 CODES AND STANDARDS

A. The light fixtures shall comply with the latest applicable standards including, but not limited to the following:

1. ANSI/IEC 60529 - Degrees of Protection Provided by Enclosures

2. ANSI/IEEE C62.41.2 - IEEE Recommended Practice for Surge Voltages in Low-Voltage

AC Power Circuits.

3. IESNA LM-79-08 - Electrical and Photometric Measurements of Solid-State Lighting Products

4. NEMA SSL 1-2010: Electronic Drivers for LED Devices, Arrays, or Systems

5. UL 8750 - Outline of Investigation for LED Light Sources for Use in Lighting Products.

6. ANSI C136.31-2010 – Standard for Roadway and Area Lighting Equipment— Luminaire Vibration.

7. Codes and Standards referenced in Section 01410 shall also apply to this section.

1.5 SUBMITTALS

A. Completely detailed working drawings and descriptive literature for all lighting fixtures, wiring devices and appurtenances shall be submitted by the Contractor for approval in conformance with the requirements of section 160511 – Requirements for Electrical Installation.

B. Submittals shall be complete with catalog sheets, distribution curves, coefficients of utilization tables, and details of construction, assembly and installation. Electronic IES files of the fixture proposed if different from the fixture specified.

C. Prior to ordering all lighting fixtures, order one sample fixture for the Owner to inspect on site and approve. Upon approval of the fixtures, order the remaining fixtures.

1.6 SUBSTITUTIONS

A. Substitutions are not normally permitting. Substitutions must be approved by Philadelphia Parks and Recreation prior to bid.

B. The lighting design shown on the drawings are based on the fixtures selected on the fixtures schedule. If substitutions are approved by PPR, contractor shall provide complete design drawings and photometric using the design basis specified on contract drawings at no additional cost.

C. PPR will only approve substitutions if lighting design proves of equal or better design and the quality of product is equivalent to the products shown on the fixture schedule and meets all requirements of the contract.

PART 2 PRODUCTS

2.1 LIGHT FIXTURES

A. All lighting fixtures shall be energy efficient solid state LED as shown on the drawings.

B. All light fixtures shall operate at 120/240 volts and furnished as described in the fixture schedule on the drawings.

C. All light fixtures shall be UL listed and manufactured in accordance with the latest applicable industry codes.

D. Where shown on drawings, provide accessories and mounting options.

E. All LED fixtures must appear on the Energy Star qualified product list or Design Lights Consortium products list to be eligible for rebates from PECO.

2.2 APPROVED FIXTURES

A. Following are approved manufacturers and model for LED light fixtures, pole, and accessories:

1. DISCERA 4 LED by Selux or approved equal.

2. Valmont Poles or approved equal.

2.3 CONSTRUCTION AND MATERIALS

A. Luminaire housing shall be constructed of rugged cast aluminum with integral heat sink specifically designed for LED.

B. The finish shall be durable, colorfast with excellent resistance to corrosion, ultraviolet degradation and abrasion. Preferred finish color shall be black or bronze. Designer may choose another color from the manufacturer's standard color palette with approval from Philadelphia Parks and Recreation.

2.4 MOUNTING AND ACCESSORIES

A. Pole: 3 1/2 Inch diameter straight steel pole with powder coat finish. Mounting heights/pole lengths shall be the following:

1. Pedestrian walkways, plazas, etc.: 14 feet from finished grade.

2. Parking areas and drives: 20 feet from finished grade.

B. Mounting Brackets: Single or double long arm mounts.

C. Photo Cell: Manufacturer's provided photocell.

D. Ground Fault Circuit Interrupter (GFCI) Receptacle: Where requested provide GFCI that is integrated into the pole by the manufacturer. Contractor/design shall confirm which poles receive GFCI outlets. The GFCI outlet shall meet the following criteria:

1. GFCI shall be 120V 15A GFCI duplex receptacle with NEC approved

weather-proof enclosure, self-closing cover; located 36 inches from base of pole, in-line with handhole. For use with 120V applications only.

2. GFCI shall be wired on a separate circuit from the luminaire.

2.5 RATINGS

E. Electrical;

1. Voltage and Frequency. 120V – 277V, 50/60Hz

2. System power factor shall be greater than 0.9

3. Total Harmonic Distortion (THD) less than 20%

4. Class "A" Sound rating

5. Electromagnetic Interference (EMI) per Title 47 CFR 15 Class A

6. Surge protection of 10Kv IEEE C62.41.2-002 Scenario 1, Location Category C

F. Enclosure Ratings

1. UL/cUL Listed, suitable for wet locations per UL 1598 when pendant mount.

2. IP66 rated optical enclosure per ANSI C136.25-2009

3. Temperature rated at –40° to 40°C.

2.6 OPTICS

A. Structured LED array for optimized under canopy photometric distribution

B. Symmetric photometric distribution suitable for mounting at 14 or 20 feet (see plans).

C. Lenses produce Type I, II, III, or V distributions per IESNA. See lighting schedule.

D. Reflective technology designed to optimize application efficiency and minimize glare.

E. Utilizes high brightness LEDs with color rendition index (CRI) of 70. Acceptable color temperature may range from 4000K to 5100K. Standard LM-79 tests and reports shall be performed in accordance with IESNA standards

2.7 WARRANTY

A. Provide Manufacturer's warranty on all LED light fixtures and all its components for a period of 5 years based on fixture operation for 24 hours/ 7days or 50,000 hours.

B. Contractor shall include 1 year of labor for lighting repairs, etc.

C. The electrical contractor shall provide all warranty documents to the Owner along with original receipts.

D. In the event any fixture(s) are not functional due to sole failure of the fixture during the warranty period of 5 years, the manufacturer shall ship upon request a new equivalent replacement fixture at no additional cost to arrive within 6 weeks. These replacement fixtures shall be covered under the original warranty and shall continue the remaining warranty period.

2.8 SPARE PARTS (AT PPR REQUEST IN WRITING ONLY)

A. The Contractor shall furnish five percent (5%) spare light fixtures for each type fixture listed on the fixture schedule.

B. All parts shall be delivered neatly wrapped or boxed, indexed and tagged with complete information for use and reordering.

PART 3 - EXECUTION

3.1 INSTALLATION AND CONNECTIONS

A. The scheme of installation, connections, arrangement, and location of equipment and outline dimensions shall be as shown and specified. Contractor shall verify all locations with designer prior to installation.

B. All installation shall meet the requirements of the National Electric code and Philadelphia Code where applicable.

C. Lighting fixtures shall be installed as indicated on the drawings and as per manufacturer's instructions.

D. Fixtures shall be clear of pipes, mechanical equipment, structural openings, and other obstructions.

E. The exact mounting of lighting fixtures shall be approved on the job before installation.

F. Pole based shall be installed relative to finish grade. Contractor shall verify top of footing elevations relative to finished grade elevation for conformance with the details and specifications prior to installation of concrete. Refer to pole base details for concrete and reinforcing information. Contractor shall use manufacturer's anchor bolt template for proper positioning of light pole base anchor bolts. Anchor bolts are to be cast into the footing.

3.1 TESTS

A. The contractor shall test for continuity and balance after installation and prior to acceptance the entire lighting system. All lighting shall be tested for proper operation.

B. The Contractor shall submit all foot-candle data along with a test report upon completion of all tests performed.

END OF SECTION 265619

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 a video surveillance system consisting of cameras, network video recorder, data transmission wiring, and a control station with its associated equipment.

B. Video surveillance system shall be integrated with existing PPR network equipment.

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. BNC: Bayonet Neill-Concelman - type of connector.

C. B/W: Black and white.

D. CCD: Charge-coupled device.

E. FTP: File transfer protocol.

F. IP: Internet protocol.

G. LAN: Local area network.

H. MPEG: Moving picture experts group.

I. NTSC: National Television System Committee.

J. PC: Personal computer.

K. PTZ: Pan-tilt-zoom.

L. RAID: Redundant array of independent disks.

M. TCP: Transmission control protocol - connects hosts on the Internet.

N. UPS: Uninterruptible power supply.

O. WAN: Wide area network.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Video surveillance system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.

3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.

4. UPS: Sizing calculations.

5. Wiring Diagrams: For power, signal, and control wiring (if provided).

6. Storage Device Calculations.

7. Network Bandwidth Requirements and Fiber Optic Channel Link-Loss Budgets .

8. Existing Equipment Frame Elevations, where new equipment is being added.

C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

D. Installer qualifications. Refer to section 1.11.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For video surveillance, cameras, camera-supporting equipment, 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.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. Include the following as well:

1.8 QUALITY ASSURANCE

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 NECA 1.

C. Comply with NFPA 70.

D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC, if access-control system is provided.

1.9 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient temperatures of 50 to 95 deg F (10 to 35 deg C) and a relative humidity of 20 to 80 percent, noncondensing.

2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.

3. Interior, Uncontrolled Environment: System components installed in non- temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 3R enclosures.

4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F (minus 34 to plus

50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick. Use NEMA 250, Type 4X enclosures.

5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.

6. Corrosive Environment: System components subject to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. Use NEMA 250, Type 4X enclosures.

7. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Final Acceptance by the City.

B. Warranty Requirements: Contractor shall warrant DPP (or PPR) that the equipment will be free and clear of any lien or encumbrance on the final acceptance date. Contractor shall further warrant for a period of three (3) year from the date of Substantial Completion that the Security System will, under normal use and service, be free from defects and faulty workmanship except as set forth below:

1. Contractor’s obligation under this warranty is to repair or replace defective equipment, parts, and associated labor thereto at its expense. Contractor shall warrant that replacement or repaired equipment furnished hereunder and labor shall be in accordance with current industry standards.

2. PPR is granted a nontransferable fully paid license (Genetec) to use all software furnished by the Contractor as part of furnishing the security system equipment provisions under terms established by the software manufacturer. The Authority will be provided with a copy of all applicable licenses. Contractor shall warrant that it has the right to grant such licenses.

3. A copy of Contractor’s standard warranty agreement must be provided and must match or exceed manufacturer’s warranty, minimum of 3 years.

4. Upgrade of software during warranty period.

5. Provide Service for three (3) years after substantial completion, includes all labor and material cost associated with the repair, with the exception of third party negligence or acts of vandalism.
6. Contractor’s personnel shall respond to all system failures within four (4) hours of the occurring event. All failure shall be corrected within eight (8) hours of the arrival on site of Contractor’s personnel.

1.11 INSTALLER’S QUALIFICATIONS

1. Installer must be a Genetech certified installer. Submit certificate, or applicable qualifications as part of the action submittals.

PART 2 - PRODUCTS

2.1 GENERAL SYSTEM REQUIREMENTS

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

C. Compatibility: Video Management Software must be compatible with IP video equipment. The contractor, if submitting components from different manufactures must submit with either shop drawings, or product data, statements of compatibility from each manufacturer guaranteeing IP video components are compatible with the IP video management software submitted.

2.2 IP VIDEO SYSTEMS

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

1. Genetec
2. Vivotek
3. Axis Communications
4. DVTEL

B. Description:

1. System shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.

2. System shall have seamless integration of all video surveillance and control functions.

3. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.

4. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-2/MPEG-4 video and H.264 video. Unit shall provide connections for all video cameras, bidirectional audio, discreet sensor inputs, and control system outputs.

5. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
6. Camera system units shall be ruggedly built and designed for extreme adverse and urban environments, complying with NEMA Type environmental standards. Where required provide vandal proof exterior camera housings.

7. Encoder/decoder combinations shall place video, audio, and data network stream that can be managed from multiple workstations on the user's LAN or WAN at the same time.

8. All system interconnect cables, workstation PCs, and network intermediate devices shall be provided for full performance of specified system.

2.3 STANDARD IP CAMERAS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Genetec (AutoVu SharpV)
2. Vivotek
3. Axis Communications
4. DVTEL

B. Network Indoor Dome Camera, HD/2Megapixel: Assembled and tested as a complete manufactured unit.

1. Image Sensor - 1/3" Progressive scan CMOS
2. Lens - 2.7-9mm Motorized Verifocal
3. Day/Night Sensor – Electronic or True
4. Minimum Illumination/Light Sensitivity (lux) - 0.5 color, 0.1 black and white
5. Maximum Resolution (pixels) - 1920x1080 (2MP)
6. Video Compression - H.264/MPEG4/M-JPEG
7. Frames per Second - 30
8. Alarm Inputs/Outputs - 2
9. Network Protocol - TCP/IP, HTTP, DHCP, DNS, DDNS, RTP/RTSP, PPPoE, SMTP, NTP
10. Power - PoE or DC Input
11. Vandal Resistant - Yes
12. Digital Pan/Tilt/Zoom
13. 20M IR LED
14. Mounting:

    a. Indoor Ceiling Mount (Vandal Proof)
    b. Wall Mount (Vandal Proof)

C. Network Indoor Dome Camera, HD/3Megapixel: Assembled and tested as a complete manufactured unit.

1. Image Sensor - 1/3" Progressive scan CMOS
2. Lens - 2.7-9mm Motorized Verifocal
3. Day/Night Sensor – Electronic or True
4. Minimum Illumination/Light Sensitivity (lux) - 0.8 color, 0.1 black and white
5. Maximum Resolution (pixels) - 2048x1536 (3MP)
6. Video Compression - H.264/MPEG4/M-JPEG
7. Frames per Second – 30
8. Alarm Inputs/Outputs - 2
9. Network Protocol - TCP/IP, HTTP, DHCP, DNS, DDNS, RTP/RTSP, PPPoE, SMTP, NTP
10. Power - PoE or DC Input
11. Vandal Resistant - Yes

12. Digital Pan/Tilt/Zoom
13. 20M IR LED
14. Mounting:

    a. Indoor Ceiling Mount (Vandal Proof)
    b. Wall Mount (Vandal Proof)

D. Network Outdoor Dome Camera, HD/ (2) Megapixel: Assembled and tested as a complete manufactured unit.

1. Image Sensor - 1/3" Progressive scan CMOS
2. Lens – 2.7-9mm Motorized Verifocal
3. Minimum Illumination/Light Sensitivity (lux) - 0.08 color, 0.1 black and white
4. Maximum Resolution (pixels) - 1920x1080
5. Video Compression - H.264/MPEG4/M-JPEG
6. Frames per Second - 30
7. Intelligent Alarm
8. Network Protocol - TCP/IP, HTTP, DHCP, DNS, DDNS, RTP, RTSP, PPPoE, SMTP, NTP, SNMP, HTTPS, FTP, 802.1x, Qos
9. Power - PoE
10. Outdoor Use - Outdoor Ready
11. Vandal Resistant - Yes
12. Digital Pan/Tilt/Zoom
13. 20M IR LED
14. Heater - Integrated with housing
15. Mounting:

    a. Outdoor Wall Mount (Vandal Proof)
    b. Outdoor Wall Mount on Pole Mount Adapter, Min. Three Clamps (Vandal Proof)

E. Network Outdoor Dome Camera, HD/ (3) Megapixel: Assembled and tested as a complete manufactured unit.

1. Image Sensor - 1/3" Progressive scan CMOS
2. Lens – 2.7-9mm Motorized Verifocal
3. Minimum Illumination/Light Sensitivity (lux) 0.5 color, 0 black and white
4. Maximum Resolution (pixels) - 2048x1536 (3MP)
5. Video Compression - H.264/MPEG4/M-JPEG
6. Frames per Second - 30
7. Intelligent Alarm
8. Network Protocol - TCP/IP, HTTP, DHCP, DNS, DDNS, RTP, RTSP, PPPoE, SMTP, NTP, SNMP, HTTPS, FTP, 802.1x, Qos
9. Power - PoE
10. Outdoor Use - Outdoor Ready
11. Vandal Resistant - Yes
12. Digital Pan/Tilt/Zoom
13. 20M IR LED
14. Heater - Integrated with housing
15. Mounting:

a. Outdoor Wall Mount(Vandal Proof)
b. Outdoor Wall Mount on Pole Mount Adapter, Min. Three Clamps(Vandal Proof)

F. Mini Dome Camera, HD/ 2 Megapixel: Assembled and tested as a complete manufactured unit.

1. Image Sensor - 1/3" Progressive scan CMOS
2. Lens - 4mm
3. Day/Night Sensor - Automatic
4. Minimum Illumination/Light Sensitivity (lux) - 0.5 color, 0.1 black and white with dynamic capture, 1.1 color, 0.2 black and white with light finder
5. Maximum Resolution (pixels) - 1920x1080 (2MP)
6. Video Compression - H.264/MPEG4/M-JPEG
7. Frames per Second - 15
8. Intelligent Alarm
9. Network Protocol - TCP/IP, HTTP, DHCP, DNS, DDNS, RTP/RTSP, PPPoE, SMTP, NTP
10. Power - PoE
11. Outdoor Use - Outdoor Ready
12. Vandal Resistant – Yes
13. Mounting:

a. Indoor Ceiling Mount (Vandal Proof)
b. Wall Mount (Vandal Proof)

G. Network Outdoor PTZ Camera HD/ 3Megapixel: Assembled and tested as a complete manufactured unit.

1. Image Sensor - 1/3" Progressive scan CMOS
2. Lens - 2.7-9mm Motorized Verifocal
3. Day/Night Sensor - Auto
4. Minimum Illumination/Light Sensitivity: 0.05LUX at (F1.6, on color), 0.01LUX at (F1.6, on black and white)
5. Maximum Resolution (pixels) - 2048x12536 (3MP)
6. Video Compression - H.264/MPEG4/M-JPEG
7. Frames per Second min– 30
8. Alarm Inputs/Outputs – 7/2
9. Network Protocol - TCP/IP, HTTP, DHCP, DNS, DDNS, RTP/RTSP, PPPoE, SMTP, NTP
10. Power - PoE or DC Input
11. Vandal Resistant - Yes
12. PTZ Function: 360deg. Endless pan range and -20deg to 90der. Tilt range
13. 20M IR LED
14. Mounting:

a. Indoor Ceiling Mount (Vandal Proof)
b. Wall Mount (Vandal Proof)

H. Network Indoor Dome Camera (360deg. or fish eye lens), HD/2Megapixel: Assembled and tested as a complete manufactured unit.

1. Image Sensor – 1/1.8" Progressive scan CMOS
2. Lens – 1.27mm, F2.8 angle of view 180 deg. (wall mount) 360 deg. (ceiling mount).
3. Day/Night Sensor - Auto

4. Minimum Illumination/Light Sensitivity: 0.05 LUX at (F1.2, AGC on color), 03 LUX at (F2.8, AGC on color), 0.0 LUX black and white
5. Maximum Resolution - 3072x2048
6. Video Compression - H.264/MPEG4/M-JPEG
7. Frames per Second - 50
8. Network Protocol - TCP/IP, HTTP, DHCP, DNS, DDNS, RTP/RTSP, PPPoE, SMTP, NTP
9. Power - PoE or DC Input
10. Vandal Resistant - Yes
11. Mounting:

    a. Indoor Ceiling Mount (Vandal Proof)
    b. Wall Mount (Vandal Proof)

2.4 VIDEO DECODERS

A.

1. Network - IPv4 or IPv6

2. Power - PoE, DC

3. Monitor Support - Up to 2 DVI or Analog

4. Network Configurable

5. Camera Viewing capability only, no control

2.5 POWER SUPPLIES

A. Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, and of type as recommended by manufacturer of camera and lens.

B.

1. Enclosure: NEMA 250, Type 3.

2. Input - 115VAC

3. Output - 16 fuse protected outputs:

    a. 12VDC or 24VDC
    b. 4A total continuous supply
    c. 3.5A rated outputs

4. Temperature Operating Range - 0 to 49 C

5. Input/Output LED Indicators

6. On/Off Switch

7. Locking Enclosure

2.6 CAMERA-SUPPORTING EQUIPMENT

A. Manufacturers: Subject to compliance with requirements of:

1. Genetec

B. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.

D. Protective Housings for Fixed Cameras: Steel enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.

1. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display.

2. Camera Viewing Window: Polycarbonate window, aligned with camera lens.

3. Duplex Receptacle: Internally mounted.

4. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.

5. Built-in, thermostat-activated heater units. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.

6. Sun shield shall not interfere with normal airflow around the housing.

7. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.

8. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.

2.7 MONITORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. NEC Display (security monitor not TV)

2. Samsung (security monitor not TV)

3. Sharp (security monitor not TV)

4. LG (security monitor not TV)

5. TATUNG (security monitor not TV)

B. Monitors shall be sized per the drawings. If size is not specified, the size shall be 26” to 32" minimum.

C. Monitors shall be mounted within a see through vandal proof enclosure. Vandal proof enclosure shall be lockable and wall mountable.

2.8 NETWORK VIDEO RECORDERS/VIDEO SERVERS

A. Manufacturers: Subject to compliance with requirements, provide products:

1. Genetec

B. Internal 12 TB min hard disk.

1. Contractor shall provide storage calculations based on quantity of cameras and recording parameters, 40TB shall be the minimum size NVR acceptable, contractor shall increase size based on number of cameras maintaining 20% spare capacity for recording and expansion.
2. Video and audio recording over TCP/IP network.
3. Video recording of MPEG-2 and MPEG-4 streams.
4. Video recording up to 48 Mbps for internal storage and up to 100 Mbps for external storage.
5. Duplex Operation: Simultaneous recording and playback.
6. Continuous and alarm-based recording.
7. Full-Featured Search Capabilities: Search based on camera, time, or date.
8. Automatic data replenishment to ensure recording even if network is down.
9. Digital certification by watermarking.
10. Internal RAID storage of up to 40 TB.
11. Full integration with LAN, Intranet, or Internet through standard Web browser or video management software, see next section.
12. Integrated Web server FTP server functionality.
13. Network video recording/storage devices shall be sized to store video at 2MP for 30 days with 20% capacity remaining, 30 fps, record on motion. Multiple storage devices shall be required as necessary. At a minimum, one storage device per facility will be required.

C. Minimum Device Requirements:

1. OS Windows 10 Enterprise LTSB.

2. Intel Core i5-8500 3.00GHz

3. RAM 16 GB DDR4

4. Onboard 1GB Network adapter

D. Each NVR shall be supplied with a keyboard and mouse for IP camera control at the viewing station. The Keyboard shall be connected directly to the NVR. The keyboard shall allow user logon, display selection, monitor configuration and camera control.

E. Contractor shall configure all new cameras for each building or each specified location for viewing, recording and playback on the NVR. Each NVR setup will be unique and configuration will be determined by the Department of Public Property. Contractor shall submit NVR and recording setup and configuration of cameras for review and approval.

F. NVR shall be mounted with a vandal proof enclosure. Vandal Proof enclosure shall be lockable and mountable.

2.9 POWER OVER ETHERNET (POE) POWER INJECTORS

A. Minimum Device Requirements:
1. Ports - 16 (min.) actual device quantities on drawings, use 24 port if necessary.

2. Power Input - 115VAC.

3. Max Power - 30W per port, Total Power 300W.
4. 19" Rack Mountable

2.10 MOSQUITO TYPE SONIC SECURITY DEVICES

A. Mosquito Sonic Devices Model Number–MK 4 with Multi-Age as manufactured by Moving Sound Technologies, or PPR approved equal.

B. Devices shall be secured with Standard Security Cage as manufactured by Moving Sound Technologies, or PPR approved equal.

C. Devices shall be connected to existing electrical panel and circuited through a new time clock. Electromechanical timer model number Tork 7200 or PPR approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP network before device installation.

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

3.2 WIRING

A. Comply with requirements in Division 26 – Raceways and Boxes for Electrical Systems. If Division 26 is not provided, install wiring per below.

B. Wiring Method: Install cables in raceways unless otherwise indicated.

1. Except raceways are not required in accessible indoor ceiling spaces and attics.

2. Except raceways are not required in hollow gypsum board partitions.

3. Conceal raceways and wiring except in unfinished spaces.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. 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.

E. For LAN connection and fiber-optic and copper communication wiring, comply with Section 271500-1.4 "Horizontal Cabling Description."

F. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.3 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Install cameras and infrared illuminators level and plumb.

B. Install cameras with an 84-inch minimum clear space below cameras and their mountings to the finished floor or grade. Change type of mounting to achieve required clearance. For exterior camera mount cameras on building exteriors or steel poles to match exterior lighting system poles.

C. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.

D. Install power supplies and other auxiliary components at control stations unless otherwise indicated.

E. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.

F. Avoid ground loops by making ground connections only at the control station.

1. For 12- and 24-V dc cameras, connect the coaxial cable shields only at the monitor end.

G. Identify system components, wiring, cabling, and terminals.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections:

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

2. Pre-testing: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:

   a. Prepare equipment list described in "Informational Submittals" Article.
   b. Verify operation of auto-iris lenses.
   c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
   d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet (17 to 23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
   e. Set and name all preset positions; consult Owner's personnel.
   f. Set sensitivity of motion detection.
   g. Connect and verify responses to alarms.
   h. Verify operation of control-station equipment.

3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

5. Video surveillance system will be considered defective if it does not pass tests and inspections.

6. Prepare test and inspection reports and submit to PPR for review.

3.5 LABELING OF CAMERA DEVICES AND CONTROL SYSTEMS

A. Contractor to provide a recommended Labeling System to Project Coordinator prior to camera installation.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits for this purpose at 6 months and 12 months. Tasks shall include, but are not limited to, the following:

1. Check cable connections.

2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.

3. Adjust all preset positions; consult Owner's personnel.
4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.

5. Provide a written report of adjustments and recommendations.

6. Cleaning per Section 3.7

3.7 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.8 DEMONSTRATION/TRAINING

A. Provide a minimum of 8 hours of training to Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

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SECTION 311000

SITE CLEARING

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. Removing existing vegetation.
   2. Clearing and grubbing.
   3. Stripping and stockpiling topsoil.
   4. Removing above- and below-grade site improvements.
   5. Disconnecting, capping or sealing, and abandoning site utilities in place.

B. Related Sections:

   1. Section 015000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion- and sedimentation-control measures.
   2. Section 017300 "Execution" for field engineering and surveying.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is 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 more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

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

1.5 INFORMATIONAL 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 photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

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

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

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed by Owner.

C. Utility Locator Service: Notify PAOne Call for area where Project is located before site clearing.

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

E. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

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

PART 3 - EXECUTION

3.1 PREPARATION

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

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

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

3.2 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

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

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

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

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

1. Notify Owner not less than two days in advance of proposed utility interruptions.

3.3 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

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

2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

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

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

3.4 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials. Contractor to identify and determine depth of existing topsoil as defined in specification.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

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

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.5 SITE IMPROVEMENTS

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

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION 311000

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SECTION 312000

EARTHWORK

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. Preparing subgrades for pavements, turf and grasses, and plants.
2. Excavating and backfilling for structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping, and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
4. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 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. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

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

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

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

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

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

H. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

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

1.4 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextile fabric.
2. Warning tapes.

1.5 PROJECT CONDITIONS

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

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

B. Utility Locator Service: Notify "One Call" for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 311000 "Site Clearing," are in place.

D. Do not commence earth moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

E. The following practices are prohibited within protection zones:

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

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 – PRODUCTS

2.1 SOIL MATERIALS

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

B. Satisfactory Soils: USDA Soil Classification 'Loam' or 'Clay Loam'; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; per Drawings.

D. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

E. Sand: ASTM C 33; fine aggregate

F. 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 (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.2 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. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.

2.3 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:

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

PART 3 – EXECUTION

3.1 PREPARATION

1. 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.
2. Protect and maintain erosion and sedimentation controls during earth moving operations.
3. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

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

materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    a. 12 inches outside of concrete forms at footings.
    b. 12 inches beneath bottom of footings, concrete paving, asphalt paving and curbing.
    c. 6 inches beneath pipe in trenches, and 12 inches on either side from outside wall of pipe.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

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

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.5 EXCAVATION FOR 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.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

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

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

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

3.7 STORAGE OF SOIL MATERIALS

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

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

3.8 BACKFILL

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. Surveying 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 and 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.

3.9 UTILITY TRENCH BACKFILL

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

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

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Place and compact initial backfill of subbase material free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

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

E. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.

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

G. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 SOIL FILL

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

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

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under footings and foundations, use engineered fill.

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

3.11 SOIL MOISTURE CONTROL

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

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

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

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, steps, and pavements, scarify and recompact top 6 inches of existing subgrade and each layer of backfill or fill soil material at 92 percent.
2. 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.
3. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.13 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 required elevations within the following tolerances.

1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm)
2. Pavements: Plus or minus 1/2 inch (13 mm)

3.14 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Section 334600 "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

3.15 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

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

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

1. Shape subbase course to required crown elevations and cross-slope grades.
2. Place subbase course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698, ASTM D 1557.

3.16 FIELD QUALITY CONTROL

A. Special Inspections if required by County or Play Equipment Manufacturer: Owner will engage a qualified special 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 and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner 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 Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

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.

3.17 PROTECTION

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

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact

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

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

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION 312000

SECTION 31 2350
SAWCUTTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes the saw-cutting of existing concrete and bituminous pavement at the locations indicated on the plans.

1.2 RELATED DOCUMENTS

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

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.1 GENERAL

A. Saws shall be equipped with guides, blade guards, water-cooling system and cut-depth control. The joint shall be sawed continuously and shall be of sufficient depth to allow removal of the paving without disturbing the paving that is to remain.

B. Contractor to mark out sawcut lines in field for approval by the Owner/Authorized Representative prior to proceeding with the paving removal.

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SECTION 312500
SOIL EROSION & SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work of this Section includes all temporary erosion and sediment control and related and incidental operations, including:

1. Filter Bag Inlet protection;
2. Compost filter sock;
3. Temporary seeding and mulching;
4. Rumble Pad;
5. Pumped Water Filter Bag;
6. Compost Sock Washout Station;
7. Safety Fence; and,
8. Maintenance and repair of erosion and sediment control measures.

1.2 SUBMITTALS

A. Submit complete shop drawings and product information for all items to be furnished under this Section upon receipt of notice to proceed and prior to construction.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary trades and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

B. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction. Construction operations shall be carried out in a manner such that soil erosion, air pollution, and water pollution is minimized. State, County, and Municipal laws concerning pollution abatement shall be followed.

C. The recommendations and Standards set forth in Chapter 102 of the Pennsylvania Code (Erosion and Sediment Control Handbook), published by the PA Department of Environmental Protection, shall be applicable where the work is not specifically detailed in this Specification, the accompanying Drawings, or the Erosion and Sediment Control Plan.

D. The Contractor shall take action to remedy unforeseen erosion conditions and to prevent damage to adjacent properties as a result of increased runoff and/or sediment displacement. Stockpiles of wood chips, hay bales, crushed stone, and other mulches shall be held in readiness to deal immediately with emergency problems of erosion. All erosion control checks and structures shall be inspected after heavy rainfalls, and if damaged, repaired or replaced.

E. No other construction activities may take place until appropriate Erosion and Sedimentation Control devices have been installed and approved by Owner/Authorized Representative. All changes to the Erosion and Sedimentation Control Plan must be approved by Owner/Authorized Representative prior to implementation.

1.4 REFERENCES

A. PennDOT, Publication 408/2016 Specifications.

B. Pennsylvania Department of Environmental Protection, Erosion and Sediment Pollution Control Program Manual (March 2012 or most recent version).

C. Commonwealth of Pennsylvania, Department of Transportation (PennDOT)

1. Bulletin No. 15: Approved Construction Materials.

PART 2 - PRODUCTS

2.1 TEMPORARY INLET PROTECTION FILTER BAG

A. Filter bags shall be manufactured with woven polypropylene geotextile and sewn by a double needle machine, using a high strength nylon thread. Filter bags shall have a design flow rate of 40 gpm/sf.

B. Filter bags shall be manufactured to fit the opening of the catch basin or drop inlet. Filter bags will have the following features:

1. Two dump straps attached at the bottom to facilitate the emptying of the bag;

2. Lifting loops as an internal part of the system to be used to lift the filter bag from the basin;

3. Restraint cord approximately halfway up the sack to keep the sides away from the basin walls, this cord is also a visual means of indicating when the sack should be emptied.

C. Filter bag seams shall have a minimum certified average wide width strength per ASTM D-4884 of 300 psi.

D. Inlet filter bags for installation in new or existing highway grate and open mouth grate inlets shall be listed in PennDOT Bulletin 15 or approved equal.

E. City inlet (and curb opening portion of open-mouth grate inlet) protection shall be a synthetic filter manufactured from recycled synthetic fibers listed in PennDOT Bulletin 15 or approved equal.

2.2 COMPOST FILTER SOCK

A. Compost filter socks shall be a three-dimensional tubular sediment control. The compost socks shall be Filtrexx Siltsox manufactured by Filtrexx International LLC of Grafton, Ohio, or approved equal.

2.3 TEMPORARY SEEDING AND MULCHING

A. All stockpiles and inactive disturbed areas shall be seeded and mulched in accordance with the design plans if they are to be left exposed for more than twenty (20) days.

2.4 RUMBLE PAD

A. Prefabricated rumble pad shall be used instead of a rock construction entrance and installed according to manufacturer's recommendations. A sufficient number of pads shall be installed to provide a minimum of four (4) tire revolutions while on pad with a minimum size of 50 feet in length and 20 feet in width.

1. More pads may be needed depending on site conditions.

B. Accumulated materials shall be cleaned from the pads daily and as necessary and disposed of in accordance with all applicable regulations.

2.5 PUMPED WATER FILTER BAG

A. Pumped water filter bags shall be provided in accordance with PennDOT Publication 408, Section 855.

2.6 CHAIN LINK FENCE

A. Temporary chain link fence shall be galvanized steel and un-coated. Fence chain link fabric shall be minimum 11 gauge steel and mesh size shall be maximum 2 inches.

B. Fence shall be 6 feet high with top and bottom rails. If a continuous fence, line posts shall be maximum 12 feet on center. If a panel fence, sections shall be maximum 12 feet wide, and each individual section shall be securely fastened to its adjacent sections.

C. Fence shall be supported by panel stands or feet and shall be installed and secured without drilling holes in the cartway or footway.

2.7 STABILIZED ROCK CONSTRUCTION ENTRANCE

A. Stabilized (or Rock) Construction Entrance shall be as indicated on the Drawings and on the attached Rock Construction Entrance Detail (Detail E&S-09).

B. Materials and construction for the stabilized construction entrance shall be in accordance with PennDOT Publication 408/2011, Section 849.

1. AASHTO #1 Aggregate shall comply with PennDOT Publication 408, Section 703.

a. Coarse aggregates shall meet the following requirements:

i. Maximum wash loss of 1% (ASTM C117)

ii. Minimum Durability Index of 35 (ASTM D3744)

iii. Maximum abrasion of 10% for 100 revolutions and maximum of 50% for 500 revolutions

iv. All aggregate shall be clean and thoroughly washed.

b. Unless otherwise approved by PWD, coarse aggregate for the stormwater trenches shall be uniformly graded as defined in Standard Sizes of Coarse Aggregate, Table 4, AASHTO Specifications, Part I, 19th Ed., 1998, or latest edition, unless otherwise specified.

1. Grading Requirements for AASHTO No 1

U.S. Standard Sieve Size	Percent Passing
4" (100 mm)	100
3½" (90 mm)	90-100
2½" (63 mm)	25-60
1½" (37.5 mm)	0-15
¾" (19 mm)	0-5

c. Crushed concrete shall not be an acceptable substitute for coarse aggregate unless specifically authorized in writing by PWD prior to placement.

2. Geotextile shall be Class 4 Type A separation fabric per PennDOT Publication 408, Section 735.

a. Geotextile: Non-woven geotextile (separation fabric) shall be US 270NW, Mirafi 1120N, or approved equal.

i. Minimum flow rate 65 gal/min/ft² (ASTM D-4491)

ii. Minimum grab tensile strength 270 lbs (ASTM D-4632)

iii. Minimum CBR puncture strength 700 psi (ASTM D-6241)

iv. Minimum tear resistance 100 lbs (ASTM D-4533)

v. Minimum UV resistance 70% retained strength (ASTM D-4355)

2.8 ORANGE SAFETY FENCING

A. Fence shall be Blaze or International Orange colored, mono-oriented laminar polyethylene plastic, U.V. stabilized material with a mesh size of 3 in. by 1.5 in. and porosity of 60%. The fence shall have a minimum height of 4 ft.

B. Posts for attachment of the fence shall be 2-in. by 2-in. wood posts at a minimum of 6 ft long, or 5-1/2 ft high 2 in. thick steel U-channel posts.

C. Ties for attachment of fencing to posts shall consist of plastic or wire of a gauge sufficient enough to bear the weight of the fencing on the posts.

2.9 COMPOST SOCK WASHOUT STATION

A. Concrete washout water shall be directed to the compost sock washout station as indicated on the plans. The compost sock washout station shall be comprised of a compost filter sock in accordance with this specification.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All temporary erosion and sediment control measures specified herein shall be in place before the beginning of any earthwork or excavation.

B. All erosion and sediment control devices shall be installed according to the manufacturer's specifications.

C. When temporary erosion and sediment control measures as described herein do not provide adequate control, replacement or relocation of measures may be required as directed by the owner/Authorized Representative.

D. Erosion and sediment control measures shall be inspected weekly and after every precipitation event.

E. Contractor shall maintain complete written logs of inspections and shall make them available to PWD Inspector/Owner/Engineer upon request.

F. All maintenance work, including but not limited to cleaning, repair, replacement, regrading, and restabilization of temporary erosion and sediment control measures shall be performed immediately.

G. Contractor shall ensure that erosion and sedimentation control measures remain in place and fully functional until site achieves final stabilization.

3.2 PUMPED WATER FILTER BAG

A. Sediment-laden water shall be pumped through a pumped water filter bag as specified herein.

B. Filter bags shall be removed and replaced when they have reached their capacity to filter sediment effectively, or upon any breach of the filter bag.

C. The Contractor shall not discharge to any sewer without the prior approval of PWD.

3.3 TEMPORARY INLET PROTECTION

A. The downstream inlets from the site of any disturbance or construction on the project site shall be protected with approved inlet protection practices. Downstream inlets are considered to be the next immediate inlet downslope that will receive runoff from the site of any disturbance, as well as any and all inlets within the site itself.

B. All new inlets shall be protected with approved inlet protection practices upon installation. Inlets draining exclusively to a stormwater feature shall remain fully closed to runoff until final site cleanup.

C. Final site cleanup shall include removal of all temporary inlet protection, cleaning of all permanent inlet protection, and cleaning of all inlets (existing downstream inlets and newly installed) of accumulated construction debris and sediment.

D. Highway grate and open mouth grate inlets shall be protected using inlet filter bags as specified herein.

E. Open mouth grate inlets and open mouth inlets (city inlets) shall be protected with a compost sock or synthetic filter as specified herein.

F. Inlet protection shall be installed, inspected, cleaned and replaced according to manufacturer's specifications.

1. Inlet filter bags and open mouth inlet protection shall be removed and replaced when filled with silt or when extended periods of ponding occur following a precipitation event. New inlet filter bags or approved inlet protection devices shall be installed and secured immediately after removal of silted protection devices.

3.4 PROTECTION OF UNDERGROUND STORMWATER BASINS

A. Install compost sock as necessary around bioinfiltration basins to prevent sediment from accumulating in the trench subgrade or stone. Compost sock shall be installed, inspected, cleaned, and replaced according to manufacturer's instructions. Any trench not protected with sedimentation barriers during either a rain event or after the end of a working day shall be assumed to be compromised, and subject to scarification and/or replacement of compromised soils with clean aggregate at the discretion of PWD. Compost socks shall not be required during active on-site construction, except as required during rain events.

B. At the end of each working day, no stormwater storage stone shall be left unwrapped in geotextile and exposed to sedimentation. Any stormwater storage stone unprotected from sedimentation during a period of construction inactivity shall be assumed to be compromised, and shall be fully replaced at no cost to the Owner.

C. All construction activities shall cease on any bioinfiltration basin found to have standing water or a subgrade in unsuitable condition (sediment deposits or excessively damp soils) as determined by Owner/Authorized Representative. Appropriate measures shall then be dictated by Owner/Authorized Representative, possibly including but not limited to abandonment of the trench installation, establishment of a dewatering system for the duration of construction, or subgrade replacement measures as outlined in Section 02709 of these Specifications.

3.5 STORAGE STOCKPLIES

A. Stockpiles of all loose materials (aggregate, fill, soils, etc) shall be protected from dust and rain by use of a cover. The cover shall be free of defects, and secured adequately to maintain protection of the materials. Owner/Authorized Representative reserves the right to refuse use of any material that has been compromised by inadequate protection onsite.

B. Stockpiles shall not be placed upslope from any infiltration structure. Any drainage structure (such as but not exclusively inlets) downslope of a stockpile shall be adequately protected from runoff.

C. Stockpile heights are not to exceed 20 feet high. Stockpile slopes shall be 2:1 or flatter.

3.6 REMOVAL AND FINAL CLEANUP

A. Once the site has been fully stabilized and approval is given by Owner/Authorized Representative, temporary erosion and sedimentation control measures and all accumulated silt and sediment shall be removed. All permanent inlet protection measures shall be cleaned, inspected, and verified to be in working order.

B. Any remaining dirt or debris within the public right of way shall be removed by the Contractor, using necessary means as sufficient to remove the dirt and debris from the public right of way. This may include, but is not limited to, street sweeping, sidewalk vacuuming, inlet cleaning, power washing, or hand removal.

C. Silt and waste materials shall be disposed of in a proper manner. No extra construction materials are to remain onsite upon completion of the Work. The Work of this Contract shall not be considered complete until all extraneous construction-related items have been removed (temporary traffic control devices, signage, etc).

3.7 REMOVAL AND FINAL CLEANUP

A. Once the site has been fully stabilized and approval is given by PWD, temporary erosion and sedimentation control measures and all accumulated silt and sediment shall be removed. All permanent inlet protection measures shall be cleaned, inspected, and verified to be in working order.

B. Any remaining dirt or debris within the public right of way shall be removed by the Contractor, using necessary means as sufficient to remove the dirt and debris from the public right of way. This may include, but is not limited to, street sweeping, sidewalk vacuuming, inlet cleaning, power washing, or hand removal.

C. Silt and waste materials shall be disposed of in a proper manner. No extra construction materials are to remain onsite upon completion of the Work. The Work of this Contract shall not be considered complete until all extraneous construction-related items have been removed (temporary traffic control devices, signage, etc).

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SECTION 321116

SUBBASE COURSE

PART 1 - GENERAL

1.1 SUMMARY

A. This item consists of the preparation of the subgrade and the construction of a layer of aggregate for driveways, footways/sidewalks, and roadway pavement of the depth indicated, to the lines and grades shown on the drawings, or as directed by the engineer.

B. Section Includes:
   1. Aggregate subbase.

1.2 RELATED DOCUMENTS

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

B. Related Sections:
   1. 310000 – Earthwork
   2. 321136 – Concrete Base Course
   3. 321216 - Asphalt Paving
   4. 321600 - Concrete Curbs, Sidewalk, and Pavement

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.

B. ASTM International:
   1. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   2. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   4. ASTM D2940 - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
   5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit data for aggregate materials.
   2. Submit data for geotextile fabric.

C. Materials Source: Submit name of aggregate and geotextile materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work according to Pennsylvania Department of Transportation standards.

C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

A. Subbase Aggregate:
   1. No. 2A Stone Aggregate in accordance with PennDOT Publication 408, Section 703.

2.2 ACCESSORIES

A. Geotextile Fabric:
   1. Class 4, Type A Non-woven Needle Punched Geotextile Fabric in accordance with PennDOT Publication 408, Section 735.

PART 3 - EXECUTION

3.1 GENERAL

A. Subbase material shall not be placed on soft, muddy or frozen areas, nor until all irregularities in the prepared areas, including soft areas in the foundation, have been satisfactorily corrected. The subgrade shall be compacted to not less than one hundred percent (100%) of the determined dry weight density.

B. Unstable subbase conditions, including soft foundation areas which develop ahead of the base and paving operations shall be satisfactorily corrected by scarifying, reshaping, and compacting, or by replacement as required.

3.2 PLACEMENT

A. Install geotextile fabric over subgrade as indicated on the plans an in accordance with manufacturer's instructions.
   1. Lap ends and edges minimum 6 inches.
   2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.

B. Place aggregate in equal thickness layers over prepared substrate to total compacted thickness indicated on Drawings.
   1. Maximum Layer Compacted Thickness: 6 inches
   2. Minimum Layer Compacted Thickness: 3 inches

C. Level and contour surfaces to elevations, profiles, and gradients indicated.

D. Add small quantities of fine aggregate to course aggregate when required to assist compaction.

E. Maintain optimum moisture content of fill materials to attain specified compaction density.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

G. When constructed in part width, the extension of the subbase construction shall not proceed to its full width until the existing edge of the subbase is trimmed and all foreign and deleterious material is removed from the remaining prepared area.

3.3 TOLERANCES

A. Maximum Variation From Flat Surface: 1/2 inch measured with 10 foot straight edge.

B. Maximum Variation From Thickness: 1/4 inch.

C. Maximum Variation From Elevation: 1/2 inch.

3.4 COMPACTION

A. The uniformly spread material shall be compacted by means of approved equipment to not less than one hundred percent (100%) of the maximum dry weight density (PENNSYLVANIA TEST METHODS (PTM) No. 106, Method B) as determined by PTM No. 112, or PTM No. 402. When the material is too coarse to satisfactorily use these methods, compaction will be determined by the Engineer based on non-movement of the material under the specified compaction equipment. Compaction shall progress gradually from the sides to the center with each succeeding pass uniformly overlapping the previous pass, and shall continue until the entire area is satisfactorily shaped and compacted to the required lines and grades. One (1) density determination shall be made for each three thousand (3,000) square yards or less, on each layer of completed subbase.

3.5 DEPTH TEST

A. The depth of the finished subbase will be determined by cutting or digging holes to the full depth of the completed subbase. One depth measurement shall be made for each three thousand (3,000) square yards, or less, of the completed subbase. Any section in which the subbase is one half inch (1/2") or more deficient in specified depth shall be scarified to a depth of at least three inches (3"), blended with the necessary additional material, and then recompacted to the specified density and depth or otherwise satisfactorily corrected.

B. All test holes shall be cut or dug, backfilled with similar material, and satisfactorily compacted by and at the expense of the Contractor. This operation shall be under the direct supervision of the inspector who will check the depth for record purposes.

3.6 MAINTENANCE OF TRAFFIC

A. No traffic shall be allowed on the completed subbase other than necessary local traffic and that developing from the operation of essential construction equipment, unless otherwise directed by the Engineer. Any defects which may develop in the construction of the subbase or any damage caused by the operation of local or job traffic is the responsibility of the Contractor and shall be immediately repaired or replaced at the expense of the Contractor.

B. The competed subbase shall be uniformly moistened immediately prior to the construction of the base course and/or pavement, except when a hot-mix bituminous base course is to be placed.

C. Completed subbase which has been subjected to hauling or exposed to the elements for periods in excess of one-hundred-twenty (120) calendar days will require re-testing of the material and re-approval by the Engineer before construction of the base course or pavement may proceed. Subbase so used or exposed, not meeting the requirements herein specified shall be reconstructed or replaced as directed by the Engineer at the expense of the Contractor.

- END -

SECTION 321136

CONCRETE BASE COURSE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes all labor, equipment, and materials necessary for the installation and testing of high early strength plain concrete base course of specified depths.

B. Section Includes:
   1. Plain Cement Concrete Base Course

C. For bituminous asphalt paving in public right-of-way. Refer to the City of Philadelphia, Department of Streets, Standard Construction Items for materials, equipment, installation, and testing requirements.

1.2 RELATED DOCUMENTS

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

B. Related Sections:
   1. Section 310000 - Earthwork
   2. Section 321116 - Subbase Course
   3. Section 321216 – Asphalt Paving

1.3 REFERENCES

A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. Pennsylvania Department of Transportation (PennDOT), Publication 408/2020
   2. PennDOT Bulletin No. 14: Aggregate Producers
   3. PennDOT Bulletin No. 15: Qualified Products List for Construction

B. The Contractor is required to have one copy of the latest edition of each of the following publications available for review in the job-site construction office at all times while performing the work described in this Section. The Contractor is to comply with each of the following unless more stringent requirements are indicated on the Drawings or within these specifications.
   1. City of Philadelphia, Department of Streets: Standard Construction Items, except that measurement and payment sections do not apply
   2. Publication 408: Specifications, except that measurement and payment sections do not apply.

1.4 SUBMITTALS

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

B. Job-Mix Design: Certification, by PennDOT and other authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Qualification Data: For firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

D. Material Test Reports: Test Reports shall be from the approved testing agency. Indicate and interpret test results for compliance of materials with requirements indicated.

E. Material Certificates: Certificates signed by manufacturers certifying that each material complies with the requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed concrete base course paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing high early strength concrete similar to that indicated for this project and with a record of successful in-service performance.

C. Firm shall be a registered and approved mix manufacturer listed in PennDOT Bulletin No. 15.

D. Testing Agency Qualifications: Demonstrate to the Owner's satisfaction, based on Owner’s evaluation of criteria conforming to ASTM D 3666, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

E. Obtain materials from the same source throughout the project.

F. Pre-construction conference: Conduct conference at the project site to comply with the requirements of Division 1 sections and to review the methods and procedures related to asphalt paving including but not limited to the following:
   1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacturer warm-mix asphalt.
   2. Review condition of substrate and preparatory work performed by other trades.
   3. Review requirements for protecting paving work, including restriction of traffic during installation period for remainder of construction period.
   4. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving installer’s personnel, and equipment required to execute the work without delays.

5. Review inspection and testing requirements, governing regulations, and proposed installation procedures.
6. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

1.6 REGULATORY REQUIREMENTS

A. Contractor shall obtain all necessary City of Philadelphia Streets Department road opening permits and approvals, and City of Philadelphia Department of Licenses and Inspections permits and approvals, upon the Contractor receiving Notice to Proceed and prior to proceeding with the Work.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply concrete materials if substrate is wet or excessively damp.

PART 2 - PRODUCTS

2.1 CONCRETE

A. High Early Strength Cement Concrete in accordance with PennDOT Publication 408, Section 704.

2.2 CURE

A. Cationic emulsified asphalt E-8C (AASHTO Grade CSS-1h) meeting the requirements of PennDOT Bulletin 25.

2.3 EXPANSION JOINT MATERIAL

A. In accordance with PennDOT Publication 408, Section 705.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subbase is dry and in suitable condition to support paving and imposed loads.

B. Refer to Section 321116 Subbase Course for subbase preparation requirements.

C. Verify gradients and elevations of subbase are correct.

D. Protect adjacent work and structures from splashing of paving materials.

3.2 SURFACE PREPARATION

A. General: Immediately before placing paving materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
   1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted aggregate base before applying paving materials.
   1. Apply herbicide only if absolutely necessary. Owner approval in writing is required prior to any herbicide application. Herbicide application must comply with all federal, state and local regulations.

3.3 CONCRETE PLACING

A. The concrete slump range shall be in accordance with PennDOT Publication 408, Section 704.

B. Concrete shall be placed on the grade without segregation of mortar from the course aggregate and as continuously as possible in order to avoid partially set joints. The completed surface shall be at the required depth below and parallel to the surface of the proposed pavement.

C. The finished surface of the base course shall be dense, free from voids or an excess of mortar with the course aggregate fully embedded. Depressions or other irregularities greater than 1/4" in the surface shall be corrected immediately.

D. For concrete pavements that are to receive a bituminous binder and surface course, the final finish shall have a minimum surface relief of .25 of an inch for the full pavement width and a uniform appearance. For all other pavements, a smooth concrete surface finish is required.

3.4 JOINTS

A. Transverse contraction joints shall be spaced at 40-foot intervals. The joints shall have a minimum depth of 33% of the depth of the concrete base and a width of not less that 1/4 inch nor greater than 3/8 inch. Joints shall be perpendicular to the surface of the concrete base and to the centerline of the street. Joint shall be filled with AC-20. Transverse and longitudinal construction joints shall be in accordance with PennDOT Standards for Roadway Construction, Cement Concrete Pavement Joints RC-20 for Type L construction joints.

3.5 CURING

A. Application of cure shall be at the rate of not less than one gallon per 165 square feet of surface, nor more than one gallon per 135 square feet of surface. The equipment shall be capable of applying the material as a fine spray without marring the surface of the concrete.

B. Application of the liquid curing material shall begin immediately following final chaining or other finishing of the concrete surface and shall produce a uniform film throughout.

C. Cold Weather Curing: In accordance with PennDOT Publication 408, Section 501.3(l)(2).

3.6 PROTECTION OF TRAFFIC

A. The Contractor shall exclude traffic from the completed pavement for seven (7) days, except on direct orders of the Project Engineer.

3.7 DEFECTIVE WORK

A. In accordance with PennDOT Publication 408, Section 501.3(t).

3.8 TOLERANCES

A. Maximum variation from Flat Surface: 1/2 inch measured with 10 foot straight edge.

B. Maximum variation from Thickness: 1/4 inch.

C. Maximum variation from Elevation: 1/2 inch.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: As part of this contract, the Contractor shall engage a qualified independent testing agency meeting the requirements of paragraph 1.05 to perform field inspections and test and to prepare test reports.
   1. Testing agency shall conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's sole expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Remove and replace or install additional concrete base course, at the Contractor’s sole expense, where test results or measurements indicate that it does not comply with specified requirements.

3.10 CLEANUP

A. Remove concrete cement material from utility structure frames and covers. Open and reset utility manhole covers and inlet grates to ensure castings are not sealed shut.

B. Clean up debris and unused material and remove from the site. Dispose of all material in accordance with local, state, and federal regulations. Do not dump material in manholes or inlets.

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SECTION 321216

ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes all labor, equipment, and materials necessary for the installation and testing of Warm Mix Asphalt Superpave Wearing Course, Warm Mix Asphalt Superpave Binder Course, and Warm Mix Asphalt Superpave Binder Course of specified depths.

B. Section Includes:
   1. Asphalt paving base course, binder course, and wearing course.

C. For bituminous asphalt paving in public right-of-way. Refer to the City of Philadelphia, Department of Streets, Standard Construction Items for materials, equipment, installation, and testing requirements.

1.2 RELATED DOCUMENTS

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

B. Related Sections:
   1. Section 310000 - Earthwork
   2. Section 321116 - Subbase Course

1.3 REFERENCES

A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. Pennsylvania Department of Transportation (PennDOT), Publication 408/2020
   2. PennDOT Bulletin No. 15: Qualified Products List for Construction
   3. Asphalt Institute (AI): “The Asphalt Handbook”
   4. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):
      a. ASTM D 692 - Coarse Aggregate for Bituminous Paving Mixtures
      b. ASTM D 979 - Sampling Bituminous Paving Mixtures
      c. ASTM D 1073 - Fine Aggregate for Asphalt Paving Mixtures
      d. ASTM D 1188 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
      e. ASTM D 2041 - Theoretical Maximum Specific Gravity and Density of Asphalt Mixtures
      f. ASTM D 2726 - Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures

g. ASTM D 2950 - Density of Bituminous Concrete in Place by Nuclear Methods
h. ASTM D 3549 - Thickness or Height of Compacted Asphalt Mixture Specimens
i. ASTM D 3666 - Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

B. The Contractor is required to have one copy of the latest edition of each of the following publications available for review in the job-site construction office at all times while performing the work described in this Section. The Contractor is to comply with each of the following unless more stringent requirements are indicated on the Drawings or within these specifications.
1. City of Philadelphia, Department of Streets: Standard Construction Items, except that measurement and payment sections do not apply
2. Publication 408: Specifications, except that measurement and payment sections do not apply.

1.4 SUBMITTALS

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

B. Job-Mix Design: Certification, by PennDOT and other authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Qualification Data: For firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

D. Material Test Reports: Test Reports shall be from the approved testing agency. Indicate and interpret test results for compliance of materials with requirements indicated.

E. Material Certificates: Certificates signed by manufacturers certifying that each material complies with the requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed warm-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing warm-mix asphalt similar to that indicated for this project and with a record of successful in-service performance.
1. Firm shall be a registered and approved paving mix manufacturer listed in PennDOT Bulletin No. 15.

C. Testing Agency Qualifications: Demonstrate to the Owner's satisfaction, based on Owner's evaluation of criteria conforming to ASTM D 3666, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

D. Obtain materials from the same source throughout the project.

E. Pre-construction conference: Conduct conference at the project site to comply with the requirements of Division 1 sections and to review the methods and procedures related to asphalt paving including but not limited to the following:
   1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacturer warm-mix asphalt.
   2. Review condition of substrate and preparatory work performed by other trades.
   3. Review requirements for protecting paving work, including restriction of traffic during installation period for remainder of construction period.
   4. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving installer's personnel, and equipment required to execute the work without delays.
   5. Review inspection and testing requirements, governing regulations, and proposed installation procedures.
   6. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

1.6 REGULATORY REQUIREMENTS

A. Contractor shall obtain all necessary City of Philadelphia Streets Department road opening permits and approvals, and City of Philadelphia Department of Licenses and Inspections permits and approvals, upon the Contractor receiving Notice to Proceed and prior to proceeding with the Work.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:
   1. Asphalt Base Course: Minimum air or surface temperature of 35 deg F at time of placement in accordance with PennDOT Publication 408, Section 313.3(b).
   2. Asphalt Wearing Course: Minimum air or surface temperature of 40 deg F at time of placement in accordance with PennDOT Publication 408, Section 413.3(b).

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Aggregates shall be in accordance with the latest version of PennDOT Publication 408, Section 413.2(b). Provide aggregate from sources listed in PennDOT Bulletin 14.

2.2 ASPHALT MATERIALS

A. Asphalt Cement: PG-64-22 emulsion in accordance with PennDOT Publication 408, Section 413.2(a)1.
   1. Water: Potable
   2. Mix designs shall contain a maximum of 15% reclaimed asphalt pavement.

B. AUXILIARY MATERIALS
   1. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA) and PADEP. Provide granular, liquid, or wettable powder form.
   2. Sand: Type B in accordance with PennDOT Publication 408, Section 703.
   3. Joint Sealant: ASTM D 3405 or AASHTO M 301, hot applied, single component, polymer-modified bituminous sealant.
   4. Geotextile: Class 4, Type A Non-Woven Needle Punched Geotextile Fabric in accordance with PennDOT Publication 408, Section 735.

C. MIXES
   1. Warm-mix Asphalt: Provide dense, hot-laid, warm mix asphalt plant mixes approved by PennDOT and complying with the following requirements:
      a. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
      b. Superpave Base Course: Superpave Asphalt Mixture Design, WMA Base Course, PG 64-22, < 0.3 Million ESALs, 25 mm Mix, in accordance with PennDOT Publication 408, Section 313.
      c. Superpave Binder Course: Superpave Asphalt Mixture Design, WMA Binder Course, PG 64-22, < 0.3 Million ESALs, 19 mm Mix, in accordance with PennDOT Publication 408, Section 413.
      d. Superpave Wearing Course: Superpave Asphalt Mixture Design, WMA Wearing Course, PG 64-22, < 0.3 Million ESALs, 6.3 mm Mix, in accordance with PennDOT Publication 408, Section 413.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Refer to Section 321116 for subbase preparation requirements. Refer to Section 321136 for Concrete Base Course Preparation.

C. Verify gradients and elevations of subbase or base are correct.

D. Asphalt paving courses shall be installed in accordance with PennDOT Publication 408, Section 413.

E. Protect adjacent work and structures from splashing of paving materials.

3.2 CONDITIONING OF EXISTING SURFACE

A. The vertical surface of curbs, structures, gutters, and existing paving in contact with bituminous mixtures, shall be painted with a uniform coating of bituminous material of the class and type designated for the surface course.

3.3 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subbase or base is ready to receive paving.
   1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted aggregate base before applying paving materials.
   1. Apply herbicide only if absolutely necessary. Owner approval in writing is required prior to any herbicide application. Herbicide application must comply with all federal, state and local regulations.

C. Adjust elevation of existing utility structure tops to remain, including but not limited to manholes, inlet grates, valve boxes, etc. to final grades. Depending on the type of utility structure, adjustment shall be accomplished by the installation of factory-fabricated adjustment rings, installation of additional masonry courses under existing manhole castings or inlet tops, or resetting structures. Coordinate with utility owners prior to disturbing existing underground utilities to remain.

D. At existing curbs to remain, mill existing pavement as required to maintain existing curb reveal unless otherwise noted on the Drawings.

3.4 DEMOLITION

A. Saw cut and notch existing paving as indicated on Drawings.

B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.

C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

3.5 WARM-MIX ASPHALT PLACING

A. Machine place warm-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and compacted thickness as indicated on the Drawings.
   1. Place warm-mix asphalt base course in a single lift and thickness indicated on the Drawings or within these specifications.

2. Place warm-mix asphalt binder course in a single lift and thickness indicated on the Drawings or within these specifications.
3. Place warm-mix asphalt wearing surface course in single lift and thickness indicated on the Drawings or within these specifications.
4. Spread mix at minimum temperature as indicated in PennDOT Publication 408, Section 413.
5. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated on the Drawings or within these specifications.

B. Place paving in consecutive strips not less than 10 feet wide, except where infill edge strips of a lesser width are required. After the first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt binder course for a section before placing asphalt wearing surface course.

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

3.6 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of warm-mix asphalt course.
1. Clean contact surfaces and apply tack coat.
2. Offset longitudinal joints in successive courses a minimum of 6 inches, however, the joint at the top layer shall be at the centerline of the roadway for 2-lane roads, and at the lane lines for roads with more than two lanes.
3. Offset transverse joints in successive courses a minimum of 24 inches.
4. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI's "The Asphalt Handbook".
5. Compact joints as soon as warm-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

B. Apply bituminous material of the class and type designated for the surface course where new pavement meets existing bituminous pavement, and where bituminous pavement meets curbs and utility structures. Apply sealant in layer thickness that provides for curing and will not cause tracking or lifting of sealant to other surfaces. Apply a fine sand covering temporarily over sealant during curing period.

3.7 PAVEMENT COMPACTION

A. When the subgrade is exposed proof roll according to the requirements shown. Densify to a stable subgrade. If the Owner determines that the subgrade cannot be densified to a stable condition, then the Owner may direct the Contractor to remove additional subgrade material to the depth required for a stable condition. The Contractor shall then replace unstable subgrade material with 2A stone compacted in 6-inch loose lifts.

B. Begin new pavement compaction as soon as placed warm-mix paving will bear roller weight without excessive displacement. Compact warm-mix paving with hot, hand tampers, or vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 F.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with warm-mix asphalt, and rerolling to required elevations.

D. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while warm-mix asphalt is still hot enough to achieve specified density. Continue rolling until warm-mix asphalt course has been uniformly compacted to the following density:
   1. Density: not less than 95 percent of the density requirements established by the Marshall method at the time of approval of the mix design.

E. Finish Rolling: Finish roll paved surfaces to remove roller marks while warm-mix asphalt is still warm.

F. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

G. Repairs: Remove newly paved areas that are defective or contaminated with foreign materials. Remove paving course over areas affected and replace with fresh, warm-mix asphalt. Compact by rolling to specified density and surface smoothness.

H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated on the Drawings within the following tolerances:
   1. Base Course: Plus or minus ¼ inch
   2. Binder Course: Plus or minus ¼ inch
   3. Wearing Surface Course: Plus ¼ inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10 foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: ¼ inch.
   2. Binder Course: ¼ inch
   3. Wearing Surface Course: 1/8 inch.
   4. Crowned Surfaces: Test with crowned template centered at right angle to crown. Maximum allowable variance from template is 0.25 inch.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: As part of this contract, the Contractor shall engage a qualified independent testing agency meeting the requirements of paragraph 1.06 to perform field inspections and test and to prepare test reports.
   1. Testing agency shall conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's sole expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Thickness: In-place compacted thickness of warm-mix asphalt courses will be determined according to ASTM D3549.

D. Surface Smoothness: Finished surface of warm-mix asphalt will be tested for compliance with smoothness tolerances.

E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by the testing agency according to ASTM D 979.
   1. Reference laboratory density shall be determined by averaging results from 4 samples of warm-mix asphalt-paving mixture delivered daily to site and compacted according to job-mix specifications.
   2. Reference maximum theoretical density shall be determined by averaging results from 4 samples of warm-mix asphalt paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   3. In-place density of compacted pavement shall be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
   4. One core sample shall be taken for every 1000 sq. yd. or less of installed pavement, but no case will fewer than 3 cores be taken.
      a. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
      b. The Contractor shall fill all holes from which cores were taken. Restore and seal the surface to conditions similar to the adjacent areas.

F. Remove and replace or install additional warm-mix asphalt, at the Contractor’s sole expense, where test results or measurements indicate that it does not comply with specified requirements.

3.10 CLEANUP

A. Remove bituminous material from utility structure frames and covers. Open and reset utility manhole covers and inlet grates to ensure castings are not sealed shut.

B. Clean up debris and unused material, and remove from the site. Dispose of all material in accordance with local, state, and federal regulations. Do not dump material in manholes or inlets.

- END -

SECTION 321223
ASPHALT PAVEMENT COLORCOATING

PART 1 - GENERAL

1.1 SUMMARY

A. Asphalt pavement colorcoating for the mini-pitch and basketball courts. The Contractor shall furnish all labor, materials and equipment required for the complete leveling/patching and surfacing of all areas indicated on the plans to the satisfaction of the Owner or Owner's Representative.

A. Related Sections:

1. Section 116833 "Athletic Equipment" for mini-pitch and basketball systems.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's data on colorcoating.

B. Instructions: Provide manufacturer's application instructions.

1.3 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum two years experience.

1.4 TEST MATERIALS

A. The Owner reserves the right to sample materials both as delivered to the job site in unopened drums and after dilution and mixing prior to application. Such testing shall be by an independent laboratory of the Owner's choice to assure that the materials meet the standards set by this specification.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not apply colorcoating when ambient air temperature is less than 50 degrees F, nor during fog, rain, or other unsuitable conditions. Do not apply when surface temperature is below 40 degrees F or in excess of 140 degrees F.

B. Surfacing system shall be asbestos free.

1.6 SUBSTITUTIONS

A. Under provisions of Division One Specification Sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: California Products Corporation, Plexipave Fortified, 150 Dascomb Rd., Andover, MA 01810, (978) 623-9980, https://www.californiasportssurfaces.com/, or approved equal.

2.2 MATERIALS

A. Acrylic Patching System: Shall be court patch binder conforming to manufacturer's specifications.

B. Crack Filler: Shall be a fortified acrylic type filler for use in fine cracks (less than 3/16" wide) conforming to manufacturer's specifications.

C. Acrylic Resurfacer: Shall be a 100% acrylic emulsion binder conforming to manufacturer's specifications.

D. Finish Coating: Shall be a pre-mixed, undiluted, textured surface system, conforming to manufacturer's specifications, color as indicated on Drawings.

E. Line Paint: Shall be a pre-mixed, undiluted, textured surface system, conforming to manufacturer's specifications, color White for basketball court and mini-pitch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that existing paving surface is ready to receive work.

B. Verify that mini-pitch system is installed and ready to receive work.

C. Beginning of colorcoating application means acceptance of existing conditions.

3.2 PREPARATION

A. Surface Preparation

1. The asphalt paving surface shall be thoroughly cleaned, removing all loose dirt, oil, grease, leaves, and drippings and scrub with a detergent and water. Remove all traces of detergent.

B. Holes and Cracks

1. Where asphalt paving surface cracks occur, they shall be milled to remove all asphalt humps, cleared of all debris, dirt, and vegetation, sprayed with an approved soil sterilant, and filled with court patch binder as recommended by colorcoating manufacturer. Hairline fissures will not be considered as surface cracks.

2. Where open joints or cracks occur (more than 3/8 inch wide and less than 1 inch wide), they shall be milled to remove all debris, dirt, and vegetation. Spray with an approved soil sterilant, backfill with crushed stone, and seal with bituminous paving.
3. Where open joints or cracks occur (1 inch wide or greater), they shall be milled to remove all debris, dirt, and vegetation. Spray with an approved soil sterilant, backfill with No. 8 coarse aggregate, and seal with 1 1/2" of bituminous paving.

C. Depressions

1. Depressions holding enough water to cover a five cent piece shall be filled with court patch binder patching mix, as recommended by the surface colorcoating manufacturer.

D. Curing

1. New asphalt concrete surface should be allowed to cure a minimum of 10 to 14 days prior to application of colorcoating.

E. Sports Courts

1. Install mini-pitch rebound walls and two goals, according to specification section 116833 “Athletic Equipment”, and manufacturer’s instructions.

3.3 APPLICATION

A. General

1. All areas to be colorcoated shall be clean, free from sand, clay, grease, dust, salt, or other foreign matters. The Contractor shall obtain the Owner’s approval, prior to applying any surface treatment. The storage of materials, mixing, and surface preparation shall be in accordance with the manufacturer’s instructions.
2. The Contractor shall arrange for a representative of the surfacing material manufacturer to be present at the start of the work, to check installation conditions, and to instruct the applicators as to proper methods and procedures, and also as may be necessary during the course of the work, to insure a satisfactorily completed installation.
3. The application shall be done by thoroughly experienced and skillful workmen, in strict accordance with the manufacturer’s instructions.

B. Filler Coat

1. Filler coat (acrylic resurfacer) shall be applied to the clean underlying surface in one application to obtain a total quantity of not less than 15-20 yards per gallon based on the material prior to any dilution. Apply filler coat as recommended by the surface colorcoating manufacturer.
2. Allow filler coat to dry thoroughly. Scrape off all ridges and rough spots prior to any subsequent application of acrylic resurfacer or color surface system.

C. Finish Coating

1. The Contractor shall apply two (2) coats of Fortified Plexipave reinforced acrylic finish coating.
2. Each finish coat shall be applied at a rate of 0.4 - 0.5 gallons per square yard. Allow each coat to dry thoroughly prior to any subsequent applications of color surface system.
3. Apply the second coat at a 90 degree angel to the previous coat.
4. The finished surface shall have a uniform appearance and be free of ridges and tool marks.

3.4 PROTECTION

A. Protect finished application under provisions of Section 01500.

B. Do not permit traffic over pavement for 24 hours.

END OF SECTION

321223

SECTION 321600

CONCRETE CURBS, SIDEWALKS, AND PAVEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes all labor, equipment, and materials necessary for the installation of the following as specified on the Drawings:
   1. City of Philadelphia Type B Curb; and,
   2. Sidewalk pavement on an aggregate subbase.
   3. Concrete Pavement, Slabs, and Pavement

1.2 RELATED DOCUMENTS

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

B. Related Sections:
   1. Section 310000 - Earthwork
   2. Section 321116 – Subbase Course
   3. Section 321136 – Concrete Base Course
   4. Section 321216 - Asphalt Paving

1.3 REFERENCES

A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. Pennsylvania Department of Transportation (PennDOT), Publication 408/2020
   2. PennDOT Bulletin No. 14: Aggregate Producers
   3. PennDOT Bulletin No. 15: Qualified Products List for Construction

1.4 PREINSTALLATION MEETINGS

A. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit required information regarding concrete materials, joint filler, admixtures, and curing compounds.
   2. Mix Design:

a. Submit concrete mix design for each concrete strength prior to commencement of Work.
b. Submit separate designs if admixtures are required for hot- and cold-weather concrete Work.
c. Identify mix ingredients and proportions, including admixtures.

3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:
1. Submit qualifications for manufacturer and installer.

1.6 QUALITY ASSURANCE

A. Perform Work according to PennDOT Publication 408, Section 630 for curb and Section 704 for sidewalks.

B. Obtain cementitious materials from same source throughout.

C. Maintain copies of each standard affecting Work of this Section on Site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according with manufacturer's instructions.

C. Protection:
1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.9 AMBIENT CONDITIONS

A. Minimum Conditions: Do not place concrete if base surface temperature is less than 40 deg. F, or if surface is wet or frozen.

B. Subsequent Conditions: Maintain minimum 50 deg. F, for not less than 72 hours after placing, and at a temperature above freezing for remainder of curing period.

1.10 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 AGGREGATE SUBBASE

A. As specified in Section 321116 - Subbase Course

2.2 CURB

A. Concrete: Class A, in accordance with PennDOT Publication 408, Section 704.

B. Premolded Expansion Joint Filler: PennDOT Publication 408, Section 705.1.

C. Covers for Curing and Protection: PennDOT Publication 408, Section 711.1.

D. Curing Compound: PennDOT Publication 408, Section 711.2(a).

E. Mortar: PennDOT Publication 408, Section 1001.2(d).

F. Caulking Compound: PennDOT Publication 408, Section 705.7.

2.3 SIDEWALK

A. Concrete: Class A, in accordance with PennDOT Publication 408, Section 704.

B. Premolded Expansion Joint Filler: PennDOT Publication 408, Section 705.1.

C. Covers for Curing and Protection: PennDOT Publication 408, Section 711.1.

D. Curing Compound: PennDOT Publication 408, Section 711.2(a).

E. Mortar: PennDOT Publication 408, Section 1001.2(d).

F. Joint Sealing Material: PennDOT Publication 408, Section 705.4(a), (b), or (c).

G. Boiled Linseed Oil: PennDOT Publication 408, Section 503.2.

2.4 FORMS

A. Material:
   1. Wood: Straight and free from warping, twisting, loose knots, splits, or other defects.

B. Profile: To suit conditions.

C. Joint Filler:
   1. Material: Asphalt-impregnated fiberboard or felt.
   2. Comply with ASTM D1751.
   3. Thickness: 1/4 inch

2.5 REINFORCEMENT

A. Deformed Reinforcing:
   1. Steel: Comply with ASTM A615/A615M.
   2. Yield Grade: 60 ksi.
   3. Billet Bars: Deformed.
   4. Finish: Galvanized.

B. Welded Plain-Wire Fabric:
   1. Comply with ASTM A1064/A1064M.
   2. From a manufacturer listed in PennDOT Bulletin 15.
   3. Configuration: Flat sheets.
   4. Finish: Galvanized.

C. Dowels:
   1. Description: Plain steel bars.
   2. Comply with ASTM A615/A615M.
   3. Yield Strength: 60 ksi.
   4. Length: As indicated on Drawings.
   5. Ends: Square, with burrs removed.
   6. Finish: Galvanized.

D. Tie Wire:
   1. Type: Annealed.
   2. Minimum Size: 16 gage.
   3. Finish: Epoxy coated.

E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify that gradients and elevations of subgrade are as indicated on Drawings.

C. Verify reinforcing placement for proper size, spacing, location, and support.

3.2 PREPARATION

A. Moisten substrate to minimize absorption of water from fresh concrete.

B. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 INSTALLATION

A. Subgrade:
   1. As specified in Section 321116 - Subbase Course.

B. Forms:
   1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
   2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
   3. Wood Forms: Thoroughly wet with water before concrete is placed.

C. Reinforcement:
   1. Place reinforcing as indicated on Drawings.
   2. Interrupt reinforcing at expansion joints.
   3. Place reinforcing to achieve indicated paving alignment.
   4. Repair damaged galvanizing to match shop finish.

D. Curb
   1. In accordance with PennDOT Publication 408, Section 630.3 with the following additions:
      a. Concrete may be placed in the forms in one lift provided there are sufficient workmen and equipment on the project to thoroughly consolidate the concrete.
      b. Cure shall be applied to the top of the curb before any marked dehydration of the concrete surface occurs. The forms shall be removed within 24 hours and all exposed concrete surfaces cured.
      c. When directed, the Contractor shall provide additional protection by covering the curb with salt hay at expense of the contractor.
      d. All curbs shall be set to lines and grades furnished by the Surveyor.

E. Sidewalk and Concrete Pavement
   1. In accordance with PennDOT Publication 408, Section 676.3. The thickness of the sidewalk paving and aggregate shall be as defined in the construction plans.

F. Joints:
   1. Place continuous transverse expansion joints at 5-foot intervals or width of sidewalk, whichever is less.
   2. Filler:
      a. Place joint filler between paving components and building or other appurtenances.
      b. Recess top of filler ¼ inch for sealant installation.
   3. Provide sawn joints at 3-foot intervals between sidewalks and curbs.
   4. Saw-cut contraction joints 3/16 inch wide at optimum time after finishing, cutting one-third into depth of slab.
   5. Seal joints as indicated on Drawings.

G. Finishing:
   1. Light broom to 6-inch radius, and trowel edges of joints.
   2. Texture Direction: Transverse to paving direction.
   3. Ramps: Broom perpendicular to slope.
   4. Place curing compound on exposed concrete surfaces immediately after finishing.
   5. Edges and Joints:
      a. Edger Radius: 1/8 inch.
      b. Spalled Corners and Edges: Clean and fill with mortar mixture and finish.

3.4 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/2 inch in 10 feet.

B. Maximum Variation from True Position: 1/4 inch.

C. Line and Grade for Forms: 1/8 inch in any 10-foot-long section.

3.5 PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, rain and flowing water, and mechanical injury.

B. Do not permit traffic over paving for minimum 14 days after finishing.

C. Damaged Concrete:
   1. Remove and reconstruct concrete that has been damaged for entire length between scheduled joints.
   2. Refinishing damaged portion is not acceptable.
   3. Dispose of damaged portions.

- END -

SECTION 321613
SITE CAST-IN-PLACE CONCRETE

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 SCOPE OF WORK

A. This Section includes the following applications for site concrete:
   1. Concrete Pads
   2. Concrete Foundations
   3. Concrete Retaining Wall

1.3 REFERENCES

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

B. Commonwealth of Pennsylvania, Department of Transportation, Specifications, Publication 408, (PennDOT 408), except that measurement and payment sections do not apply

C. American Concrete Institute (ACI)
   1. ACI 301: Specification for Structural Concrete
   2. ACI 347: Guide to Formwork for Concrete
   3. ACI 304R: Guide for Measuring, Mixing, Transporting and Placing Concrete
   4. ACI 309R: Guide for Consolidation of Concrete
   5. ACI 306.1: Standard Specification for Cold Weather Concreting
   6. ACI 311.4R: Guide for Concrete Inspection
   7. ACI 311.5R: Batch Plant Inspection and Field Testing of Ready-Mixed Concrete
   8. ACI 350R: Code Requirements for Environmental Engineering Concrete Structures
   9. ACI SP 66: ACI Detailing Manual

D. American Society for Testing and Materials (ASTM)
   1. ASTM A 185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
   2. ASTM A 615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   3. ASTM C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field
   4. ASTM C 33: Standard Specification for Concrete Aggregates

5. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
6. ASTM C 42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
7. ASTM C 94: Standard Specification for Ready-Mixed Concrete
8. ASTM C 143: Standard Test Method for Slump of Hydraulic Cement Concrete
9. ASTM C 150: Standard Specification for Portland Cement
10. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete
11. ASTM C 172: Standard Practice for Sampling Freshly Mixed Concrete
12. ASTM C 231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
13. ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete
14. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
15. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete
16. ASTM C 618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
17. ASTM C 1064: Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
18. ASTM D 1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
19. ASTM D 1752: Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

E. The Contractor is required to have one copy of the latest edition of each of the following publications available for review in the job-site construction office at all times while performing the work described in this Section. The Contractor is to comply with each of the following unless more stringent requirements are indicated on the Drawings or within these specifications.
1. City of Philadelphia Department of Streets - Standard Construction Items, except that measurement and payment sections do not apply
2. ACI 301: Specification for Structural Concrete

1.4 SUBMITTALS

A. General: Submit each item in accordance with the General Requirements and Conditions of the Contract documents.

B. Product Data: For each type of manufactured material and product indicated.

C. Design Mixes: For each concrete pavement mix and class. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

D. Joint Layout: Submit a sketch showing the location of all expansion and control joints and scoring prior to placing concrete. Indicate method of installing score lines.

E. Shop Drawings: For concrete reinforcement, including dowels, wire fabric, bar layout, and all other reinforcement. Shop drawings shall be in accordance with the ACI SP66, and detailed at scales to clearly show the layout of all new reinforcing steel.

F. Laboratory test reports: From a testing laboratory meeting the requirements of paragraph 1.05.C below, indicating and interpreting test results for compliance with the requirements indicated within these specifications and based on comprehensive testing of current materials and mix designs.

G. Material Certificates: Signed by manufacturers and the Contractor certifying that each of the following materials complies with or exceeds requirements:
1. Cementitious materials and aggregates.
2. Admixtures.
3. Curing compounds.
4. Applied finish materials.
5. Bonding agent or adhesive.
6. Joint fillers and sealers.
7. Forming accessories.
8. Steel reinforcement.

1.5 QUALITY ASSURANCE

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

B. Concrete 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 Certification Program.

C. Testing Agency Qualifications: "Testing Agency Qualifications": An independent testing agency conforming to the requirements of the American Concrete Institute Publications ACI 311.4R and ACI 311.5R (latest editions), and also acceptable to the project team

D. Source Limitations: Obtain each type of 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 ACI 301, unless modified by the requirements of the Contract Documents.

F. Concrete Testing Service: Engage a qualified independent testing laboratory to perform material evaluation tests and to design concrete mixes.

1.6 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans.

1.7 REGULATORY REQUIREMENTS

A. Traffic Control: Maintain access of and protection for vehicular and pedestrian traffic as required for construction activities in accordance with local regulations.

B. Contractor shall obtain a curb permit for each City of Philadelphia Highway District the work is being performed in.

C. Contractor shall obtain all necessary City of Philadelphia Streets Department road opening permits and approvals, and City of Philadelphia Department of Licenses and Inspections permits and approvals, upon the Contractor receiving Notice to Proceed and prior to proceeding with the Work.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces. Use flexible or curved forms for curves of a radius 100 feet or less.

B. Form Release Agent: Provide commercially formulated form-release agent with a maximum of 350 g/l volatile organic compound (VOCS) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Portland Cement: ASTM C 150, type IA.

C. Fly Ash: ASTM C 618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.

D. Normal-Weight Aggregates: ASTM C 33, class 4, uniformly graded, from a single source, with coarse aggregate as follows:
   1. Size 67.
   2. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
   3. Do not use fine or coarse aggregate containing substances that cause spalling.

E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a No. 4 sieve, 10 percent maximum shall pass a No. 100 sieve.

F. Water: Potable, ASTM C 94.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Joint Dowel Bars: ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

C. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures. Use only one manufacturer as a source for all admixtures. Contractor is responsible for verifying that any and all admixtures, when used in combination, are compatible with any other admixture used in mix design. Verification to be provided with mix design and product data submittals, for review by the Owner.

B. Air-Entraining Admixtures: ASTM C 260, certified by manufacturer to be compatible with other required admixtures and not containing more chloride ions than are present in municipal drinking water.

C. Water-Reducing Admixture: ASTM C 494, Type A, certified by manufacturer to be compatible with other required admixtures and not containing more chloride ions than are present in municipal drinking water.

D. High-Range Water-Reducing Admixture: ASTM C 494, Type F or G, and not containing more chloride ions than are present in municipal drinking water.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

G. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq.yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film-forming compound, manufactured for application to fresh concrete for temporary protection from rapid moisture loss.

E. Clear or white Liquid-Membrane-Forming Curing Compound: PENNDOT 408 Section 711.2

2.6 CONCRETE PROTECTION MATERIALS

A. Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.7 RELATED MATERIALS

A. Expansion-and-Isolation-Joint-filler-Strips: PENNDOT 408, Section 705.1, Type (b) filler

B. Joint Sealer: In accordance with PennDOT 408, Section 705.4.

C. Graphite Lubricant: In accordance with PennDOT 408, Section 705.6.

2.8 CONCRETE MIXES

A. Prepare design mixes, proportioned according to PENNDOT 408, for each type and strength of concrete.

B. Use an independent testing agency meeting the requirements of paragraph 1.5.C for preparing and reporting proposed mix designs for the trial batch method.

C. Proportion mixes to provide concrete with the following properties.
   1. Compressive strength: Class C – 2,000 psi (28 day); Class A – 3,300 psi (28 day); Class AA – 3,750 psi (28 day); Class AAA - 4,500 psi (28 day); H.E.S – 3,000 psi (3-day).
      a. Sewer Lateral Connection – Class C
      b. Concrete Pads – Class A
      c. Pipe Bollard Foundations – Class A
      d. Chain Link Fence Foundations – Class A
      e. Concrete Footway – Class A
      f. Concrete Curb - Class A
      g. Concrete Wheel Stop – Class A
   2. Maximum Water-Cementitious Materials Ratio: at point of placement, 0.45.
   3. Slump Limit: 3 inches, in accordance with ASTM C143.
      a. Slump Limit for concrete containing high-range-water admixture (superplasticizer): not more than 8 inches after adding admixture to plant-or-site verified, 2-to-3 inch slump concrete.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
   1. Fly Ash: 15 percent.

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 from 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. Compact subgrade as indicated in Section 321116. Proceed with pavement only after nonconforming conditions have been corrected and subgrade and base course are stable and ready to receive pavement. Subgrade shall be in a moist condition when concrete is placed.

B. Remove loose material from compacted base course surface immediately before placing concrete.

3.2 FORMWORK, EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure formwork, including edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement. Form work shall be in accordance with ACI 347.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendation in CRSI's "Placing Reinforcing bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, dirt, ice or other bond reducing materials.

C. Arrange, space, and securely tie bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.4 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 or ACI 350R and as indicated on the Drawings.

B. Inspection: Before placing concrete, inspect and complete formwork installation, and installation of all items to be embedded or cast in. Notify other trades so that they may install any embedded or cast in items required for their work prior to Contractor's inspection.

C. Remove snow, ice, or frost from subbase or base course surface before placing concrete. Do not place concrete on surfaces that are frozen.

D. Moisten base course 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.

E. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

F. Do not add water to concrete during delivery, at Project, or during placement.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in 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.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Immediately lay welded wire fabric or bar mats in final position. Place top layer of concrete, strike off, and screed.
   1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer, or use bonding agent if approved by the Engineer.

J. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open texture and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations.

K. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

L. Cold-Weather Placement: Comply with ACI 306.1 and as follows: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 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.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

M. Hot-Weather Placement: Place concrete according to recommendations in 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. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.5 JOINTS

A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated on the Drawings.
1. When joining existing pavement, place transverse joints to align with previously placed joints, unless indicated otherwise on the Drawings.

B. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, manholes, inlets, structures, sidewalks, other fixed objects, and where otherwise indicated on the Drawings.
1. Locate expansion joints at maximum intervals of 150 feet, unless shorter intervals are otherwise indicated on the Drawings.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than ½ inch or more than 1 inch below finished surface if joint sealant is indicated to be used above joint filler.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not to be used.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
7. Install joint sealer in accordance with Manufacturer's instructions.

C. Transverse Control Joints: Form weakened-plane transverse control joints, sectioning concrete into areas as indicated on the Drawings. Where sectioning is not indicated on the Drawings, space joints as described within this Section. Construct transverse control joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a 3/8-inch radius unless shown otherwise on the Drawings. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

D. Edging: Tool edges of pavement, curbs, and joints formed in concrete after initial floating with an edging tool to a 3/8-inch radius unless shown otherwise on the drawings. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
1. Sealant: Provide joint sealant at all isolation joints in accordance with sealant manufacturer's written instructions.

3.6 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Comply with ACI-302-1R, regarding slab construction, regarding overworking of slab surfaces during finishing operations; in such cases where the air entrainment exceeds 3%.

C. 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. Cut down high spots and fill low spots. Re-float surface immediately to a uniform granular texture.

D. Surface Texture: Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris. Any type of transverse texturing shall produce grooves in straight lines across each lane within a tolerance of plus or minus 1/2 inch of a true line.
1. Produce a surface which is free from porous spots, irregularities, depressions, and small pockets or rough spots which may result from accidentally disturbing particles of coarse aggregate embedded near the surface.
2. Broom Texturing – Concrete pavement and sidewalks. Surface texture shall be applied using an approved mechanical stiff bristle broom drag of a type that will uniformly score the surface. The broom shall be operated to score the surface transverse to the pavement center line. The broom shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the broom shall be overlapped the minimum necessary to obtain a uniformly textured surface. Brooms shall be washed thoroughly at frequent intervals during use. Worn or damaged brooms shall be removed from the job site. Brooming should be completed before the concrete has hardened to the point where the surface will be unduly torn or roughened, but after hardening has progressed enough so that the mortar will not flow and reduce the sharpness of the scores. Specific requirements for the texturing will be given on the drawings, but, if not given, the scores shall be uniform in appearance and approximately 1/16 inch in depth but not more than 1/8 inch in depth. Hand brooming will be permitted only on isolated odd shaped slabs or slabs where hand finishing is permitted. For hand brooming, the brooms shall have handles longer than half the width of slab to be finished. The hand brooms shall be

drawn transversely across the surface from the centerline to each edge with slight overlapping strokes.

3. On inclined slab surfaces including sidewalk curb ramps, provide a coarse, non slip finish by scoring surface with a stiff bristled broom, perpendicu¬lar to line of traffic.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold and hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and follow recommendations in ACI 305R for hot weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy weather conditions cause moisture loss approaching 0.2 lb./sq. ft x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. 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 seven days with the following materials.
    a. Water.
    b. Continuous water-fog-spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 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.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 TOLERANCES

A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 inch and -3/4 inch.

B. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +3/4 inch and - 1/4 inch.

C. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 3, 4, and 5 (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or

stirrups is +0 inch and -1/2 inch where gross bar length is less than 12 feet, or +0 inch and -3/4 inch where gross bar length is 12 feet or more.

D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155 for exterior slabs, except as follows:
   1. Test entire slab surface, including those areas within 2 feet of construction joints and vertical elements that project through slab surface.
   2. Maximum elevation change which may occur within 2 feet of any column or wall element is 0.25 inches.
   3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 5 feet.

3.9 FIELD QUALITY CONTROL TESTING

A. Testing Laboratory: As part of this contract the Contractor shall retain the services of an independent testing and inspection laboratory meeting the qualifications of paragraph 1.5.C to sample materials, perform tests and prepare and submit reports during concrete placement.

B. Testing Services: Testing shall be performed according to the following requirements:
   1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to 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 concrete truck delivery. Slump testing is to be performed prior to concrete placement. Addition of water to the concrete mix is not permitted after slump test.
   3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
   4. Concrete temperature: ASTM C 1064; 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 one set of four standard cylinders for each compression-strength test, unless directed otherwise. Cylinders shall be molded and stored for laboratory-cured test specimens except when field-cured test specimens are required. Contractor shall provide an insulated storage box for concrete cylinders.
   6. Compression-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; and one specimen shall be retained in reserve for later testing if required.
   7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   8. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive-strength and no individual compressive-strength test result falls below specified compressive-strength by more than 500 psi.
   9. Thickness Evaluation: The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section.

C. Test results shall be reported in writing to the Owner, concrete manufacturer, and Contractor, within 24 hours of testing. Reports of compressive-strength tests shall contain the concrete manufacturer and Contractor name, Project identification name and number, date of concrete placement, name of concrete testing laboratory, concrete type and class, location of concrete batch in pavement, 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.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner but shall not be used as the sole basis for approval or rejection.

E. Additional Tests: Testing laboratory shall make additional tests of concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by the Owner. Testing laboratory may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

F. Appearance: Exposed surfaces of the finished work will be inspected by the Owner and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the works shall be removed and replaced at the Contractor's sole expense.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet the requirements in this Section. Concrete sections shall be removed to the nearest regularly spaced joint.

B. Drill test cores where directed by the Owner when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

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

D. Maintain concrete pavement free of stains, discoloration, dirt and other foreign material. Sweep concrete pavement not more than 2 days before date scheduled for Substantial Completion inspections.

E. Repair Surface Defects in accordance with ACI 301.

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SECTION 321816

PLAYGROUND PROTECTIVE SURFACING

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. Bonded poured-in-place rubber seamless surface.

B. Related Sections:

1. Section 312000 "Earth Moving" for filling and grading and for drainage course drainage/separation geotextiles and subbase courses.

1.3 DEFINITIONS

A. Critical Height: Standard measure of shock attenuation. According to CPSC No. 325, this means "the fall height below which a life-threatening head injury would not be expected to occur."

B. SBR: Styrene-butadiene rubber.

1.4 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: According to ASTM F 1292.

B. Accessibility of Surface Systems: According to ASTM F 1951.

C. US Consumer Product Safety Commission – Public Playground Safety Handbook No. 325.

D. ASTM F2223 – Standard Guide for ASTM Standards on Playground Surfacing.

1.5 SUBMITTALS

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

B. Samples for verification: For each type of playground surface system indicated.
   1. Minimum 6-by-6-inch Sample of safety pad.
   2. Minimum 6-by-6-inch Sample of geotextile.

C. 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. Extent of surface systems and use zones for equipment.
   2. Critical heights for playground surfaces and fall heights for equipment.

D. Qualification Data and Certification: For qualified Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each unitary synthetic playground surface system.
   1. Impact/drop test per the requirements of ASTM F1292 to show conformance with the G-Max and HIC criteria listed above. Per ASTM F1292 the impact/drop test shall be performed at the most adverse location on the playground. The impact/drop test shall be conducted by a Certified Playground Safety Inspector (CPSI) who will prepare a certification report of the results. If the surface fails to meet the stated criteria the surface shall be corrected/removed and reinstalled.

F. Field quality-control reports.

G. Closeout Submittals - Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company specializing in the manufacture of products specified in this Section with minimum of three (3) years experience.

B. Installer Qualifications: Contractor shall have had experience with at least two (2) other projects of similar scope and complexity and shall perform work with personnel totally familiar with playground safety surface installation and construction techniques under the supervision of an experienced foreperson.

C. Source Limitations: Obtain playground surface system materials from single source from single manufacturer.

D. Provide secondary materials including geotextiles and repair materials of type and from source recommended by manufacturer of playground surface system materials.

E. Standards and Guidelines: Comply with CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.

1.7 PROJECT CONDITIONS

A. Verify existing conditions in the field prior to start of work. Should Contractor, in the course of work, find any discrepancies between Drawings and physical conditions or any omissions or errors in Drawings, inform Owner immediately in writing for clarification. Work done after such discovery, unless authorized by Owner, shall be at Contractor's risk.

B. Environmental Requirements: Install surfacing system when minimum ambient temperature is 40 degrees F (1 degree C) and maximum ambient temperature is 90 degrees F (32 degrees C). Do not install in steady or heavy rain.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground surface system that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Reduction in impact attenuation.
b. Deterioration of surface and other materials beyond normal weathering.
c. Deterioration or failure of seams.

2. Warranty Period: Five years from date of Substantial Completion.

B. Proper drainage is critical to the longevity of the Poured-in-Place surfacing system. Inadequate drainage will cause premature breakdown of the poured system in affected areas; and void the warranty.

PART 2 - PRODUCTS

2.1 POURED-IN-PLACE PLAYGROUND SURFACING SYSTEM

A. Manufacturer: Surface America, Inc., PO Box 157, Williamsville, NY 14231, (716) 632-8413, or approved equal.

B. Product: Poured-in-place playground surfacing system as per Manufacturer - Surface America Proprietary Products/Systems, including the following:
1. PlayBound Poured-In-Place Primer:
a. Material: Urethane.
2. PlayBound Poured-in-Place Basemat:
a. Material: Blend of 100% recycled SBR (styrene butadiene rubber) and urethane.
b. Thickness: To be confirmed with fall height of play equipment.
c. Formulation Components: Blend of strand and granular material.
3. PlayBound Poured-In-Place Top Surface:

a. Material: Blend of recycled EPDM (ethylene propylene diene monomer) rubber and aliphatic urethane binder.
b. Thickness: Nominal 1/2" (12.7 mm), minimum 3/8" (9.5 mm), maximum 5/8" (15.9 mm).
c. Color A: Royal Blue 65%, Dark Gray 35% (Colors to be selected from standard color range for pricing by contractor)
d. Color B: Teal 65%, Dark Gray 35% (Colors to be selected from standard color range for pricing by contractor)
e. Color C: Hunter Green 33%, Bright Green 33%, Dark Gray 34% (Colors to be selected from standard color range for pricing by contractor)
f. Dry Static Coefficient of Friction (ASTM D2047): 1.0.
g. Wet Static Coefficient of Friction (ASTM D2047): 0.9.
h. Dry Skid Resistance (ASTM E303): 89.
i. Wet Skid Resistance (ASTM E303): 57.

4. Crushed Stone Base as per Manufacturer recommendations.
   a. The stone for the base must be crushed so it compacts to a 95% Standard Proctor Compaction (as per A.S.T.M. Test). The stones should be a homogeneous mixture of the following size stones:

Sieve Size	% Passing by Weight
1"	90 - 100
5/8"	50 - 80
1/4"	30 - 50
#4	15 - 35
#8	10 - 30
#30	3 - 5
#200	0 - 3

5. Mixes
   a. Required mix proportions by weight:
      1) Basemat: 16+% urethane (as ratio: 14% urethane divided by 86% rubber). 14% urethane, 86% rubber (based on entire rubber & urethane mix).
      2) Top Surface: 22% urethane (ratio: 18% urethane divided by 82% rubber). 18% urethane, 82% rubber (based on entire rubber & urethane mix).

2.2 GEOSYNTHETICS

A. 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. 40 sieve, maximum; ASTM D 4751.
3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with the instructions and recommendations of the playground surfacing manufacturer.

3.2 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. Verify that play equipment is in place.
   1. Begin installation of safety surface immediately upon completion of play equipment installation.

C. Verify that stone base is ready to receive poured-in-place safety surface.
   1. Verify gradients and elevations are correct.

D. Beginning of installation means acceptance of existing conditions.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 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.

3.4 INSTALLATION, GENERAL

A. General: Comply with playground surface system manufacturer's written installation instructions. Install playground surface system over area and in thickness indicated.

B. Secure manufacturer's representative to observe all phases of safety surface installation and provide Owner with a written statement certifying compliance with manufacturer's drawings and specifications.

C. Install safety surface according to manufacturer's instructions and specifications in locations shown on Drawings.
   1. Meet or exceed current: CPSC guidelines, ADA guidelines and ASTM F-1292-93 requirements.

3.5 GEOSYNTHETIC INSTALLATION

A. General: Install geosynthetics according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions.

1. Geotextiles: Completely cover area indicated, overlapping sides and edges a minimum of 4 inches (100 mm) > with manufacturer's standard treatment for overlapping loosely laid seams.

3.6 POURED-IN-PLACE PLAYGROUND SURFACING SYSTEM INSTALLATION

A. Crushed Stone Base Installation:

1. The minimum depth of the crushed stone base is 4". Typical thickness range is 4” - 6”. Thickness is never to exceed 10”.
2. The crushed stone base should be sloped 2% to allow run-off of the excess water that doesn’t percolate through the crushed stone.
3. The crushed stone base must be thoroughly compacted by using a tamper, roller or combination of both to a 95% compaction rate throughout the base.

B. Basemat Installation:

1. Using screeds and hand trowels, install the basemat at a consistent density of 29 pounds, 1 ounce per cubic foot (466 kg/m3) to the specified thickness indicated on drawings.
2. Allow basemat to cure for sufficient time so that indentations are not left in the basemat from applicator foot traffic or equipment.
3. Do not allow foot traffic or use of the basemat surface until it is sufficiently cured.

C. Primer Application: Using a brush or short nap roller, apply primer to the basemat perimeter and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 300 ft2/gal (7.5 m2/L).

D. Top Surface Installation:

1. Using a hand trowel, install top surface at a consistent density of 58 pounds, 9 ounces per cubic foot (938 kg/m3) to a nominal thickness of 1/2" (12.7 mm).
2. Allow top surface to cure for a minimum of 48 hours.
3. At the end of the minimum curing period, verify that the top surface is sufficiently dry and firm to allow foot traffic and use without damage to the surface.
4. Do not allow foot traffic or use of the surface until it is sufficiently cured.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of completed applications of playground surface system shall take place according to ASTM F 1292.

C. Remove and replace applications of playground surface system where test results indicate that it does not comply with requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with requirements.

3.8 CLEAN UP

A. Maintain the site in an orderly condition during the progress of work. Promptly remove debris and trash. Leave the site in a neat, orderly condition, broom clean.

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SECTION 323113
CHAIN-LINK FENCING AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences and gates.

B. Related Sections:

1. Division 01 Section “Construction Waste Management”
2. Division 01 Section “Sustainable Design Requirements”
3. Division 2 Section “Earthwork”.
4. Division 2 Section “Tree Protection and Trimming”.
5. Division 2 Section “Asphalt Paving”.
6. Division 2 Section “Site Concrete”.

1.3 REFERENCES

A. The following apply to work in this Section:
1. ASTM: Specifications of the American Society for Testing and Materials latest editions. Modifications specified herein shall govern where conflicts with ASTM standards occur.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Minimum Post Size: Refer to Drawings.
2. Minimum Post Size and Maximum Spacing: Refer to Drawings.
   a. Fence Height: Refer to Drawings.
   b. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.

1.5 SUBMITTALS

A. Product Data: Submit product literature or tear sheets with name of product and manufacturer. Fence and gate posts, rails, fittings, and locks. Confirm that gate locking mechanism works with PPR preferred locking system.

1. Chain-link fences and gates.

B. Product Test Reports: For framing strength according to ASTM F 1043.

C. Field quality-control reports.

D. Warranty: Sample of warranty.

1.6 QUALITY ASSURANCE

A. Contractor shall have had experience with at least two (2) other projects of similar scope and complexity and shall perform work with personnel totally familiar with playground, chain link fence installation and construction techniques under the supervision of an experienced foreperson.

B. Manufacturer: Company specializing in the manufacture of chain link fences with minimum three (3) years experience.

1.7 REGULATORY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary to make work comply with such requirements without additional cost to Owner.

1. Coordinate work with utility companies. Notify Pennsylvania One Call System, Inc. 1-800-242-1776 not less than three working days prior to beginning work.

B. Investigate the conditions of public thoroughfares and roads as to availability, clearances, loads, limits, restrictions and other limitations affecting transportation to and ingress and egress at the site.

1. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

C. Conform to applicable code for disposal of debris.

D. Procure and pay for permits and licenses required for work.

1.8 DELIVERY STORAGE AND HANDLING

A. Deliver, store, handle and protect all materials from damage.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

B. Should any work performed under this Section expose previously unknown conditions, immediately report the discovery to Architect. However, during this time use any measures necessary to maintain adequate safety conditions.

1. Should Contractor, in the course of work, find any discrepancies between Drawings and physical conditions or any omissions or errors in Drawings, inform Architect immediately in writing for clarification. Work done after such discovery, unless authorized by Owner, shall be at Contractor's risk.

1.10 WARRANTY

A. Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated.

B. Fence fabric mesh size, gauge per Drawings.

1. Thermally fused vinyl coated steel chain link fence ASTM F668- Type 2B with a galvanized steel core in accordance with ASTM A-641-71A.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on Drawings. Coating to match chain link fence fabric.

2.3 FITTINGS

A. General: Comply with ASTM F 626. Provide coating to match chain link fence fabric.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive top rail.

C. Rail and Brace Ends: For each corner and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Hot-dip galvanized rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
    a. Hot-Dip Galvanized Steel: 0.106-inch diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

C. Terminal Posts: Locate terminal end, and corner posts per ASTM F 567

D. Line Posts: Space line posts per Drawings.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch diameter hog rings of same material and finish as fabric wire, spaced per Drawings. Install tension wire

in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing. Each end of wire tie shall be wrapped around fabric at least 540 degrees.

1. Maximum Spacing: Tie fabric to line posts at dimension indicated on Drawings.

3.5 CLEAN UP

A. Maintain the site in an orderly condition during the progress of work. Promptly remove debris and trash. Leave the site in a neat, orderly condition, broom clean.

END OF SECTION 323113

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SECTION 329100
PLANTING PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soils. Scope of work includes, but is not limited to, sourcing, purchase, delivery and installation of Planting Soil and soil amendments and clean up and disposal of all excess and surplus material.

B. The specific soil types in this section include:

1. Planting Soil for trees, plant beds, and lawn

1.3 RELATED REQUIREMENTS

A. Section 311000 Site Clearing

B. Section 312000 Earthwork

C. Section 329200 Lawn and Fine Grading

D. Section 329300 Plants

1.4 REFERENCE STANDARDS

A. In the event that the requirements of any of the referenced standards and specifications herein conflict with each other the more stringent requirement shall prevail. Where reference is made to one of the standards, the revision in effect at the time of bid opening shall apply.

B. American Society for Testing Materials (ASTM):
1. ASTM C33 – Gradation Requirements for Coarse Aggregates.
2. ASTM C602 Standard Specification for Agricultural Liming Materials.
3. ASTM D422 – Standard Test Method for Particle Size Analysis of Soils.
4. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
5. ASTM D3385 – Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer.
6. ASTM D4972 – Standard Test Method for pH of Soils.

7. ASTM D5298 – Standard Specification for Topsoil Used for Landscaping Purposes.
8. ASTM D7481 – Standard Test Methods for Determining Loose and Tapped Bulk Densities of Powders using a Graduated Cylinder.
9. ASTM F1632 – Standard Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sports Field Rootzone Mixes.
10. ASTM F1647 – Standard Test Methods for Organic Matter Content of Athletic Field Rootzone Mixes.
11. ASTM F1815 – Standard Test Methods for Saturated Hydraulic Conductivity, Water Retention, Porosity, and Bulk Density of Athletic Field Rootzones.

C. Other Standards:
1. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service, Soil Texture Calculator.
2. USDA, Natural Resources Conservation Service, 2003. National Soil Survey Handbook, title 430-VI, current edition.
3. USDA Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report, current edition.
4. Environmental Protection Agency (EPA) Section 503 Regulations.
5. Department of Environmental Protection (DEP), Pennsylvania Bulletin, Management of Fill, Clean Fill Policy, current edition.
6. U.S. Composting Council (USCC), Test Methods for the Examination of Composting and Compost (TMECC), current edition.
7. USCC, Landscape Architecture / Design Specifications for Compost Use, Planting Bed Establishment with Compost.
8. Association of Official Analytical Chemists (AOAC), Official Methods of Analysis, current edition.
9. Soil Science Society of America (SSSA), Methods of Soil Analysis, current edition.

1.5 DEFINITIONS

A. Bulk Density: is an indicator of soil compaction calculated as the dry weight of soil by its volume typically expressed in g/cm3.

B. Coarse Sand: sharp natural or manufactured fine aggregate and further defined in this specification.

C. Compacted soil: soil where the density of the soil is greater that the threshold for root limiting, and further defined in this specification.

D. Compost: Well decomposed stable organic material as defined by the US Composting Council and further defined in this specification.

E. Planting Soil: Planting soil shall harvested from fields or development sites or manufactured uniformly mixed individual soil components (Topsoil, Sand, Compost) or existing mineral soil at the locations of proposed planting meeting the criteria specified herein.

F. Topsoil: Naturally produced and harvested soil from the A horizon or upper layers or the soil as further defined in this specification.

G. Salvaged Topsoil: Topsoil stripped from the Project Site and prepared for reuse at the Project Site.

1.6 SUBMITTALS

A. Submit a list of materials to be provided for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.

B. Submit dated certificates or letters, signed by the materials producer, stating that materials meet or exceed the specified requirements.

C. For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with testing requirements and referenced standards and specific requested testing.

D. Laboratory soil testing requirements:
   1. Samples of soil(s) to be submitted to an approved soil testing laboratory for testing in accordance with specifications herein. Submit the soil testing laboratory for review and approval prior to commencing with any soil testing.
   2. Test results shall be submitted to the Landscape Architect for approval in conjunction with soil amendment products in accordance with soil testing laboratory recommendations.
   3. Submit soil test reports including test results for each criteria listed within the Products section herein for:
      a. Individual Components for Soil Mixes: Topsoil, Compost and Sand.
      b. Soil Mixes Using Individual Components.
      c. Test reports for Individual Components and Soil Mixes must be submitted concurrently.
      d. The source of supply for Individual Components for Soil Mixes and Soil Mixes Using Individual Components must be indicated on the test report submittals.
   4. Test reports must be the same material to be supplied and must be current within the period of time defined as follows unless approved otherwise by the Landscape Architect:
      a. Topsoil: no more than 6 months old.
      b. Salvaged Topsoil: no more than 6 months old.
      c. Compost: no more than 3 months old.
      d. Sand: no more than 6 months old.
      e. Planting Soil: test data must be no more than 1 month old.
      f. Sample test results shall be considered valid until the time of construction and for the material supplied.
   5. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by the Landscape Architect.
   6. Soils shall not contain any traces of hydrocarbons, petroleum products, chemically prohibited substances, or any other elements considered to be toxic to any vegetation that is used. Clean fill certification shall be submitted by the manufacturer.
   7. All soil testing will be at the expense of the Contractor.

E. Physical samples:
   1. All samples must be submitted simultaneously with the laboratory test reports. Samples are required for the following:
      a. Salvaged Topsoil
      b. Manufactured Planting Soil
   2. Provide one (1) one-gallon sample in a resealable plastic bag to the Landscape Architect.

1.7 On-site verification soil testing requirements:

A. Landscape Architect may require Compaction Testing:
   1. Maintain an up-to-date written report of compaction test results. Test compaction every 12-inch lift of soil for every 300 square feet of soil installed for each planting area designated on the Drawings. The Landscape Architect may review the written report at any time to confirm conformance with the specification. Submit final report at the completion of soil installation.
   2. Maintain at the site at all times a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture.
      a. Penetrometer shall be AgraTronix Soil Compaction Meter or approved equal.
      b. Moisture meter shall be "general digital soil moisture meter".

B. Should any verification test results indicate soil material is not consistent with the approved submittals or requirements specified herein, the Contractor shall remove the installed soil and re-install soil at the Contractors expense until the Contract Document requirements are met.

1.8 Accompany each delivery of soil mixes, bulk materials, fertilizers and soil amendments provide the appropriate certificates and delivery tickets to the Landscape Architect. The soil supplier must be indicated on delivery tickets for all soil mix deliveries and the supplier must match the approved submittals.

1.9 Quality Assurance

A. All materials, methods of construction, and workmanship shall conform to applicable requirements of ASTM, PTM, PennDOT Standard Specifications and AASHTO Standards, PADEP Clean Fill Guidance, unless otherwise specified.

B. Soil Testing Laboratory Qualifications: The laboratory shall be an independent laboratory, recognized by the State Department of Agriculture. The testing laboratory must have experience in performing agronomic testing including physical and chemical properties of soil. Tests shall be made in strict compliance with the standards of the Association of Official Analytical Chemists and follow standards from the NRCS Soils Manual and ASTM testing methods applicable to the specific tests requested. Laboratory shall have staff fully qualified to review test results, and to make recommendations to amend samples based on what is planned to grow in the soil. American Association for Laboratory Accreditation (A2LA) certification is preferred.
   1. Compost that participates in the US Composting Council's Seal of Testing Assurance (STA) Program and tested through an STA program lab, using appropriate test methods from the TMECC (Test Methods for the Examination of Compost and Composting) is preferred. Test data shall be presented on a Compost Technical Data Sheet.

C. Any fill or topsoil sources, disposal areas, or temporary offsite storage locations shall be subject to review and approval by the Landscape Architect.

D. Installer Qualifications: The installer shall be a firm having at least five (5) years of experience of a scope similar to that required for the work.
   1. Installer Field Supervision: When any soil work is in progress, installer shall maintain, on-site, an experienced full-time supervisor.

2. Installer's field supervisor shall have a minimum of five (5) years experience as a field supervisor installing soil, shall be trained and proficient in the use of field surveying equipment to establish grades.

1.10 Delivery, Storage, and Handling

A. Preparation, amendment, and mixing of soils shall be performed at the soil supplier location.

B. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity. Soils shall not be handled, hauled, placed, or compacted when wet or frozen. Soil shall only be handled when the moisture content is between the specified ranges in percent water by volume.

C. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Once spread, soils shall be protected with staked erosion control blankets.

D. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. Biological additives shall be protected from extreme cold and heat. All products shall be freshly manufactured and dated for the year in which the products are to be used.

E. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

F. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

G. None of the soil materials shall be delivered to the site until sample certifications are approved by the Landscape Architect, however, such approval does not constitute final acceptance. Certification submittal shall include recommended soil amendment products if proposed to modify the soils. Any approval of soils made conditional upon utilizing one or more amendments shall be understood to afford to the Landscape Architect the right for further testing and refusal of materials that do not meet these Specifications.

PART 2 - PRODUCTS

2.1 Individual Components for Soil Mixes

A. Topsoil

1. Topsoil definition: Topsoil shall be a harvested from the Project Site or fields or development sites and shall be loose, friable mineral particles resulting from natural soil formation from the A, E and upper B horizons, or "solum" where most plant roots grow. Manufactured soils where sand, composted organic material, chemical additives or similar elements has been blended to meet the requirements of Topsoil is not acceptable. The soil shall be free of

construction and trash debris, rocks, hydrocarbons, petroleum materials, herbicides, or other harmful contaminants that would impact plant growth.

a. Topsoil shall comply with the following parameters:
   i) Organic matter (ASTM F1647, Method A): 1.5% minimum (by dry weight).
   ii) pH (1 soil : 1 water): 5.0 - 7.0.
b. Stockpiled Existing Topsoil at the site meeting the above criteria may be acceptable.

B. Organic Amendment / Compost

1. Compost is as defined by the "US Composting Council Landscape Architecture / Design Specifications for Compost Use, Planting Bed Establishment with Compost". Compost shall be a well decomposed, stable, weed free organic matter source. It shall be derived from: agricultural, food, or industrial residuals; leaf litter and yard trimmings; or source-separated waste. The product shall contain no substances toxic to plants and shall be reasonably free (< 1% by dry weight) of man-made foreign matter. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived.
2. Compost shall comply with the following parameters:
   a. pH: 6.0 - 8.0.
   b. Soluble salt content (electrical conductivity, 1 soil : 2 water): maximum 5 dS/m (mmhos/cm).
   c. Compost derived from stabilized mushroom soil compost may possess a maximum EC of 10 dS/m (1:2), if the maturity testing is a minimum of 95% and ammonia (NH4) content is a maximum of 250 ppm.
   d. Moisture content %, wet weight basis: 30 – 60.
   e. Organic Matter Content, % dry weight basis: 30 – 65.
   f. Particle size, dry weight basis: 98% pass through 1/2 inch screen.
   g. Stability carbon dioxide evolution rate: mg CO2-C/ g OM/ day ≤ 3.
   h. Maturity, seed emergence and seedling vigor, % relative to positive control: minimum 80%.
   i. Physical contaminants (inerts), %, dry weight basis: <0.5%.
   j. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 3 levels.
   k. Biological contaminants select pathogens fecal coliform bacteria, or salmonella, meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) level requirements.

C. Coarse Sand

1. Sharp natural or manufactured fine aggregate shall be hard and durable and free of limestone (calcareous sand), shale and slate particles and free of harmful contaminants that would impact plant growth complying with the following parameters:
   a. pH shall be lower than 7.0.
   b. Sieve analysis:

Sieve	Percent passing (by mass)
3/8 inch (9.5 mm)	100
No 4 (4.75 mm)	95-100
No 8 (2.36 mm)	80-100
No 16 (1.18 mm)	50-85
No 30 (.60 mm)	25-75
No 50 (.30 mm)	5-40

No 100 (.15 mm) 2-20
No 200 (0.75 mm) 2-15

c. Particle analysis must be per USDA classification, Sand.
Sand (2 - 0.05 mm): ≥88%
Silt (0.05 - 0.002 mm): ≤9%
Clay (< 0.002 mm): ≤3%

D. Chemical Amendments

1. Lime, ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
   a. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
   b. Provide lime in form of dolomitic limestone.

2.2 Soil Mixes Using Individual Components

A. Definition

1. Manufactured uniformly mixed individual soil components (Salvaged Topsoil, Topsoil, Sand, Compost) meeting the criteria specified herein. Provide Soils at the locations indicated on the Drawings complying with the following parameters.

B. Planting Soil, Plant Beds and Lawn

1. Planting soil shall be manufactured from uniformly mixed individual soil components (Salvaged Topsoil, Sand, Compost) or existing mineral soil at the locations of proposed planting meeting the criteria specified herein.
2. Provide Planting Soil at the locations indicated on the Drawings complying with the following parameters:
   a. Particle analysis must be per USDA classification for loam, sandy loam, sandy clay loam, or silt loam within the following parameters using ASTM D422:
      Sand: 45 - 55%
      Silt: no more than 30%
      Clay: no more than 20%
      Gravel content larger than 2mm shall be less than 12%.
   b. pH (1 soil : 1 water): 6.0 - 7.2.
   c. Organic matter (ASTM F1647, Method A): 3 - 6% (by dry weight).
   d. Hydraulic conductivity (ASTM F1815) at 85% Proctor (ASTM D698): 1.0 in/hr +/- 0.5 in/hr
   e. Soluble salt content (electrical conductivity, 1 soil : 2 water): maximum 1.60 mmho/cm. Sodium (Na) salinity shall not exceed 700 ppm.
   f. Cation Exchange Capacity (CEC): >15 meq/100g.
   g. Nutrient analysis including macronutrients and micronutrients (Mehlich-3) with soil fertility interpretation and recommendations relevant to the specified plant species.
   h. Compost shall not be added at more than 30% by volume.

C. Erosion Control Mat
1. Straw Blanket

a. For use on 4:1 to 3:1 slopes with moderate runoff conditions: utilize ECS-1 Single Net Straw Rolled Erosion Control Blanket, East Coast Erosion Blankets, 443 Bricker Road, Bernville, PA 19506, 800-582-4005, www.erosionblankets.com, or approved equal.
b. Matting containing non-degradable plastic mesh is prohibited.

2. Straw Mulch:
   a. For use on slopes less than or equal 4:1 with minimal runoff conditions: utilize mildew-free and seed-free salt hay with a nonasphaltic liquid tackifier.

D. Amendments

1. At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the species of plants to be grown.

PART 3 - EXECUTION

3.1 SITE EXAMINATION

A. Prior to installation of soil, examine site to confirm that existing conditions are satisfactory for the work of this section to proceed. The Landscape Architect shall approve the condition of the subgrade and the previously installed subgrade preparation and the installation of subsurface drainage.

1. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope toward the under drain lines as shown on the Drawings.
   a. Subgrade definition: surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.
2. Confirm that all surface areas to be filled with Soil are free of construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches diameter, soil crusting films of silt or clay that reduces or stops drainage from the Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.
   a. Debris definition: Elements including, but not limited to, concrete, concrete masonry, wood, excavated rock and rock fragments, rubble, overburden soils, abandoned utility structures, trash, refuse and litter.
3. Confirm that no adverse drainage conditions are present.
4. Confirm that no conditions are present which are detrimental to plant growth.

B. If unsatisfactory conditions are encountered, notify the Landscape Architect immediately to determine corrective action before proceeding.

3.2 SOIL INSTALLATION

A. All equipment utilized to install or grade Soils shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery equipment shall have buckets equipped with 6 inch long teeth to scarify any soil that becomes compacted.

B. In areas of soil installation above existing subsoil, scarify the subgrade material prior to installing Soil.

1. Scarify the subsoil of the subgrade to a depth of 3 – 6 inches with the teeth of the back hoe or loader bucket, tiller or other suitable device.
2. Immediately install the Planting Soil. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.
3. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Planting Soil.

C. Install the Planting Soil in 6 inch lifts to the required depths. Refer to the Drawings for minimum planting soil depths.

1. Apply compacting forces to each lift as required to attain the required compaction. Scarify the top of each lift prior to adding more Planting Soil by dragging the teeth of a loader bucket or backhoe across the soil surface to roughen the surface.
2. Approved compaction equipment includes a smooth drum roller or plate compactor. Typically one to three passes per lift will achieve the desired compaction. Contractor to test desired compaction methodology with actual soil to be installed to confirm installation method and material properties are compatible and will achieve the specified compaction rates.
3. Provide adequate equipment to achieve consistent and uniform compaction of the Soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction. Use the same equipment and methods of compaction for the entire project area once soil, installation methodology, and compaction critieria have been coordinated and confirmed.

D. Do not pass motorized equipment over previously installed and compacted soil except as authorized below.

1. Light weight equipment such as trenching machines or motorized wheel barrows is permitted to pass over finished soil work.
2. If work after the installation and compaction of soil compacts the soil to levels greater than the above requirements, follow the requirements of Over Compaction Reduction herein.

E. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts in one row before proceeding to the next. Work out from the furthest part of each bed from the soil delivery point to the edge of each bed area.

F. Where travel over installed soil is unavoidable, limit paths of traffic to reduce the impact of compaction in Planting Soil. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. Comply with Over Compaction Reduction herein in the event that soil becomes over compacted. Access over finished grade soils shall be restricted. If access is required across placed soils, Contractor shall be required to rework compacted soil areas prior to fine grading to the full depth of the placed soils as directed by the Landscape Architect.

G. The depths and grades shown on the Drawings are the final grades after settlement and shrinkage of the compost material. The Contractor shall install the Planting Soil at a higher level to anticipate this reduction of Soil volume. A minimum settlement of approximately 10 - 15% of the soil depth is expected. All grade increases are assumed to be as measured prior to addition of surface Compost till layer, or mulch.

H. Maintain moisture conditions within the Soil during installation or modification to allow for satisfactory compaction.

1. Volumetric soil moisture level during installation shall be above permanent wilt point and below field capacity for each type of soil texture within the following ranges.

Soil texture	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

2. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). Suspend operations if the Soil becomes wet. Apply water if the soil is overly dry.

I. Installing Planting Soil with soil or mulch blowers or soil slingers is not permitted.

3.3 SOIL COMPACTION REQUIREMENTS FOR PLANT BEDS AND LAWN

A. The following are threshold levels of compaction as determined by each method for the subsoil surface and full profile of Planting Soil, testing each lift of Soil with a penetrometer. The same penetrometer and moisture meter shall be used to test installed soil throughout the work.

1. Acceptable Compaction
   a. Standard Proctor Method – 75-85%.
   b. Penetration Resistance Method – about 75-250 psi.
   c. Soil below 75 psi soil becomes increasingly unstable and will settle excessively.
2. Unacceptable Compaction
   a. Standard Proctor Method – Above 85%.
   b. Penetration Resistance Method – Approximately above 300 psi
3. Prior to testing the soil with the penetrometer check the soil moisture. Penetrometer readings are impacted by soil moisture and excessively wet or dry soils will read significantly lower or higher than soils at optimum moisture.
4. The penetrometer readings shall be within 20% plus or minus of the specified levels.
5. Where the Standard Proctor Method is utilized, the following Bulk Density levels based on 75% minimum and 85% maximum standard Proctor indicate acceptable compaction.

Soil Texture	Bulk Density (g/cm^3)	
	Max.	Min.
Loamy Sand	1.80	1.65
Sandy Loam	1.65	1.45
Sandy Clay Loam	1.55	1.35
Loam	1.50	1.30
Silt Loam	1.45	1.25

3.4 OVER COMPACTION REDUCTION

A. Compacted soil: soil where the density of the soil, at each lift for the full profile, is greater that the threshold for root limiting, and further defined in this specification.

B. Any soil that becomes compacted to a density greater than the specified density shall be dug up and reinstalled. This requirement includes compaction caused by other sub-contractors after the Planting Soil is installed and approved.

C. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6 inches or greater below finished grade.

3.5 INSTALLATION OF CHEMICAL ADDITIVES

A. Following the installation of each soil and prior to fine grading and installation of the Compost till layer, apply chemical additives as recommended by the soil test, and appropriate to the soil and specific plants to be installed.

B. Types, application rates and methods of application shall be approved by the Landscape Architect prior to any applications.

3.6 FINE GRADING

A. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes other suitable devices, and further defined in this specification, and further defined in this specification.

B. The Landscape Architect shall approve all rough grading prior to the installation of Compost, fine grading

C. Grade the finish surface of all planted areas to meet the grades shown on the Drawings, allowing the finished grades to remain higher than the grades on the grading plan, as defined in paragraph Soil Installation, to anticipate settlement over the first year.

D. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.

E. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify the Landscape Architect in the event that conditions make it impossible to achieve positive drainage.

F. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after settlement is one or two inches below all paving surfaces or as directed by the Drawings.

3.7 INSTALLATION OF IN-SITU COMPOST AMENDMENT

A. After Planting Soil is installed in planting bed areas, spread 2 – 3 inches of Compost over the beds and roto till into the top 4 - 6 inches of the Planting Soil. This step will raise grades slightly above the grades required in Fine Grading herein. This specification anticipates that the raise in grade due to this tilling will settle within a few months after installation as Compost breaks down. Additional settlement as defined in paragraph “Soil Installation” must still be accounted for in the setting of final grades.

B. Soil Tilling: Loosening the surface of the soil to the depths specified with a rotary tine tilling machine, roto tiller, (or spade tiller), and further defined in this specification.

3.8 PROTECTION

A. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

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

B. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by the Landscape Architect and replace contaminated planting soil with new planting soil.

3.9 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

END OF SECTION 329100

SECTION 329200

LAWN AND FINE GRADING

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. Reseeding of existing lawns disturbed during construction.

2. Seeding of new lawns.

3. Maintenance of lawn areas until acceptance.

B. Related Sections:

1. Division 2 Section “Planting”.
2. Division 2 Section “Soil Preparation”.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Topsoil: Native or Imported topsoil. See Soil Preparation section.

E. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

1.4 SUBMITTALS

A. Submit prior to delivery of materials to site.
   1. Submit seed mixes for review.

B. Certifications: Submit certificate with names of materials and manufacturer.
   1. Ground limestone: Include guaranteed analysis, and weight for packaged material.
   2. Commercial fertilizers: Include guaranteed analysis.
   3. Seed: include origin of seed.

C. Product data: Submit product literature or tear sheets with name of product, and manufacturer.
   1. Commercial fertilizer, including type and application rate.

D. Source of supply: Submit in writing all proposed sources.

E. Test reports: Submit test reports at least three (3) weeks prior to delivery of materials to site.
   1. Seed: Test for purity, proportion by weight, weed seed content and germination percentage of all seed mixture proposed for use. No seed shall be delivered until the test reports are approved. All seed shall be tested within six (6) months immediately preceding date of sowing. Seed must comply with all Commonwealth of Pennsylvania seed certifications.

A. Qualification Data: For qualified landscape Installer.

B. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

   1. Experience: Five (5) years' experience in turf installation in projects of similar complexity in addition to requirements in Division 1 Section "Quality Requirements."
   2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   3. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
   4. Pesticide Applicator: State licensed, commercial.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged materials: Deliver packaged materials in clearly marked containers showing net weight, guaranteed analysis and name of manufacturer. Specified requirements for packaged materials apply to bulk shipments. Protect materials from deterioration during delivery and during storage at site.
   1. Deliver fertilizer and limestone in waterproof bags.

2. All seed shall be labeled to show compliance with requirements of governmental agencies having jurisdiction. All bag tags of seed used shall be retained and if requested, submitted to Owner. Seed shall be kept in dry storage away from contaminants, insects and rodents.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

1.7 PROJECT CONDITIONS

A. Protection of existing conditions adjacent to and within construction zone:

1. All necessary precautions for safety including barricades and other protection measures shall be taken during all work.
2. All heavy equipment shall be driven or parked on the site only where approved by Owner.
3. Existing pavements, lawns, structures, walls, etc. damaged or disturbed during construction shall be repaired or replaced to the satisfaction of the Owner.
4. Repair and replace all active utility lines, above and below grade, damaged in the course of construction operations.
5. Avoid damaging existing trees. Damage includes but is not limited to: cutting, breaking, skinning or compacting of roots, skinning and bruising of bark and breaking of branches and limbs.
    a. Contractor shall not park or store equipment and supplies within four (4) feet of trunk of existing trees to remain.

B. Environmental requirements:

1. Seed only between April 1 - May 15 and September 1 - October 15, unless otherwise permitted by the Owner.
2. Do not seed during adverse weather, windy conditions or on wet or frozen ground.

PART 2 - PRODUCTS

2.1 SEED

A. Fresh, clean, new seed. Seed shall be packed in sealed 50 lb. bags showing net weight, composition of mix, date of germination tests and supplier's name. Germination test must be done within a nine-month period prior to sale of the seed.

1. Seed shall not contain in excess of 0.1% by weight weed seed, no more than 1.5% inert matter, and no more than 0.1% other crop seed and no noxious weed seed or undesirable grass species. Comply with state laws governing noxious weeds. Seed containing prohibited or restricted noxious weeds shall not be accepted.
2. Seed shall be Pennsylvania certified and blue tagged.

B. Seed mixture: areas of permanent turf grass shall adhere to the following mixture ratios, unless otherwise approved by the Landscape Architect or Parks and Recreation.

Seed Type	Proportion by Weight	Minimum Purity	Minimum Germination
Turf-Type Tall Fescue (3 Varieties Min.)	60%	95%	80%
Perennial Rye Grass	30%	95%	85%
Kentucky Blue Grass	10%	90%	80%

2.2 LIMESTONE

A. In accordance with soil test recommendations, provide ground, high magnesium limestone containing not less than 85% total carbonates, 95% passing a 20 mesh sieve, 40% passing a 60 mesh sieve and a minimum of 30% percent passing a 100 mesh sieve.

2.3 MULCH

A. Mulch shall consist of specially prepared wood cellulose processed into a uniform fibrous physical state. Wood cellulose fiber mulch shall be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry. The fiber mulch, including dye, shall contain no germination or growth inhibiting factors. The mulch material shall be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with other additives to form a homogenous slurry. The mulch material shall form a blotter-like ground cover, on application, having moisture absorption and percolation properties and shall cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.

B. Mulch shall contain no elements or compounds at concentration levels that will be phytotoxic. Wood cellulose fiber must conform to the following physical requirements:

1. fiber length to be approximately 10 mm
2. diameter approximately 1 mm
3. pH range of 4.0 to 8.5
4. ash content of 1.6% maximum
5. water holding capacity of 90% minimum

C. Slope stabilization: in areas where erosion may occur, use an organic tackifier such as CONTACK or an erosion fabric or approved equal, in accordance with manufacturer's instructions.

2.4 WATER

A. Potable, clean fresh and free from harmful materials. Contractor shall provide all means of conveyance including hoses, sprinklers, tank trucks or other means which may be required to water lawns until accepted by Owner.

2.5 FERTILIZER

A. A standard complete slow release fertilizer. At least 50% by weight of the nitrogen content of the fertilizer shall be derived from organic materials with the remainder in urea form or

equivalent. Fertilizer shall contain percent nitrogen, phosphorous, and potash by weight of ingredients dictated by the topsoil test results.

1. Fertilizer shall be in bags showing weight, analysis, and manufacturer's name

2.6 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent and Post-Emergent Herbicides (Selective and Non-Selective) shall only be used with written authorization by the Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not work soil in frozen, wet, or muddy conditions.
3. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner and replace with new planting soil as specified in Division 2 Section “Soil Preparation”.

3.2 PREPARATION

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

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Grass seed shall be applied to all disturbed areas a result of this project.

B. Preparation of surface for seeded areas (except within root zones of existing trees):

1. Vertically aerate soil if it has become compacted as a result of construction activities.
2. Prior to applying soil amenities, roll lawn area with a filled water roller. Correct any surface irregularities to prevent formation of low spots.
3. If required by soil test, evenly distribute ground limestone at the recommended rate. Work lightly into the top four (4) inches of topsoil at least one full week prior to applying fertilizer.
4. Spread starter fertilizer uniformly, at the rate determined by soil test for new lawns. Add organic matter 1" deep, if required by soil test.
5. Go over the entire area with a spike drag or rototiller and loosen surface at least 3" deep and then hand rake to a smooth, even surface.

C. Seeding

1. As soon as ground has been properly prepared, sow grass seed at the rate of 6 lbs. per 1,000 sq. ft. total. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.
    a. Use suitable mechanical seeder to sow by hand for small areas.
2. Cover seed with a thin layer of topsoil by light raking.
3. Roll seed in both directions very lightly with an empty water roller.
4. After seed application, apply mulch at a net dry weight of 1,500 lbs. per acre. Mulch shall be mixed with water and the mixture shall contain a maximum of 50 lbs. of wood cellulose fiber per 100 gallons of water. Use a slope stabilizing device in areas where erosion may occur.
5. Water with a fine spray immediately after seeding operations are completed.
    a. Water all newly installed seeded areas as necessary to keep lawn healthy. Apply water in sufficient quantities so it penetrates four (4) inches into planting soil without puddling. Continue watering until seeded areas are accepted by the Owner.
6. Protect all newly seeded lawn areas from damage.
7. When seeding occurs after acceptable seeding dates, over winter protection shall consist of applying five bales clean straw per 1,000 sq. ft. and anchor mulch by commercial mulch netting or 20 lbs./1,000 sq. ft. cellulose fiber. Asphalt emulsion anchoring is not permitted.

3.4 TURF MAINTENANCE

A. Begin maintenance immediately after each lawn area is restored.

1. All lawn areas shall be watered and kept moist to maximize germination.
    a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch.
    b. Seed: Water seeded areas as often as required to keep the top 1-inch of soil moist until the seed germinates. Avoid excessive water that will cause the seeds to rot. Once seedlings have germinated and established reduce watering frequency and

increase volume for deeper watering. Continually adjust irrigation system until intervals have been stretched to the greatest extent practical.

2. All areas and spots which do not show a prompt catch of grass shall be reseeded and this operation repeated until complete coverage is obtained.
3. When the area does not need to be reseeded, it shall be thoroughly wetted every time the surface shows evidence of drying out and this shall continue through entire period of maintenance.
4. When the average height is 3-4" and the lawn areas are fully germinated, firmly rooted and secure in place, grass shall be cut to 2-3" or 1/3 of the grass blade. Any depressions or irregularities in the lawn surface shall be leveled off and reseeded.
5. Maintenance shall cease after the third mowing, provided all grass areas are properly established and free of washouts, depressions, bare spots, weeds and large off-color areas. If seeding is done in the autumn, the Contractor shall complete the three mowings in the following spring.
6. All lawns shall show a uniform, thick, well-developed stand of grass. If the grass stand is unsatisfactory, the Contractor's maintenance responsibility shall continue until an acceptable stand of grass is achieved.

3.5 SATISFACTORY LAWN

A. Seed installations shall meet the following criteria as determined by Owner:

1. Satisfactory Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
2. Provide at minimum three (3) mowings in accordance with grass height requirements.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.6 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

C. Notification signage must be posted at every entrance in a highly visible location at least five (5) days in advance of application and maintained five (5) business days following application, or as recommended by the manufacturer’s instructions, whereby it is then removed from the site.

1. Notification Signage shall be brightly colored, laminated and at least 8.5” by 11” format including the following information:

a. Date of Notification.
b. Date of Application.
c. Name of Chemical.
d. Reason for Chemical Application.
e. Information informing as to the precautions that must be taken including humans and pets.

3.7 CLEANUP AND PROTECTION

A. Do not allow soil and debris created by turf work onto permeable unit paving areas. Promptly clean up any soil or debris on impervious paving areas, such as concrete sidewalk or roadway paving. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Protection of newly planted lawn areas is critical to healthy establishment. Erect temporary protection fencing and warning signs to protect newly planted areas from traffic. Maintain fencing throughout initial maintenance period. Remove protection fencing only after lawn areas have become well established and are able to tolerate regular use. Install temporary protection fencing and signage in accordance with the following:

1. Temporary Protection Fencing

    a. Fencing shall cordon off the entire perimeter of lawn area to prevent access.
    b. Fencing shall be supported securely as required to remain erect for duration of site protection. Utilize heavy-duty 12 gauge minimum metal fence posts spaced at 6 to 8 feet on center, or as required. Posts shall be driven into the soil sufficient depth to support fencing against heavy wind load.
    c. Fencing shall be at least 4-foot high. Secure fencing to posts at the top and bottom and in at least one location in the middle with zip or cable ties. Fencing may also be woven through each post and secured at the top only with a zip tie.

2. Signage: Notification signage shall be brightly colored, laminated and at least 8.5” by 11” format attached to fencing every 10 to 12 feet, including the following information.

    a. “Please keep off lawn areas. Lawn will be available once protection fencing has been removed.”

C. If utilized, remove non-degradable erosion-control measures after grass establishment period.

END OF SECTION 329200

SECTION 329300

PLANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Provide trees, shrubs and groundcover, as well as all necessary accessories.
   2. Maintenance and replacement during Establishment Period.
   3. Provide and install decorative boulders.

1.2 RELATED SECTIONS

A. Section 329100 – Planting Preparation

B. Section 329200 – Lawns and Fine Grading

1.3 REFERENCES

A. The following apply to work in this Section:

   1. ASNS: “American Standard for Nursery Stock,” latest edition, published by the American Nursery and Landscape Association.
   2. NAA: “National Arborist Association Standards for Pruning”, latest edition, published by the National Arborist Association.
   3. ANSI: “American National Standards Institute”, latest edition.

1.4 SUBMITTALS

A. Certifications: Submit certificate with names of materials and manufacturer.

   1. Plants: Furnish certificates of inspection as may be required by Federal, State or other authorities that plants are free of disease or hazardous insects.
   2. Commercial fertilizers: Include guaranteed analysis.
   3. Ground limestone: include guaranteed analysis and weight for packaged material.
   4. Commercial fertilizers: include guaranteed analysis.

B. Instructions: Submit planting and maintenance schedule.
   1. Submit the proposed planting installation schedule indicating dates for tagging and installation, dates and duration of plant storage at an off-site location, and a detailed program of Establishment Period maintenance.

C. Product data: Submit product literature or tear sheets with name of product, and manufacturer.
   1. Commercial fertilizer.
   2. Mulch.
   3. Boulders

E. Samples: Submit loose materials in sealed bags labeled with name of material and manufacturer.
   1. Mulch, 1/2 lb. bag.

F. Source of supply: Submit in writing all proposed sources.
   1. Locate trees and make all pre-selection arrangements at the source of supply required to ensure an efficient selection procedure. Landscape Architect, with Contractor present, will select plants at nursery on the basis of their compliance with the Drawings. Contractor shall inspect the selected plants on the basis that the plants are free of disease and otherwise conform to the requirements of the Contract Documents. The accuracy of the varieties of species specified for plant material shall be the Contractor's responsibility. Request visit at least 14 days in advance of desired inspection date.
      a. Trees will be inspected and approval given by Landscape Architect at the source for conformity to Specification requirements. Such approval shall not affect the right of inspection and rejection during delivery and installation.
      b. All trees specified as B&B must be in the ground at the growing source at the time of inspection. Pre-dug trees shall not be acceptable.
   2. Locate boulders and make all pre-selection arrangements at the source of supply required to ensure sufficient selection procedure. Landscape Architect, with contractor present, will select boulders based on the compliance with size and shape on the basis of compliance with the Drawings, as well as product data provided herein.

1.5 QUALITY ASSURANCE

A. Contractor shall have had experience with at least two (2) other projects of similar scope and complexity and shall perform work with personnel totally familiar with planting installation and general construction techniques under the supervision of an experienced landscape foreperson.

B. Plants: Meet or exceed applicable AAN standards.
   1. Plant List: Investigate sources of supply prior to submitting bid. Confirm that size, variety and quantity of plants specified on Plant List can be supplied. Failure to take this precaution shall not relieve the successful bidder from responsibility for furnishing and installing all plants in strict accordance with Contract requirements.
      a. Substitutions shall not be permitted unless substantiated written proof is supplied that a specified plant is not obtainable. In this situation a proposal to use the nearest equivalent size or variety with an equitable adjustment of Contract Price will be considered.
      b. Plant substitutions will be permitted only upon approval by the Owner and Landscape Architect.
      c. All plants shall be grown on their own roots. No grafted species shall be acceptable.
      d. Plants shall be of the quantity and quality indicated, true to name, properly labeled with botanical name and in accordance with the sizes and grades specified.

1.6 PROJECT CONDITIONS

A. Protection of existing conditions adjacent to and within construction zone:
   1. All necessary precautions for safety including barricades and other protection measures shall be taken during all work.
   2. All heavy equipment shall be driven or parked on the site only where approved by Owner.
   3. Existing pavements, structures, walls, etc. damaged or disturbed during construction shall be repaired or replaced to the satisfaction of the Owner.

4. Repair and replace all active utility lines, above and below grade, damaged in the course of construction operations.
5. Avoid damaging existing trees. Damage includes but is not limited to: cutting, breaking, skinning or compacting of roots, skinning and bruising of bark and breaking of branches and limbs.
    a. Contractor shall not park or store equipment and supplies within four (4) feet of trunk of existing trees to remain.

B. Environmental requirements:
1. Plant only within the following dates, weather permitting. Do not plant when ground is frozen, when the soil is excessively wet, when ambient air temperature exceeds 85 degrees or in otherwise unsatisfactory weather conditions.
    a. Plant between March 1 and June 15 and August 15 until the ground freezes.
    b. Plant trees known to be fall digging hazards only in the Spring.
2. Chemical Spraying Program: no spraying of herbicides, insecticides, fungicides, nematicides, fumigants or other chemicals shall be done without first submitting a spray program to the Owner.

1.7 DELIVERY, STORAGE AND HANDLING

A. Packaged materials: Deliver packaged materials in clearly marked containers showing net weight, guaranteed analysis and name of manufacturer. Specified requirements for packaged materials apply to bulk shipments. Protect materials from deterioration during delivery and during storage at site.
1. Deliver fertilizer in waterproof bags.
2. All seed shall be labeled to show compliance with requirements of governmental agencies having jurisdiction. All bag tags of seed used shall be retained and if requested, submitted to Owner. Seed shall be kept in dry storage away from contaminants, insects and rodents.

B. Plants: Notify Owner seven (7) days in advance of any delivery of plants to site.
1. Dig and handle trees with care to prevent injury to trunks, branches and roots. Do not prune prior to delivery. Do not bend or bind-tie trees in such manner as to damage bark, break branches or destroy natural shape. Pack and ship to ensure arrival at site in good condition. Provide protective covering during delivery. Plants with cracked or broken root balls shall not be accepted.
2. Deliver plants after preparation of planting areas has been completed and approved, install plants immediately.
    a. If planting is delayed more than eight (8) hours after delivery, set balled and burlapped plants on the ground well protected with soil, wet mulch or other acceptable material. Protect balls and roots, and container grown material from freezing, sun, drying winds and/or mechanical damage. Water as necessary until planted.
    b. Do not heel in plants for more than five business days.
3. Immediately remove rejected plants from site.

1.8 INSPECTION FOR SUBSTANTIAL COMPLETION

A. Plants:
1. All plants shall be alive, healthy and installed to be accepted.
2. Guarantee Period for plants shall not begin until all items have been completed or corrected.

1.9 GUARANTEE / ESTABLISHMENT PERIOD FOR PLANTS

A. Contractor shall not be held responsible for acts of vandalism occurring after the beginning of Guarantee Period, nor shall Contractor be held responsible for deleterious effects caused by maintenance procedures performed by Owner without concurrence of Contractor.

B. Replace at no additional cost for a period of two growing seasons after the beginning date of Guarantee Period, any plants that have died or that are, in the opinion of Owner, in unhealthy or unsightly condition, or that have lost their natural shape due to dead branches, excessive pruning, excessive defoliation.
   1. A growing season is defined as the period during which plant growth takes place from last killing frost of Spring to the first killing frost of Autumn.
   2. Replace unacceptable plants no later than the next succeeding planting season. All replacements shall have a guarantee of one planting season from date of replacement.
      a. Replace unacceptable plants in accordance with original Specification. Cost is considered to be included in the Bid and Contract Price.

PART 2 PRODUCTS

2.1 PLANTS

A. Provide freshly dug plants nursery grown in accordance with good horticultural practice.
   1. Sound, healthy and vigorous, well-branched and fully foliated when in leaf, free from disease, insect pests, eggs or larvae with healthy well-developed root systems.

B Conform to measurements specified on Plant List. Plants shall be measured before pruning, with branches in normal position. Any necessary pruning shall be done at time of planting. Requirements for the measurement, branching, grading, quality, balling, and burlapping of plants shall be in accordance with standards specified in ASNS and conform to ANSI Z.60.1.

C. Provide B&B stock with a compact natural ball of earth, firmly wrapped and tied in burlap so that upon delivery the soil in the ball is still firm and compact about the small feeding roots. Root ball sizes shall be in accordance with standards specified in ASNS.

D. Furnish trees with rootballs measured from top of rootball which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before trees are dug to ensure proper rootball depth.

E. Plants shall be measured before pruning, with branches in normal position. Any necessary pruning shall be done at time of planting. Requirements for the measurement, branching, grading, quality, balling, and burlapping of plants shall be in accordance with standards specified in ASNS.

2.2 STAKING AND GUYING MATERIALS

A. Tree Stakes: 2” x 2” x 8' long wood posts, minimum 2 per tree, if required.

B. Guys: Nylon straps shall be used wrapped loosely around tree trunks and securely fastened to stakes.

2.3 LIMESTONE

A. In accordance with soil test recommendations, provide ground, high magnesium limestone containing not less than 85% total carbonates, 95% passing a 20 mesh sieve, 40% passing a 60 mesh sieve and a minimum of 30% percent passing a 100 mesh sieve.

2.4 MULCH

A. Double shredded hardwood bark. To be natural in color, free of dye.

2.5 WATER

A. Potable, clean fresh and free from harmful materials.

2.6 HERBICIDES

A. Herbicides, fungicides, and pesticides: Approved before use for type and rate of application by Owner and local, state and/or federal agencies with jurisdiction. Spraying of all herbicides shall be done in accordance with the Chemical Spraying Program.
   1. Non-selective herbicide shall be Round-Up as manufactured by Monsanto or approved equal.

B. A standard complete slow release fertilizer. At least 50% by weight of the nitrogen content of the fertilizer shall be derived from organic materials with the remainder in urea form or equivalent. Fertilizer shall contain percent nitrogen, phosphorous, and potash by weight of ingredients dictated by the topsoil test results.
   1. Fertilizer shall be in bags showing weight, analysis, and manufacturer's name.

2.7. PROTECTION MATERIALS

A. Wood stakes, suitable in length so that 30” minimally is exposed above ground.

B. Durable twine with fluorescent flagging.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that previously installed protection measures are in place.

B. Verify that excavation and grading is complete.

C. Do not begin planting and lawn work until all other work is complete. Planting areas shall be free of waste and debris generated by other construction activities.

D. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees from damage caused by seeding operations.

B. Install 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. Planting Pits:
   1. Verify by testing that planting areas are free draining. If planting areas are not free draining notify Owner and submit alternative method of drainage for approval.
   2. Stake out location of trees.
      a. Completely layout planting areas before seeking approval by Landscape Architect and Owner.
   3. Planting pits in plant beds shall be excavated to the depth of the rootball and trees shall be planted on undisturbed soil.
      a. Tree pit excavations shall be circular with vertical sides.
      b. Install sand, as minimally required, to create a leveling bed under root balls of trees.
      c. Install planting soil continuously at depths indicated on Drawings.
   4. Remove all existing materials from tree pits and scarify bottom and sides of planting pits and beds.
      5. If an impervious hard plan layer exists in the bottom of the pit after excavation, the pits shall be excavated to the depth of the hardpan or 36 inches below the bottom of the ball. Pit shall then receive a 6 inch layer of AASHTO 57 stone, covered with straw or similar material. Remainder of pit shall be backfilled with topsoil as specified.

3.3 PLANT INSTALLATION

A. Planting:
   1. Do not plant until trees and planting pits have been approved by Owner and Landscape Architect.
   2. Plant trees to a depth such that the bottom of the trunk flare is 1” above finished grade.
   3. Plant upright and plumb and faced to give the best appearance or relationship to adjacent plants and structures.
   4. Do not pull burlap out from under balls. Remove platforms, wire and surplus binding to the greatest extent possible. Remove burlap from the top and sides of the rootball to the greatest extent possible. Cleanly cut off all broken or frayed roots.
   6. Remove all non-biodegradable materials from the planting area.
   7. Carefully place planting soil in six (6) inch lifts to avoid injury to roots and to fill all voids. Firmly tamp each lift to prevent settlement.
   8. When the planting area is nearly filled, water and allow to soak away. If planting soil settles after watering, add more planting soil to bring to required level.
   9. Upon completion of planting operations, water plants thoroughly over the entire planting bed until fully saturated.
      a. Apply water slowly to ensure penetration into the entire root system.
   10. Mulch within two (2) days of planting. Install two (2) inches of mulch over tree rootballs, and continuously over entire planting beds. Keep mulch at least 2 inches away from tree trunk.
   11. Staking and guying shall be done immediately after trees are planted. Trees shall stand plumb after staking.
      a. Provide a minimum of two (2) stakes per tree.
   12. Neatly prune trees to remove broken or badly bruised branches with a clean cut in accordance with NAA standards, and at the time designated by, and to the satisfaction of Owner.
      a. Preserve the plant's natural character,

b. Perform pruning with clean, sharp tools.

3.4 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION

A. Begin maintenance immediately after each planting area is installed.
   1. Provide all care necessary to keep trees healthy including but not limited to: watering, mulching, weeding, fertilizing, pruning and spraying.
   2. During periods of inadequate rainfall, as determined by the Owner, all plants shall be watered to maintain a constant suitable moisture level for good plant growth. Contractor shall provide all watering hoses and devices. Owner will provide water source.
   3. Weed control shall be by mechanical or hand weeding.
   4. Use of herbicides, insecticides, fungicides, nematicides, fumigants or other chemicals are only acceptable upon approval by the Owner.

B. Prior to inspection for Substantial Completion remove all excess soil and debris from site and repair damage resulting from planting operations.

3.5 PLANT GUARANTEE / ESTABLISHMENT PERIOD

A. The Establishment Period will begin upon notice of substantial completion by the Owner.

B. Contractor shall guarantee the plants against defects including death and unsatisfactory growth. Guarantee shall include the purchase of the plants, the rental of any required special equipment necessary to place the plants and the installation of the plants. Contractor shall not be liable for vandalism out of Contractor's control.

C. New plants installed during the Establishment Period shall carry a new establishment period guarantee equal to the original that begins at the time of acceptance of the replacements plant(s). Replacement and repair work shall be re-inspected by the Owner.

D. At the end of the Plant Establishment Period, Owner shall make an inspection to determine that all plants are living and healthy. Any replacement of plants at this time shall be made according to the specifications for that type of plant. New plants installed as part of the original two-year guarantee, shall carry a new one-year guarantee period that begins at the time of acceptance of the replacement plant(s). Any replacement and repair work that is required shall be re-inspected by the Owner.

3.6 PLANT MAINTENANCE DURING ESTABLISHMENT PERIOD

A. General: Perform procedures set forth in the submitted and approved maintenance program for the duration of Guarantee Period.
   1. Inspect all plants at least once a month to locate any disease or pest infestations. If infestation is present, submit a proposed method of control to Owner for approval prior to application of control measures.
   2. Remove dead plants within five (5) business days of notification by Owner or the Owner will remove the plants and bill the Contractor accordingly.
      a. Replacement plants may be installed during the next appropriate planting season.
      b. Replacement plants shall be of the same species and size as specified in the Plant List.
   3. Perform all maintenance procedures, including but not limited to: fertilizing, watering, weeding, and mulching.
      a. Prune, as necessary, to remove dead, diseased and damaged branches.

b. During periods of inadequate rainfall, all plants shall be watered to maintain a constant suitable moisture level for adequate plant growth. Apply water slowly so as to penetrate the entire root zone. Contractor shall provide water hoses. The Owner shall provide the water source.
c. Completely remove, by hand pulling, all weeds within mulch areas. Under no circumstances are weeds to attain more than two (2) inches of growth. Herbicide use is acceptable with Owner approval.
d. Restore mulch around trees as necessary to preserve their appearance and to control weed growth.
e. If re-fertilizing of trees is required, apply Ra-Pid-Gro at manufacturer's suggested rate.
f. If any tree settles from its proper elevation, raise it to the proper level.
g. If spraying to control insects, fungus, and other diseases is required seek approval from Owner before spraying. Furnish a spray program and product information on all sprays to be used to Owner for approval. After approval, application will only be permitted by licensed applicators. Applicators shall follow Notification requirements and report any Chemical Hypersensitivity Registries for the area.

3.7 FINAL ACCEPTANCE

A. At end of Establishment Period, submit a written request to the Owner for Inspection for Final Acceptance at least two (2) weeks prior to the day on which inspection is requested.

B. At the end of the Establishment Period, Owner and Contractor shall make an inspection to determine that all plants are living and healthy. Any plant that is dead or not in satisfactory condition, as determined by the Owner, shall be removed from the site and replaced in accordance with the specifications.

END OF SECTION 329300

SECTION 331100

WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes water-distribution piping and related appurtenances for site work to be picked up by the general site contractor 5’ from the face of all buildings.

B. All work shall conform to the requirements of Philadelphia Water, Philadelphia Fire Marshall, and any other regulatory authorities having jurisdiction.

C. All water main work and water service connections under this contract shall be governed by, and done in accordance with the most recent revision or amendment to the Standard Specifications and Standard Details of the Philadelphia Water Department.

D. All work on water service connections shall be done by, or under the direction of, a licensed Master Plumber.

1.2 RELATED DOCUMENTS

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

1.3 REFERENCES

A. Philadelphia Water Department (PWD)
   1. Standard Details
   2. Standard Specifications

B. Factory Mutual (FM)
   1. Approval Guide

C. Underwriters Laboratories (UL)
   1. Fire Protection Equipment Directory
   2. UL 1285 - Pipe and Couplings, Polyvinyl Chloride (PVC), for Underground Fire Service
   3. UL 262 - Gate Valves for Fire-Protection Service
   4. UL 246 - Hydrants for Fire-Protection Service

D. National Sanitation Foundation (NSF)
   1. NSF 14 - Plastics Piping System Components and Related Materials
   2. NSF 61 - Drinking Water System Components - Health Effects

E. National Fire Protection Association (NFPA)
   1. NFPA 70 - National Electrical Code

2. NFPA 24 - Hydraulic Fluid Power Systems - Methods to Improve Sealing Reliability (new standard)
3. NFPA 1963 - Screw Threads and Gaskets for Fire Hose Connections (revision of ANSI/NFPA 1963-1993)

F. American Water Works Association (AWWA)
1. C151 Ductile-Iron Pipe, Centrifugally Cast, for Water (revision of ANSI/AWWA C151/A21.51-91)
2. C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
3. C150 - Thickness Design of Ductile-Iron Pipe
4. C110 - Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids
5. C153 - Ductile-Iron Compact Fittings, 3 in. through 24 in. (76 mm Through 610 mm) and 54 in. through 64 in. (1,400 mm Through 1,600 mm), for Water Service
6. C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inch through 12 Inch for Water Distribution
7. C500 - Gate Valves for Water and Sewage Systems
8. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
9. C550 - Protective Epoxy Interior Coatings for Valves and Hydrants
10. C509 - Resilient-Seated Gate Valves for Water Supply Service
11. C800 - Underground Service Line Valves and Fittings
12. C702 - Cold Water Meters - Compound Type
13. C502 - Hydrants, Dry Barrel Fire
14. C600 -Installation of Ductile-Iron Water Mains and Their Appurtenances
15. C605 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water
16. C651 - Disinfecting Water Mains

G. American Society for Testing and Materials (ASTM)
1. B88 - Standard Specification for Seamless Copper Water Tube
2. B813 - Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
3. B32 - Standard Specification for Solder Metal
4. D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
5. D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
6. F645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems

H. American Society of Mechanical Engineers (ASME)
1. B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings R(1994)
2. B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

I. Manufacturer’s Standardization Society (MSS)

1.4 SUBMITTALS

A. Product Data for the following:
1. Valves, Corporation Stops, Curb Boxes, Curb Stops, Valve Boxes

2. Backflow preventers and assemblies; and

B. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data for the following:
1. Valves;
2. Backflow preventers;
3. Protective enclosures; and,

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of the regulatory authorities having jurisdiction; including tapping of water mains, backflow prevention, installation, testing, and disinfection. Comply with standards of the regulatory authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

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

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

D. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

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

F. NSF Compliance: Comply with NSF 14 for plastic potable-water-service piping. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

G. Comply with requirements of Section 315000 – Excavation Support and Protection.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify the engineer and the Owner not less than 2 days in advance of proposed utility interruptions; and,
2. Do not proceed with utility interruptions without written permission from the engineer or the Owner.

1.7 COORDINATION & FEES

A. The Contractor shall be responsible for obtaining and payment of all tap and construction permit fees associated with this section.

B. The Contractor shall install water lines and appurtenances as shown on the drawings. Including, but not limited to, any taps, meters, vault and backflow prevention. The Contractor shall install plugging and marking apparatus as necessary to protect his work.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS, APPLICATION

A. Ductile-Iron Pipe
   1. Ductile iron pipe shall conform to the requirements of AWWA C151, class 350, and shall have a cement-mortar lining of standard thickness in accordance with AWWA C104; pipe thickness shall be in accordance with AWWA C150; pipe shall have push-on joints in accordance with AWWA C110. Additional fittings shall be mechanical-joint ductile-iron compact fittings in accordance with AWWA C153 or standard size in accordance with AWWA C110.
   2. Cast into, stamp or paint on each pipe: the manufacturer's mark; casting number; year of cast; "DI"; class of pipe. Markings shall be clear and legible.

2.2 VALVES

A. Cast-Iron, Gate Valves:
   1. Nonrising-Stem, Metal-Seated Gate Valves: AWWA C500, UL 262, FM-approved, gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
      a. Minimum Working Pressure: 200 psig (1380 kPa).
      b. End Connections: Mechanical joint, per (AWWA C 111).
      c. Interior Coating: Complying with AWWA C550.
      d. Nut: 2 inches square, complying with AWWA C500.
   2. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, UL 262, FM-approved, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
      a. Minimum Working Pressure: 200 psig (1380 kPa).
      b. End Connections: Mechanical joint, per ANSI A21.11 (AWWA C111).
      c. Interior Coating: Complying with AWWA C550.
      d. Nut: 2 inch square, complying with AWWA C500.

B. Tapping-Sleeve Assemblies: Conform to the requirements of MSS SP-60. Tapping sleeves may be cast-iron, ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection.

C. 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, lid with lettering "WATER," bottom section with base of size to fit over valve, and approximately 5 inch diameter barrel.

D. Operating Wrenches: Steel tee-handle, stem of length to operate deepest buried valve, and 2 inch square socket matching valve operating nut, placed in sprinkler room.

2.3 WATER SERVICE CONNECTIONS

A. Service-Saddle Assemblies: Comply with AWWA C800.

B. Corporation Valve: Comply with AWWA C800, bronze body, threaded inlet and outlet matching service piping material.

C. Buffalo type curb boxes or approved equal

D. Curb Stops: Comply with AWWA C800, bronze body, with inlet and outlet matching service piping material.

E. Copper service pipe in accordance with ASTM B 88, Type K, annealed (temper O50 or O60).

2.4 BACKFLOW-PREVENTION DEVICES

A. Comply with regulatory authorities having jurisdiction requirements.

PART 3 - EXECUTION

3.1 TRENCHING

A. Comply with requirements of Section 315000, Excavation Support and Protection.

3.2 VALVES

A. General Application: Use mechanical joint valves for NPS 2 inch and larger underground installation. Use threaded or flanged-end valves for installation in vaults.

B. Set Valve boxes to grade, true and plumb with valve operating nut centered in box.

3.3 PIPE AND FITTING INSTALLATION

A. Water-Main Connection: Verify with regulatory authorities having jurisdiction that size of tap and location shown on drawings is acceptable. Make tap conforming to requirements of regulatory authorities having jurisdiction and Manufacturers Standardization Society (MSS) standards.

B. Install each service pipe with the material specified, or as directed by the Project Manager.

C. Comply with NFPA 24 for fire-service-main piping materials and installation.

D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

E. All piping shall be installed with a minimum of 4 feet of cover, or 12 inches below level of max frost penetration, or as required by regulatory authorities having jurisdiction, whichever is deeper. If pipe is installed in a cut section prior to completion of grading operations, pipe shall be installed so that minimum required cover will exist upon completion of grading operations.

F. 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.

G. Pipe Bedding: Pipe bedding material shall be installed if required by regulatory authorities having jurisdiction water authority or engineer. No pipe shall be laid resting on a rock, blocking or unyielding objects.

H. Location with Sewers: Separate trenches shall be provided for water lines and sewer lines, with lines separated by a minimum of 10 feet horizontally. Water mains that cross sewers shall have a minimum vertical separation of 18 inches).

I. Tap water main for installation of ferrule. Use a single piece of service pipe between ferrule or swing joint and curb stop. Connect new service to water distribution pipe. Where adapter is required between curb stop and water distribution pipe, length of adapter may not exceed two feet without written approval from Project Manager for each such connection.

3.4 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600;
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23;
   3. Fire-Service-Main Piping: According to NFPA 24; and,
   4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 BACKFLOW-PREVENTER INSTALLATION

A. Comply with regulatory authorities having jurisdiction, including water authority requirements.

B. Do not install bypass piping around backflow preventers.

3.6 QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after 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:

1. The Contractor shall test all pipe lines and appurtenances with water at test pressure of 150 psi or 1.5 times working pressure, whichever is greater. Test pressure must be maintained for at least 2 hours. All leakage apparent after testing must be repaired immediately. a. The work will not be finally accepted until leakage shall prove to be less than 10 gallons per 24 hours per mile of pipe at test pressure; and,
2. Fire Water System tests shall be in full conformity with the requirements of all applicable codes, NFPA standards, and other authorities having jurisdiction.
    a. All new underground mains and lead-ins shall be flushed thoroughly before connection is made to internal system piping. The site utility subcontractor shall be responsible for disposal of the test water drained from the test outlets.
    b. The trench shall be backfilled between joints before testing to prevent movement of pipe.
    c. Test shall be made by the site utility subcontractor in the presence of the regulatory authority having jurisdiction and/or the Owner's representative.
    d. The site utility subcontractor shall prepare reports of testing activities and submit 2 copies to the General Contractor.

3.7 IDENTIFICATION

A. Install continuous underground detectable warning tape in accordance with Section 312000 – Earth Moving, or a 14-gauge solid copper tracer wire prior to backfilling of trench for underground PVC water-service piping. Locate below finished grade, directly over piping.

3.8 CLEANING

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

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use;
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet;
3. Use purging and disinfecting procedure prescribed by regulatory authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below; and,
    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

4. The site utility subcontractor shall prepare reports of purging and disinfecting activities and submit 2 copies to the General Contractor.

- END -

SECTION 33 3116
SANITARY UTILITY PIPING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section includes all materials and appurtenant work necessary to furnish and install new sanitary sewer lateral connection and repairs or modifications to existing sanitary sewer pipes or structures for site work to be picked up by the general site contractor 5’ from face of all buildings.

1.2 RELATED DOCUMENTS

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

1.3 REFERENCE STANDARDS

A. All sewer work under this contract shall be governed by, and done in accordance with the most recent revision or amendment to the Standard Specifications and Standard Details of the Philadelphia Water Department, including the following:

1. Standard Details and Standard Specifications for Sewers.
2. Standard Specifications for Excavation, Refilling, Grading, Landscaping and Repaving.
3. Standard Specifications for Masonry: Concrete.
4. Standard Specifications for Masonry: Stone and Brick.
5. Standard Specifications for Gray and Ductile Iron

B. The Standard Detail for Saddle Connection to RC Pipe Sewers is hereby modified so that the openings for the lateral connections shall be core drilled and rubber saddles shall be substituted in place of clay saddles. The 2000 psi concrete encasement around the saddle shall be extended to the cradle of sewer as shown in the Detail for Resilient Saddle Connection to RC Pipe Sewers affixed to the end of these specifications.

C. The Standard Detail for cast in place and brick Wellholes is hereby modified so that a 5000 psi concrete base slab (12" thick) is cast separately from the brick or concrete walls. The base slab shall have the dimensions shown in the Standard Details.

D. All materials and workmanship shall conform to the most recent revision or amendment to the following standards, except as modified by the Contract Documents:

1. ASTM C 94, Standard Specification for Ready-Mixed Concrete.
2. ASTM C 890, Standard Practice for Installation of Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

1.4 SUBMITTALS

A. Ready-Mixed Concrete: Before starting work, submit to Owner/Authorized Representative a copy of manufacturer's QCS-approved mix design for concrete to be delivered under this Contract. For each truckload of concrete delivered, submit a batch ticket in accordance with QC-3.

B. Certificates of Compliance: Before installation of any Precast Concrete Products, Gray / Ductile Iron Casting, Ready-Mixed Concrete, Welded Steel Inlet Frame or Grates, Reinforced Concrete Pipe, Filter Media Products, Vitrified Clay Pipes & Fittings, submit an acceptable Certificate of Compliance to Owner/Authorized Representative for each such unit, in accordance with QC-1, QC-2, QC-3, QC-4, QC-6, QC-7, or QC-9 respectively.

1.5 REGULATORY REQUIREMENTS

A. Traffic Control: Maintain access of and protection for vehicular and pedestrian traffic as required for construction activities in accordance with local regulations.

B. Contractor shall obtain all necessary City of Philadelphia Streets Department road opening permits and approvals, Philadelphia Water Department Connection permits and approvals and City of Philadelphia Department of Licenses and Inspections permits and approvals, upon the Contractor receiving Notice to Proceed and prior to proceeding with the Work.

PART 2 - PRODUCTS

2.1 BACKFILL

A. Ordinary Backfill Material may include all material excavated from the trench and free of objectionable matter unless rejected by the Engineer. The Contractor shall furnish any deficiency of Ordinary Backfill Material.

B. Furnish Select Backfill Material in accordance with PennDOT Publication 408 Specifications, Section 703.3, Select Granular Material-2RC (as amended). The use of slag as Select Backfill Material is hereby prohibited.

2.2 RUBBER SADDLES

A. Rubber Saddles for Lateral Connections to RC Pipe Sewers shall be manufactured from a blend of rubber that is laboratory tested and appropriate for sewer applications.

B. Pipe clamps and expansion rings shall be Type 304 Stainless Steel.

C. Rubber Saddles shall provide a watertight connection and be compatible with ASTM C-923.

2.3 GRAY (CAST) IRON SOIL PIPE

A. All gray iron pipe shall be manufactured and tested in accordance with ASTM A 74 Standard specification for Cast Iron soil pipe and fittings

B. Pipes shall have a nominal laying length of 5 feet and 10 feet for all size diameters.

C. Joints in cast iron pipes and fittings shall be sealed with pre-formed rubber gaskets. The gaskets shall be manufactured and tested in accordance with ASTM C564.

D. Pipe shall conform to the Standard Specifications for Gray and cast iron soil pipe of PWD.

2.4 4" FRESH AIR INLET

A. Contractor to furnish and install L&I approved vent covers.

B. All work and materials to be in accordance with the City of Philadelphia Streets Department standard construction items, Philadelphia plumbing code and PWD sewer service detail.

PART 3 - EXECUTION

3.1 MAINTENANCE AND PROTECTION OF TRAFFIC DURING CONSTRUCTION

A. Maintain and protect traffic during construction as required elsewhere in these Contract Documents.

3.2 EXCAVATING

A. Excavate in accordance with the Standard Specifications for Excavation, Refilling, Grading, Landscaping, and Repaving. Excavation will not be classified, whether by type of material encountered, or by type of equipment required.

B. Use sheathing and shoring sufficient to avoid damage to or settlement of adjacent buildings, paving, and underground structures.

C. Protect from damage and provide adequate temporary support for all existing underground facilities, except those known to be abandoned. Repair any damage to existing underground facilities due to Contractor's operations without charge to Owner.

D. Use of a Hydro-Hammer or similar equipment for breaking existing paving is hereby prohibited.

3.3 DEBRIS GRILLS

A. Take great care when breaking the sewer crown to prevent debris from being washed down the sewer.

B. At the end of each work day, cover the open end of the sewer with a metal debris grill to prevent debris from being washed down or thrown into the sewer during non-work hours. At the beginning of each work day, remove all accumulated debris before removing the debris grill.

C. Employ a rigid, portable metal debris grill which is sufficiently strong to withstand the impact of any debris which may be washed down stream or thrown against it. Openings shall be 3" x 3".

D. During working hours, prevent any debris, construction material, or equipment from being washed down the sewer. Remove any such material from the sewer without charge. Use debris grill during working hours when feasible.

3.4 TRENCH BENCHING AND SHORING

A. The Contractor shall provide all labor, material, and tools to furnish sheeting, shoring, and bracing as required by the Division of Aviation, the Commonwealth of Pennsylvania, and Department of Labor OSHA 29 CFR Part 1926 including any successive regulations.

B. The Contractor shall be responsible for submission of a sheeting, shoring, and bracing or benching plan drawing showing details and sequencing of construction, construction materials, construction material sizing, calculations, and existing soil conditions. This plan drawing shall be developed, reviewed, approved and sealed by a Professional Engineer registered in the Commonwealth of Pennsylvania.

C. The Contractor shall submit six (6) sets of trench benching and shoring plans, clearly showing the Engineers Seal, to the Engineer.

D. Shoring shall not be removed until the permanent work is in proper condition to receive the load.

3.5 INSTALLATION OF PIPES

A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than one-sixteenth of an inch (1/16”) per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site.

B. All pipe shall be examined before laying and no piece shall be installed which is found to be defective.

1. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.

C. After the excavation is complete to normal grade of the bottom of the trench and bottom preparation according to the Drawings and Specifications is completed, crushed stone bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid diameter and hand tools shall be used to force the bedding where needed to give firm continuous support for the pipe. AASHTO #57 aggregate shall then be placed to twelve inches (12”) above the top of the pipe. Detectable underground utility marking tape shall be installed over all pipe not otherwise marked (see Section 02709 for pipe within a stone storage trench). The initial three feet (3’) of backfill above the bedding shall be placed in one-foot (1’) layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been

placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial three feet (3') of backfill shall be approved by the pipe manufacturer's representative prior to use.

D. All piping shall be sound and clean before installation. When installation is not in progress for any length of time, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer.

E. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

F. Precautions shall be taken to prevent flotation of the pipe in the trench.

G. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below the top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, crushed stone shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe

H. The use of ninety-degree (90°) bend pipe fittings is not permitted in the installation of piping. The Contractor shall use minimum-angle fittings to construct the pipe layout diagrammatically shown in the Drawings. The maximum fitting angle approved for use is forty-five-degrees (45º), and fittings of lesser angles (22½° or 11¼°) are preferred for use where practical

3.6 BACKFILLING AND COMPACTING

A. Place and compact backfill in accordance with the Standard Specifications for Excavation, Refilling, Grading, Landscaping and Repaving, except as herein modified.

B. Do not place backfill around any structure requiring time to gain strength (e.g., masonry or concrete), until so directed by Owner/Authorized Representative.

C. Place Ordinary Backfill up to three feet (3') below subgrade elevation in all sewer trenches and sewer manholes to be abandoned. Place Select Backfill Material-2RC for three feet (3') below subgrade elevation in all sewer trenches and sewer manholes to be abandoned.

D. Compact backfill around and to a depth of six inches (6") over pipes and fittings by hand tamping. Compact all other backfill in eight-inch (8") layers by mechanical tamping. Puddling is prohibited.

E. When backfill has been placed to three feet (3') below street surface or finish grade, cut off and remove sheathing and shoring (including soldier beams) two feet (2') below street surface or finish grade. All sheathing and shoring shall be removed in its entirety from excavations for infiltration facilities (tree trenches, basins, etc.).

3.7 CLEANING PIPELINES

A. As pipe laying progresses and at the conclusion of the work thoroughly clean all new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If, after this cleaning, obstructions remain, they shall be removed prior to approval and acceptance of the pipe by Owner/Authorized Representative.

3.8 REPAVING

A. Restore all disturbed paving, curb, and grass areas in accordance with specifications section 32 1601 Concrete Curbs, Sidewalks and Roadway Repair and as required elsewhere in the Contract Documents.

- END -

SECTION 334007
STORMWATER CONTROL STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

A. The work of this Section consists of the construction of the outflow control structures for stormwater management basins.

B. All materials shall be manufactured, supplied, stored and placed according to the latest referenced standards and as outlined herein.

1.02 RELATED DOCUMENTS

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

1.03 SUBMITTALS

A. Submit complete shop drawings and product information for all items to be furnished under this Section upon receipt of notice to proceed and prior to construction.

B. Certificates of Compliance: Before installation of any Precast Concrete Products, submit an acceptable Certificate of Compliance to Owner/Authorized Representative

C. Submit a list of materials to be provided for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.

D. Submit certificates, signed by the materials producer, stating that materials meet or exceed the specified ASTM and ACI requirements

E. Submit detailed diagrams of all outflow structure depicting dimensions and materials used to construct the entire structure. Indicate knockout elevations and size for all pipe entering manhole structures or other concrete structures.

1.04 QUALITY ASSURANCE

A. All materials, methods of construction, and workmanship shall conform to applicable requirements of ASTM, PTM, PWD, PennDOT Standard Specifications and AASHTO Standards, unless otherwise specified.

PART 2 - PRODUCTS

2.01 MANHOLE COVER AND FRAME

A. Manhole frame and cover shall be in accordance with PennDOT Publication 72M, Roadway Construction Standards RC-39M and PennDOT Publication 408, Section 605.2(b).

2.02 PRECAST CONCRETE TOP UNIT, GRADE ADJUSTMENT RINGS, AND INLET BOX

A. In accordance with PennDOT Publication 408, Section 605.

2.03 CATCH BASIN TRAP

A. Provide Catch Basin Trap Number R-3711 manufactured by Neenah Foundry Inc. or Philadelphia Water department (PWD) approved alternative.

PART 3 - EXECUTION

3.01 GENERAL CONDITIONS

A. During construction, the contractor must ensure that a copy of the Approved Post-Construction Stormwater Management Plan (PCSMP) and Erosion and Sediment Control (E&S) Plan are available on-site at all times.

B. Prior to any earth disturbance activities, a preconstruction meeting must be held. All parties including, but not limited to, the property owner's representative, the design professional, the contractor, the PWD Inspector, and state and municipal authorities are required to attend. As part of the preconstruction meeting, a time table for the project's construction sequence stages must be provided. The PWD Inspector must be contacted at least seven (7) days prior to the date of the preconstruction meeting to ensure that appropriate staff can be present. If at least seven (7) days' notice is not provided, PWD cannot guarantee that the preconstruction meeting will be held on the requested date. Further, earth disturbance activities should not commence until the preconstruction meeting is held.

C. The PWD Inspector must be notified at least three (3) days prior to the start of construction of any SMP elements. If the required notice is not provided, the project site may be subject to the enforcement actions outlined in the Stormwater Regulations. Any SMP, or portion of a SMP, that is constructed without prior notice to PWD or without the PWD Inspector present on-site may be required to be removed and reconstructed.

3.02 CONSTRUCTION CERTIFICATION PACKAGE

A. Contractor shall complete, fill out, report, sign, and date all information required in the Construction Certification Package at the time of each element's installation.

B. The Construction Certification Package and all supplementary documentation required by the forms must be submitted to PWD along the the project's record drawings once construction is completed. The measurements/specifications required to be documented on the SMP Construction Certification Package must be reflected on the project's Record Drawings.

C. Additional documentation may be deemed necessary by PWD staff on a project-specific basis.

3.03 INSTALLATION OF OUTFLOW STRUCTURES

A. Install in accordance with PennDOT Publication 408, Section 605.

- END -

SECTION 334009
CONNECTIONS TO EXISTING STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. The Work described in this Section shall include all materials, labor, equipment and incidentals required to make connections to structures from stormwater conduit piping as shown on the drawings. All orifice, underdrain, distribution, or other piping that connects to a structure shall have the connection constructed per these Specifications.

1.2 REFERENCES

A. ASTM C 109, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50 mm Cube Specimens).
B. ASTM D 638, Test Method for Tensile Properties of Plastics.
C. ASTM D 695, Test Method for Compressive Properties of Rigid Plastics.

1.3 SUBMITTALS

A. Before starting this work, submit for approval of Owner/Authorized Representative, manufacturer's literature describing Epoxy Mortar Gel and Epoxy Bonding Agent. Literature must address each requirement (e.g. Compressive Strength per ASTM C109) as specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The following products are acceptable as Epoxy Mortar Gel, provided they continue to meet all requirements:

1. Meta Bond HM Gel, as manufactured by American Meta Seal Company, 509 Washington Avenue, Carlstadt, NJ 07072.
2. Sikadur 31 Hi-Mod Gel, as manufactured by Sika Corporation, Box 297, Lyndhurst, NJ 07071.
3. Thermal-Chem Mortar Resin Gel (Product No. 304), as manufactured by Thermal-Chem, Inc., 1400 Louis Avenue, Elkgrove, IL 60007.
4. Approved equivalent product.

B. The following products are acceptable as Epoxy Bonding Agent, provided they continue to meet all requirements.

1. Meta Bond HM, or Meta Bond HM Gel, as manufactured by American Meta Seal Company.
2. Sikastix 370, Sikadur Hi-Mod, or Sikadur 31 Hi-Mod Gel, as manufactured by Sika Corporation.
3. Thermal-Chem Mortar Resin (Product No. 3), or Thermal-Chem Mortar Resin Gel (Product No. 34), as manufactured by Thermal-Chem, Inc.
4. Approved equivalent product.

2.2 MATERIALS

A. Epoxy Mortar Gel shall:

1. Be a 100% solids formulation.
2. Have a Tensile Strength per ASTM D 638 not less than 3000 psi after 7 days at 73 degrees F.
3. Have a Tensile Elongation per ASTM D 638 not over 7%.
4. Have a Compressive Strength per ASTM D 695 not less than 3000 psi after 24 hours at 73 degrees F, and not less than 6000 psi after 7 days at 73□F.

B. Sand shall:

1. Be oven-dry silica sand.
2. Have at least 70% by weight pass #20 sieve.
3. Have not over 35% by weight pass #40 sieve.

C. Epoxy Bonding Agent shall meet the requirements for Epoxy Mortar Gel.

2.3 MIXES

A. Epoxy Mortar shall consist of Epoxy Mortar Gel and Sand mixed at a 1:1 ratio by loose volume.

PART 3 - EXECUTION

3.1 MAKING CONNECTION

A. Make hole(s) in existing structure as necessary to permit connection. Core through existing concrete structures and cut reinforcing as necessary. Remove all dirt, laitance, and other loose or undesirable material from mating surfaces. Check hole(s) for fit.

B. Comply fully with manufacturer's instructions. Coat mating surfaces with Epoxy Bonding Agent and set pipe. Seal all openings with Epoxy Mortar. Support pipe securely to prevent movement and protect for at least 24 hours.

- END -

SECTION 33 4201
STORMWATER GRAVITY PIPING AND INLETS

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. This section includes all materials and appurtenant work necessary to furnish and install solid and perforated corrugated high density polyethylene (HDPE), polypropylene (PP) pipe, polyvinyl chloride (PVC) pipe, Cast Iron Pipe (CIP), Ductile Iron Pipe (DIP), and/or structures and appurtenances as shown on the Drawings and as specified herein.

1.2 REFERENCE STANDARDS

A. All sewer work in the public right-of-way under this contract shall be governed by, and done in accordance with the most recent revision or amendment to the Standard Specifications and Standard Details of the Philadelphia Water Department, including the following:

1. Standard Details and Standard Specifications for Sewers.
2. Standard Specifications for Excavation, Refilling, Grading, Landscaping and Repaving.
3. Standard Specifications for Masonry: Concrete.
4. Standard Specifications for Masonry: Stone and Brick.

B. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO M-252 - Standard Specification for Corrugated Polyethylene Pipe (4-in to 10-in)
2. AASHTO M-294 - Standard Specification for Corrugated Polyethylene Pipe (12-in to 36-in)

C. The Standard Detail for Saddle Connection to RC Pipe Sewers is hereby modified so that the openings for the lateral connections shall be core drilled and rubber saddles shall be substituted in place of clay saddles. The 2000 psi concrete encasement around the saddle shall be extended to the cradle of sewer as shown in the Detail for Resilient Saddle Connection to RC Pipe Sewers affixed to the end of these specifications.

D. PennDOT Publication 72M, Roadway Construction Standards and PennDOT publication 408, Section 605.

E. All materials and workmanship shall conform to the most recent revision or amendment to the following standards, except as modified by the Contract Documents:

1. ASTM C 94, Standard Specification for Ready-Mixed Concrete.
2. ASTM C 890, Standard Practice for Installation of Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

1.3 SUBMITTALS

A. Submit complete shop drawings and product information for all items to be furnished under this Section upon receipt of notice to proceed and prior to

construction.

B. Certificates of Compliance: Before installation of any Precast Concrete Products, submit an acceptable Certificate of Compliance to Owner/Authorized Representative

C. Submit a list of materials to be provided for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.

D. Submit certificates, signed by the materials producer, stating that materials meet or exceed the specified ASTM and ACI requirements

E. Submit detailed diagrams of all outflow structure depicting dimensions and materials used to construct the entire structure. Indicate knockout elevations and size for all pipe entering manhole structures or other concrete structures.

1.4 REGULATORY REQUIREMENTS

A. Traffic Control: Maintain access of and protection for vehicular and pedestrian traffic as required for construction activities in accordance with local regulations.

B. Contractor shall obtain all necessary City of Philadelphia Streets Department road opening permits and approvals, Philadelphia Water Department Connection permits and approvals and City of Philadelphia Department of Licenses and Inspections permits and approvals, upon the Contractor receiving Notice to Proceed and prior to proceeding with the Work.

1.5 QUALITY ASSURANCE

A. All materials, methods of construction, and workmanship shall conform to applicable requirements of ASTM, PTM, PennDOT Standard Specifications and AASHTO Standards, unless otherwise specified.

B. HDPE pipe shall be furnished by a manufacturer / facility that is certified by the National Transportation Product Evaluation Program (NTPEP). The pipe shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with this section.

C. All pipe, fittings, cleanout covers, domed riser covers, and other products shall be installed to ensure a minimum loading capacity in accordance with H-20 loading, as required by Philadelphia Department of Streets. Any deviation from manufacturer’s specifications for product installation (without approval by manufacturer or signed and sealed statement of adequacy by Professional Engineer) is prohibited.

PART 2 - PRODUCTS

2.1 BACKFILL

A. Ordinary Backfill Material may include all material excavated from the trench and free of objectionable matter, unless rejected by the Owner/Authorized Representative. The Contractor shall furnish any deficiency of Ordinary Backfill Material.

B. Furnish Select Backfill Material in accordance with PennDOT Publication 408 Specifications, Section 703.3, Select Granular Material-2RC (as amended). The use of slag as Select Backfill Material is hereby prohibited.

2.2 CORRUGATED HDPE OR PP PIPE AND PVC PIPE AND FITTINGS

A. Corrugated HDPE or PP pipe shall have an annular corrugated exterior and smooth inner wall. Pipe shall be manufactured by an approved supplier under QC-13.

B. Corrugated pipe shall be high density polyethylene or polypropylene of the size and type as shown on the Drawings, all manufactured by the same company and shall meet or exceed the following specifications as applicable: AASHTO M-252, AASHTO M-294, ASTM F2306, or ASTM F2881. HDPE pipe shall be ADS ST IB N-12 or approved equal. PP pipe shall be ADS N-12 HP or approved equal.

C. Polyvinyl Chloride Pipe for distribution or drainage piping shall be SDR -35 or ASTM D 3034, Type PSM.

D. Backfilling over the pipe shall be to ASTM D2321 or the pipe manufacturer's specifications. Cover shall be compacted to at least 95 percent of its maximum dry density as determined by ASTM Test D1557, Method D.

E. Joints shall be watertight according to the requirements of ASTM D3212. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

F. Fittings shall be polyvinyl chloride (PVC) or high-density HDPE of the size and type as shown on the Drawings; all manufactured by the same company and shall meet or exceed the following specifications as applicable: AASHTO M-252, AASHTO M-294, ASTM F2306, and/or ASTM D3034. Fittings shall have bell and spigot connections that utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of ASTM D3212. Fittings shall be manufactured by Nyloplast, ADS, or approved equal.

G. Perforated pipe shall have AASHTO Class II perforations. Class II perforations shall be located in the outside valleys of the corrugations, be circular and/or slotted, and evenly spaced around the circumference and length of the pipe. The opening area shall be no less than 0.945 square inches per linear foot (pipe diameters 4 through 10-inches).

2.3 RUBBER SADDLES

A. Rubber Saddles for Lateral Connections to RC Pipe Sewers shall be manufactured from a blend of rubber that is laboratory tested and appropriate for sewer applications.

B. Pipe clamps and expansion rings shall be Type 304 Stainless Steel.

C. Rubber Saddles shall provide a watertight connection and be compatible with ASTM C-923.

2.4 GRAY (CAST) IRON DRAINAGE PIPE

A. All gray iron pipe shall be manufactured and tested in accordance with ASTM A 74 Standard specification for Cast Iron soil pipe and fittings

B. Pipes shall have a nominal laying length of 5 feet and 10 feet for all size diameters

C. Pipe shall conform to the Standard Specifications for Gray and Ductile Iron Pipe of PWD.

2.5 INLET GRATE AND FRAME

A. Inlet frame and structural steel bicycle safe grate shall be in accordance with PennDOT Publication 72M, Roadway Construction Standards RC-45M and PennDOT Publication 408, Section 605

2.6 PRECAST CONCRETE TOP UNIT, GRADE ADJUSTMENT RINGS, AND INLET BOX

A. Concrete top unit type M shall be In accordance with PennDOT Publication 72M, Roadway Construction Standards RC-45M and PennDOT Publication 408, Section 605.

B. Grade adjustment rings shall be in accordance with PennDOT Publication 72M, Roadway Construction Standards RC-45M and PennDOT Publication 408, Section 605.

C. Concrete inlet box shall be in accordance with PennDOT Publication 72M, Roadway Construction Standards RC-46M and PennDOT Publication 408, Section 605.

2.7 PWD INLET TRAP

A. Provide Standard Catch Basin Trap Number 2563 manufactured by Campbell Foundry Company, R-3711 manufactured by Neenah Foundry Inc. or approved alternative.

2.8 4” FRESH AIR INLET

A. Contractor to furnish and install L&I approved vent covers.

B. All work and materials to be in accordance with the City of Philadelphia Streets Department standard construction items, Philadelphia plumbing code and PWD sewer service detail.

2.9 CONCRETE MIX

A. Concrete for sewer lateral connection to be in accordance with PennDOT Publication 408, Section 704 Class C Concrete.

2.10 AREA DRAIN

A. Provide area drain as indicated on the design plans or approved equal.

B. Grate to be provided with H-20 vehicle loading.

C. Size of grate opening and orientation to meet the requirements of the American Disability Act.

2.11 OBSERVATION WELLS

A. Observation wells shall be four-inch (4”) inside diameter rigid Schedule 40 PVC pipe in upper section, with solid cap.

B. Slotted sections shall be four-inch (4”) PVC slotted well with 0.01 slots and attached plug. Atlantic Screen and Manufacturing Item # OE540400 or approved equivalent.

C. Covers for observation wells shall be lockable ductile iron with gray iron frames, East Jordan Ironworks product #00157024R or approved equivalent. Cover and/or frame shall be stamped “OBS WELL”.

D. Aggregate fill around observation wells shall be consistent with surrounding aggregate.

2.12 DETECTABLE UNDERGROUND TAPE

A. Detectable Warning Tape shall be six inches wide (6”), 5-mil thickness, with aluminum foil core. Tape shall be printed with an appropriate legend (“Caution: Buried Storm Sewer Below” or as approved) and shall conform to the color standards of the APWA for buried utilities (green for sewer).

2.13 PERMANENT INLET PROTECTION

A. Permanent inlet protection shall be installed in all inlets, the permanent inlet protection for all grate inlets shall be the Gratemaster Permanent Inlet protection Type A (a division of ACF Environmental) or approved equal.

B. Permanent inlet protection shall have the following properties (minimum):

1. Sediment Bag
    a. Flow rate: 200 gallons per minute per square foot (gpm/sqft)
    b. AOS: 20 (sieve size)
    c. Puncture Strength: 135 pounds
    d. Filtration Efficiency: 82%
2. Frame
    a. Stainless steel construction
    b. Integral lifting points

PART 3 - EXECUTION

3.1 GENERAL CONDITIONS

A. During construction, the contractor must ensure that a copy of the Approved Post-Construction Stormwater Management Plan (PCSMP) and Erosion and Sediment Control (E&S) Plan are available on-site at all times.

B. Prior to any earth disturbance activities, a preconstruction meeting must be held. All parties including, but not limited to, the property owner’s representative, the design professional, the contractor, the PWD Inspector, and state and municipal authorities are required to attend. As part of the preconstruction meeting, a time table for the project’s construction sequence stages must be provided. The PWD Inspector must be contacted at least seven (7) days prior to the date of the preconstruction meeting to ensure that appropriate staff can be present. If at least seven (7) days’ notice is not provided, PWD cannot guarantee that the preconstruction meeting will be held on the requested date. Further, earth disturbance activities should not commence until the preconstruction meeting is held.

C. The PWD Inspector must be notified at least three (3) days prior to the start of construction of any SMP elements. If the required notice is not provided, the project site may be subject to the enforcement actions outlined in the Stormwater Regulations. Any SMP, or portion of a SMP, that is constructed without prior notice to PWD or without the PWD Inspector present on-site may be required to be removed and reconstructed.

3.2 MAINTENANCE AND PROTECTION OF TRAFFIC DURING CONSTRUCTION

A. Maintain and protect traffic during construction as required elsewhere in these Contract Documents.

3.3 EXCAVATING

A. Excavate in accordance with the Standard Specifications for Excavation, Refilling, Grading, Landscaping, and Repaving. Excavation will not be classified, whether by type of material encountered, or by type of equipment required.

B. Use sheathing and shoring sufficient to avoid damage to or settlement of adjacent buildings, paving, and underground structures.

C. Protect from damage and provide adequate temporary support for all existing underground facilities, except those known to be abandoned. Repair any damage to existing underground facilities due to Contractor's operations without charge to the Owner.

D. Use of a Hydro-Hammer or similar equipment for breaking existing paving is hereby prohibited.

3.4 CONSTRUCTION CERTIFICATION PACKAGE

A. Contractor shall complete, fill out, report, sign, and date all information required in the Construction Certification Package at the time of each element’s installation.

B. The Construction Certification Package and all supplementary documentation required by the forms must be submitted to PWD along the the project’s record drawings once construction is completed. The measurements/specifications required to be documented on the SMP Construction Certification Package must be reflected on the project’s Record Drawings.

C. Additional documentation may be deemed necessary by PWD staff on a project-specific basis.

3.5 DEBRIS GRILLS

A. Take great care when breaking the sewer crown to prevent debris from being washed down the sewer.

B. At the end of each work day, cover the open end of the sewer with a metal debris grill to prevent debris from being washed down or thrown into the sewer during non-work hours. At the beginning of each work day, remove all accumulated debris before removing the debris grill.

C. Employ a rigid, portable metal debris grill which is sufficiently strong to withstand the impact of any debris which may be washed down stream or thrown against it. Openings shall be 3" x 3".

D. During working hours, prevent any debris, construction material, or equipment from being washed down the sewer. Remove any such material from the sewer without charge. Use debris grill during working hours when feasible.

3.6 INSTALLATION OF INLETS

A. Install inlets in accordance with manufacture's specifications and PennDOT Publication 408, Section 605.

B. Construct inlet connections in accordance with the 1985 Standard Details and Standard Specifications for Sewers, and the Contract Plans and Special Specifications.

C. All inlets shall be constructed to provide positive drainage. All associated pavement restoration shall be sloped inwards towards the inlet, and the inlet grate or throat as appropriate shall be slightly below the surrounding paving surface. No inlet may be constructed such that its function is restricted, and the Owner/Authorized Representative reserves the right to refuse payment on any inlet that does not provide positive drainage. This may include, but is not limited to, inlets that do not meet the minimum throat opening requirements of four inches (4") after final paving and surfacing is complete, or inlets whose grate is higher than the surrounding paving surface.

3.7 PERMANENT INLET PROTECTION

A. All stormwater inlets that are directly connected with and tributary to subsurface stormwater storage units shall be protected with both temporary and permanent measures as specified above

B. Installation of permanent inlet protection shall be in accordance with the manufacturer's recommended installation procedures.

C. Permanent inlet protection shall not take the place of temporary inlet protection in any case. Inlets to subsurface stormwater units (to receive permanent inlet protection) shall remain fully closed to runoff until final site cleanup. Cleaning of green inlets as part of final site cleanup shall include opening of the inlet to accept runoff as well as cleaning any installed permanent inlet protection devices.

3.8 INSTALLATION OF PIPES

A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than one-sixteenth of an inch (1/16") per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site.

B. All pipe shall be examined before laying and no piece shall be installed which is found to be defective.

1. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required. HDPE pipe and fittings shall be installed in accordance with ASTM D2321 and the requirements of the manufacturer (see "Corrugated HDPE Pipe Installation Guide" from ADS), or as otherwise provided herein or on the Drawings.

C. After the excavation is complete to normal grade of the bottom of the trench and bottom preparation according to the Drawings and Specifications is completed, crushed stone bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid diameter and hand tools shall be used to force the bedding where needed to give firm continuous support for the pipe. AASHTO #57 aggregate shall then be placed to twelve inches (12") above the top of the pipe. Detectable underground utility marking tape shall be installed over all pipe not otherwise marked (see Section 02709 for pipe within a stone storage trench). The initial three feet (3') of backfill above the bedding shall be placed in one-foot (1') layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial three feet (3') of backfill shall be approved by the pipe manufacturer's representative prior to use.

D. All piping shall be sound and clean before installation. When installation is not in progress for any length of time, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer.

E. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

F. Precautions shall be taken to prevent flotation of the pipe in the trench.

G. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below the top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, crushed stone shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe

H. The use of ninety-degree (90°) bend pipe fittings is not permitted in the installation of piping. The Contractor shall use minimum-angle fittings to construct the pipe layout diagrammatically shown in the Drawings. The maximum fitting angle approved for use is forty-five-degrees (45º), and fittings of lesser angles (22½° or 11¼°) are preferred for use where practical

3.9 BACKFILLING AND COMPACTING PIPES

A. Place and compact backfill in accordance with the Standard Specifications for Excavation, Refilling, Grading, Landscaping and Repaving, except as herein modified.

B. Do not place backfill around any structure requiring time to gain strength (e.g., masonry or concrete), until so directed by the Owner/Authorized Representative.

C. Place Ordinary Backfill up to three feet (3') below subgrade elevation in all sewer trenches and sewer manholes to be abandoned. Place Select Backfill Material-2RC for three feet (3') below subgrade elevation in all sewer trenches and sewer manholes to be abandoned.

D. Compact backfill around and to a depth of six inches (6”) over pipes and fittings by hand tamping. Compact all other backfill in eight-inch (8”) layers by mechanical tamping. Puddling is prohibited.

E. When backfill has been placed to three feet (3’) below street surface or finish grade, cut off and remove sheathing and shoring (including soldier beams) two feet (2’) below street surface or finish grade.

3.10 OBSERVATION WELLS

A. Observation wells are typically placed within a subsurface stormwater structure. The well shall be placed in a location similar to that shown on the Drawings.

B. The well location shall be over-excavated twelve inches (12”) below the depth of the surrounding stormwater structure. This excavation shall be performed by hand, so as not to disturb the surrounding soils.

C. The slotted section of well shall be placed into the over-excavation, with the attached plug at the bottom. A minimum of six inches (6”) separation shall be maintained between the top of the slotted well section and the top of the subsurface stormwater structure. Well section length shall be field-adjusted to maintain this separation.

D. The over-excavation and area surrounding the well within the subsurface stormwater structure shall be backfilled with the same material as the stormwater structure (typically AASHTO #57 stone).

E. The well section from the slotted section ending six inches (6”) below the top of the stormwater structure to the top of the well within the cover shall be four-inch (4”) solid Schedule 40 PVC, attached to the slotted section by mechanical means (not PVC cement alone).

F. The area surrounding the solid well section shall be restored in kind with the adjoining area over the subsurface stormwater structure. Any geotextile wrap separating the stormwater structure from the covering fill shall be cut and wrapped six inches (6”) up the solid well section.

G. The well cover shall be installed within the surface restoration as required, such that the cover plate is flush with the surrounding surface.

H. The solid well section shall extend into the cover frame enough such that a bentonite seal can be placed around the well within the frame, and a solid slip-on cap can be fitted onto the pipe end.

3.11 AREA DRAIN

A. The installation of the area drains to be in accordance with the manufactures specifications.

3.12 CLEANING PIPELINES

A. As pipe laying progresses and at the conclusion of the work thoroughly clean all new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If, after this

cleaning, obstructions remain, they shall be removed prior to approval and acceptance of the pipe by Owner/Authorized Representative.

3.13 REPAVING

A. Restore all disturbed paving, curb and grass areas as required elsewhere in the contract documents.

- END -

SECTION 334726
SUBSURFACE STORMWATER STORAGE

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION

A. In general, the work to be done under this section consists of construction activities pertaining to subsurface stormwater storage, including but not limited to earthwork and excavation, protection of existing features, preparation of subgrade, grading, sheathing and shoring, placement and compaction of clean stone, construction of stone and/or modular stormwater storage structures, installation of geotextiles and impermeable liners, connection of distribution and drainage piping, backfilling, and any incidental and related operations.

B. The installation of the Modular storage units shall include any necessary bedding or subgrade preparation not otherwise accounted for, any observation or maintenance ports integral to the modular system, all interfaces required for piping, waterstops, geogrid and geotextile installation, onsite assembly of modular units, and furnishing and installing any additional fittings or appurtenant materials necessary to complete installation of the modular stormwater storage system.

1.2 REFERENCE STANDARDS

A. The following apply to work in this section:

B. ASTM: Specifications of the American Society for Testing and Materials latest editions. Modifications specified herein shall govern where conflicts with ASTM standards occur.

C. PennDOT: Publication 408 current edition of the Commonwealth of Pennsylvania Department of Transportation Specifications.

D. AASHTO: American Association of State Highway and Transportation Officials, current published standards.

E. PTM: Pennsylvania Test Methods, current published standards.

F. APWA: American Public Works Association, Uniform Color Code.

G. PWD: Philadelphia Water Department Stormwater Management Guidance Manual, latest version

1.3 SUBMITTALS

A. Submit a list of materials to be provided for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.

B. Submit certificates, signed by the materials producer, stating that materials meet or exceed the specified requirements. In addition, submit the following:

1. Aggregate: sieve analysis
2. Non-woven geotextile: product manufacturer and specification sheets
3. Impermeable liner (if required): product manufacturer and specification sheets
4. Modular stormwater storage units: product manufacturer and specification sheets, installation instructions and maintenance guidelines.

C. Submit samples of coarse aggregates and sand.

1. Aggregate and sand: Samples of loose material in sealed bag labeled with name of material and manufacturer to be submitted for analysis by owner. Quantity of sample by weight shall be in accordance with ASTM standards.
2. Sub-surface stormwater storage modules; provide a single unit, height as specified in the contract drawings to be reviewed and retained by owner.

1.4 QUALITY ASSURANCE

A. All materials, methods of construction, and workmanship shall conform to applicable requirements of ASTM, PTM, PennDOT Standard Specifications and AASHTO Standards, unless otherwise specified.

B. Upon completion of relevant excavation work, and prior to placement of geotextile and aggregate, subgrade soil shall be inspected by owner or authorized representative. Survey or acceptable measurement by the Contractor shall verify the finished subgrade elevation in accordance with the construction plans.

C. Upon completion of placement of subgrade storage (stone fill or as otherwise specified) and geotextile, and prior to backfilling or surface restoration, the structure shall be inspected by owner or authorized representative. Survey or acceptable measurement by the Contractor shall verify the finished elevation(s) of the subsurface stormwater trench in accordance with the construction plans.

1.5 DELIVERY STORAGE AND HANDLING

A. Deliver, store, and handle all materials to ensure protection from damage.

B. All plastic wrapping from the packaging should be removed and the units should be stored under a tarp or roof where they are protected from weather.

C. If stored for an extended period of time, additional measures should be taken to prevent UV and weather damage

D. Stored components should be checked at least once a week. A check of the stored area should be done to make any minor repairs to the cover or to restack any components that could have fallen over.

PART 2 - PRODUCTS

2.1 AGGREGATE

A. Coarse aggregates shall meet the following requirements:

1. Maximum wash loss of 0.5% by mass (AASHTO T-11)

2. Minimum Durability Index of 35 (ASTM D3744)
3. Maximum abrasion of 10% for 100 revolutions and maximum of 50% for 500 revolutions
4. All aggregate shall be clean and thoroughly washed.
5. Aggregate shall be 100% crushed material.

B. Unless otherwise approved by PWD, coarse aggregate for the stormwater trenches shall be uniformly graded as defined in Standard Sizes of Coarse Aggregate, Table 4, AASHTO Specifications, Part I, 19th Ed., 1998, or latest edition, unless otherwise specified.

1. Grading Requirements for AASHTO No. 57

U.S. Standard Sieve Size	Percent Passing
1 ½"(37.5 mm)	100
1" (25 mm)	95-100
½ " (12.5 mm)	25-60
No. 4 (4.75 mm)	0-10
No. 8 (2.36 mm)	0-5

3. Any and all other specified coarse aggregates shall conform in gradation and type to the current standards of PennDOT Publication 408, Section 703 Table C.

C. Crushed concrete shall not be an acceptable substitute for coarse aggregate.

2.2 SAND

A. Sand if used or required by the modular manufacture to line the bottom of stormwater trenches shall be AASHTO M-6 or ASTM C-33 and have a grain size of 0.02 inches to 0.04 inches.

B. Sand shall not be an acceptable substitute for coarse aggregate

2.3 GEOTEXTILES

A. Non-woven geotextile (drainage filter fabric) minimum 6 oz.

1. Must consist of polypropylese fibers
2. AASHTO Class 1 or Class 2
3. Minimum flow rate: 95 gal/min/ft² (ASTM D-4491)
4. Minimum grab tensile strength: 120 lbs (ASTM D-4632)
5. Minimum Mullen Burst Strength: 225 psi (ASTM D-3786)
6. Minimum CBR puncture strength: 300 psi (ASTM D-6241)
7. Minimum tear resistance: 50 lbs (ASTM D-4533)
8. Minimum UV resistance after 500 hrs: 70% retained strength (ASTM D-4355)
9. Heat-set or heat-calendared fabrics are not permitted.

B. Impermeable liner if used shall be 40 mil thick high density polyethylene geomembrane designed specifically for flexible geomembrane applications. Geomembrane liner shall be GSE Lining Technology product # HDE 040A000 or approved equivalent.

1. Minimum average thickness 40 mil (mm) (ASTM D 5199)

2. Density 0.94 g/cm^3 (ASTM D 1505)
3. Strength at break 152 lb/in-width
4. Strength at yield 84 lb/in-width
5. Elongation at break 700%
6. Elongation at yield 12%
7. Tear resistance 28 lb (ASTM D 1004)
8. Puncture resistance 72 lb (ASTM D 4833)
9. Carbon black content 2% (ASTM D 5596)
10. Notched constant tensile load 300 hr (ASTM D 5397, Appendix)

C. Geotextiles and geogrids associated with modular stormwater systems shall be as specified by the manufacturer.

2.4 PERFORATED HDPE PIPE

A. Pipe within the subsurface infiltration SMP Shall meet the following:

1. Continuously perforated with a smooth interior.
2. The specifications of AASHTO M252, Type S or AASHTO M294, Type S.

2.5 BACKFILL MATERIALS

A. Ordinary Backfill Material may include all material excavated from the trench and free of objectionable matter, unless rejected by PWD or authorized representative. The Contractor shall furnish any deficiency of Ordinary Backfill Material.

B. Select Backfill Material shall be furnished where specified in accordance with PennDOT Publication 408 Specifications, Section 703.3, Select Granular Material-2RC (as amended). The use of slag as Select Backfill Material is hereby prohibited.

2.6 WATERSTOPS

A. Waterstops (or antiseep collars) if required shall be quarter-inch (¼") HDPE sheets cut to the dimensions indicated and installed per the Drawings. All metal fittings or attachments used shall be nylon or stainless steel (Grade 304 or better). Plastic sealant for weld shall be as suggested by manufacturer.

2.7 DETECTABLE UNDERGROUND TAPE

A. Detectable Underground Utility Warning Tape shall be six inches wide (6"), 5-mil thickness, with aluminum foil core. Tape shall be printed with an appropriate legend ("Caution: Buried Storm Sewer Below" or as approved) and shall conform to the color standards of the APWA for buried utilities (green for sewer).

2.8 MODULAR STORMWATER STORAGE SYSTEMS

A. Modular Stormwater Storage Systems shall be as indicated on the Drawings. Fittings, installation, and appurtenant materials (geogrids, geotextiles, etc) shall be as specified by the manufacturer.
1. ACO StormBrixx - SD or Approved equal

B. The sub-surface stormwater storage system modules under the required 2.0 ft. cover must withstand, at a minimum live loading consisting of the design truck (HS-20) loading in accordance with AASHTO LRFD Bridge Design Requirements, without geogrid.

C. The Modular storage units must have a 93.9% void space.

PART 3 - EXECUTION

3.1 GENERAL CONDITIONS

A. During construction, the contractor must ensure that a copy of the Approved Post-Construction Stormwater Management Plan (PCSMP) and Erosion and Sediment Control (E&S) Plan are available on-site at all times.

B. Prior to any earth disturbance activities, a preconstruction meeting must be held. All parties including, but not limited to, the property owner's representative, the design professional, the contractor, the PWD Inspector, and state and municipal authorities are required to attend. As part of the preconstruction meeting, a time table for the project's construction sequence stages must be provided. The PWD Inspector must be contacted at least seven (7) days prior to the date of the preconstruction meeting to ensure that appropriate staff can be present. If at least seven (7) days' notice is not provided, PWD cannot guarantee that the preconstruction meeting will be held on the requested date. Further, earth disturbance activities should not commence until the preconstruction meeting is held.

C. The PWD Inspector must be notified at least three (3) days prior to the start of construction of any SMP elements. If the required notice is not provided, the project site may be subject to the enforcement actions outlined in the Stormwater Regulations. Any SMP, or portion of a SMP, that is constructed without prior notice to PWD or without the PWD Inspector present on-site may be required to be removed and reconstructed.

D. Coordinate the installation with the product distributor, to have the distributor on-site during product installation.

E. Review manufacture's installation procedures and coordinate Sub-surface stormwater storage system installation with other work affected, such as grading, excavation, utilities, construction access, erosion control, etc.

F. Cold weather installation or assembly of modules should not be undertaken when temperatures are below 40°F, without utilization of a heated facility.

G. Assembled modules may be walked on, but vehicle traffic if prohibited until properly backfilled and covered per Manufacturer's recommendations. Protect personnel and the installation against damage with highly visible construction tape, fencing or other means until construction is complete.

3.2 EXCAVATION BELOW GRADE

A. Subgrade shall be unfrozen, firm, and stable with no standing water, mud, or muck. If the Contractor fails to maintain the subgrade properly, the Contractor shall remove the unsuitable material at no additional cost to owner. If the bottom of any excavation is taken out below the limits shown on the Drawings, it shall be restored at the Contractor's

expense with six-inch (6”) layers of AASHTO #57 aggregate to the elevations shown in the Drawings. Compacted earthen fill is not acceptable.

B. If in the opinion of owner or authorized representative the undisturbed natural subgrade, at or below the normal grade of the excavation as indicated on the Drawings, is unsuitable for construction, it shall be removed to such depth and width as owner or authorized representative may direct and be replaced with suitable material as directed. These activities shall be included in the appropriate lump sum price bid for the related construction activates by location.

C. Excavation of trenches required for the installation of all pipes and structures shall be made to the depths and widths indicated on the Drawings. The Contractor shall render the bottom of the excavations firm and dry and in all respects acceptable to owner or authorized representative. Pavement, when encountered, shall be sawcut along straight lines before excavating.

D. Excavation shall be performed in-the-dry and shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The existing subgrade shall not be compacted or subject to excessive construction equipment prior to placement of geotextile and crushed stone. If it is essential that equipment be used in the excavated area of infiltration facilities, all equipment must be approved by PWD or authorized representative. Use of equipment with narrow tracks or tires, rubber tires with large lugs, or high pressure tires that will cause excessive compaction shall not be permitted within the excavation.

3.3 EXCAVATION SUPPORT

A. Furnish, install, monitor and maintain excavation support (e.g., shoring, sheeting, bracing, trench boxes, etc) as required by Federal, State or local laws, ordinances, regulations and safety requirements. Support the sides of excavation, to prevent any movement which could in any way reduce the width of the excavation below that necessary for proper construction and protect adjacent structures from undermining, settlement or other damage.

B. The Contractor shall take care to prevent the formation of voids outside of sheeting. If voids occur behind sheeting, immediately backfill and compact the voids with AASHTO #57 aggregate. Voids in locations that cannot be properly compacted upon backfilling shall be filled with lean concrete.

C. All excavation supports shall be carefully removed in such manner so as not to endanger the Work or other adjacent structures, utilities, or property. All voids left or caused by withdrawal of supports shall be immediately filled with crushed stone and compacted. No sheeting shall be left in the trench following installation of improvements.

D. No payment will be given for sheeting, bracing, etc, during the progress of the work. All payment for installing, maintaining, and removing sheathing and shoring or any other required excavation support shall be included in the appropriate lump sum price bid for the related construction activites by location.

3.4 CONSTRUCTION CERTIFICATION PACKAGE

A. Contractor shall complete, fill out, report, sign, and date all information required in the Construction Certification Package at the time of each element's installation.

B. The Construction Certification Package and all supplementary documentation required by the forms must be submitted to PWD along the the project's record drawings once construction is completed. The measurements/specifications required to be documented on the SMP Construction Certification Package must be reflected on the project's Record Drawings.

C. Additional documentation may be deemed necessary by PWD staff on a project-specific basis.

3.5 SUBGRADE PREPARATION AND GRADING

A. Subgrade of infiltration beds shall be level: Plus or minus one-half inch (+/- ½") is acceptable as level.

B. Grading shall be performed to the lines and grades shown on the Drawings. All objectionable material encountered within the limits indicated shall be removed and disposed of by the Contractor.

C. In excavation faces, all loose or protruding rocks shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the Drawings or as directed by PWD or authorized representative.

D. Prior to backfill for stone stormwater systems, Double Ring Infiltrometer Testing shall be conducted in one location for each system in accordance with ASTM Standard D 3385: Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer. Test holes shall be located within the limits of the proposed trench excavation and results of the testing shall be submitted to PWD or an authorized representative.

3.6 DISPOSAL OF UNSUITABLE OR SURPLUS MATERIAL

A. Excavated materials that will not be reused shall be removed from the site of the work and disposed of by the Contractor. Disposal of excavated materials shall be included in the appropriate lump sum price bid for the related construction activites by location, and no additional payment shall be made for disposal of excavated materials regardless of class or condition.

B. Excavated material shall be stacked without excessive surcharge on the trench bank and without obstructing free access to utilities, private drives and public rights-of-way. Inconvenience to traffic and abutters shall be avoided as much as possible. Excavated material shall be segregated for use in backfilling as specified or shown on the Drawings, and protected as specified in Section 02270.

3.7 BACKFILL

A. Backfill shall be brought up evenly on all sides in 8-inch maximum lifts (sand layer shall be placed in a single six-inch (6") lift). Each layer of backfill material shall be compacted by rolling, tamping, or vibrating with mechanical compacting equipment or hand tamping. If rolling is employed, it shall be by use of a suitable roller or tractor, being

careful to compact the fill throughout the full width of the trench. Use a pad foot roller for cohesive fill (silts and clay) and a smooth drum roller or vibrating plate for coarse grained fill (sands and gravels). If material is compacted by hand-tamping, there must be at least one laborer tamping for each laborer shoveling material into the trench.

B. Where pipes are laid in off-street easements, the remainder of the trench (one foot (1') or more above the top of the pipe) shall be filled with common fill in layers not to exceed eight inches (8") and compacted by rolling, tamping or vibrating with mechanical compacting equipment. Wherever a loam or gravel surface exists prior to excavations, it shall be removed, conserved and replaced to the full original depth as part of the work unless specified or shown otherwise. In some areas it may be necessary to remove excess material during the clean-up process, so that the ground may be restored to its original level and condition. If the Contractor prefers not to store loam, gravel, or topsoil it shall be replaced with material as specified herein.

C. Where pipes are laid in PennDOT or local roadways or rights-of-way, the remainder of the trench above the crushed stone backfill and up to the bottom of the specified paving or surface restoration shall be backfilled with fill materials as specified on the Drawings. Lifts shall at no time exceed eight inches (8") loose, and compaction shall be in accordance with these specifications. Preparation and paving shall be performed as shown on the Drawings or as specified herein.

3.8 INSTALLATION OF SUBSURFACE STONE STORMWATER TRENCHES

A. Impermeable liner, non-woven geotextile, and/or sand layer shall be placed immediately after approval of subgrade preparation (to include infiltration testing). Subgrades shall not be subject to compaction during excavation or during installation of geotextile and aggregates. Subgrades shall be hand-raked to scarify bottoms of infiltration systems prior to geotextile and aggregate placement. Any accumulation of debris or sediment which has taken place after approval of subgrade shall be removed prior to installation of non-woven geotextile at no extra cost to owner.

B. Geotextile shall be placed in accordance with manufacturer's standards and recommendations. Adjacent strips of geotextile shall overlap a minimum of eighteen inches (18") or per manufacturer specifications, whichever is greater. Secure non-woven geotextile at least four feet (4') outside of trench and take steps necessary to prevent any runoff or sediment from entering the trench.

C. Install coarse aggregate in eight inch (8") maximum lifts. Lightly compact each layer with equipment, keeping equipment movement on storage bed subgrades to a minimum. Install aggregate to grades indicated on the drawings. Install detectable underground utility warning tape at the perimeter of the subsurface stone storage trench on all sides. Once aggregate is backfilled and compacted to grades indicated on the Drawings, geotextile shall be folded over and overlapped on top of the bed to prevent soil intrusion into the aggregate bed.

D. Impermeable liner shall be placed in accordance with manufacturer's instructions and as indicated in the Drawings. All seams and openings in the liner shall be sealed according to manufacturer's recommendations and specifications. Adjacent strips of impermeable

liner shall overlap a minimum of eighteen inches (18”) or per manufacturer specifications, whichever is greater.

E. Where an existing utility lateral or branch main intersects the stone stormwater storage system, a pass-through conduit (utility sleeve) shall be constructed to convey the existing utility. PWD shall review and approve any pass-through conduits for utility lines not indicated on the Drawings, and any utility laterals that may be reconstructed such that a pass-though conduit is not necessary shall be so reconstructed.

1. Pass-through conduits shall be constructed of Schedule 40 PVC pipe of adequate diameter to convey the utility lateral within.
2. Waterstops shall be installed at either end of the pass-through conduit, outside the geotextile wrap of the stone stormwater storage.
3. The conduit shall be of watertight construction, and shall be sealed at either end around the existing pipe with non-shrink grout or sealant.
4. Any pass-through conduits for utilities not indicated on the Drawings found to be necessary upon excavation will be paid at a contingency price.
5. The Contractor shall coordinate sleeving of all existing and intersecting utility lines with the owners/operators of said utility lines.
6. Split Pipe Conduit shall be P6F as manufactured by Conduit Repair Systems or approved equal.

3.9 INSTALLATION OF MODULAR SUBSURFACE STORMWATER STORAGE.

A. Installation procedure as follows shall be followed by the Contractor. The Contractor shall also reference the manufacturer’s installation guidelines, and where any discrepancy exists owner reserves the right to preempt the manufacturer’s installation guidelines as specified herein.

1. Impermeable liner, non-woven geotextile, and/or sand layer shall be placed immediately after approval of subgrade preparation. Subgrades shall not be subject to compaction during excavation or during installation of geotextile and aggregates. In the event of over-compaction of the SMP footprint, the contractor may be required to complete infiltration testing and submit to the owner for final approval of the subgrade. Subgrades shall be hand-raked to scarify bottoms prior to geotextile and aggregate placement. Any accumulation of debris or sediment which has taken place after approval of subgrade shall be removed prior to installation of non-woven geotextile at no extra cost to owner.
2. Geotextile shall be placed in accordance with manufacturer’s standards and recommendations. Adjacent strips of geotextile shall overlap a minimum of eighteen inches (18”) or per manufacturer specifications, whichever is greater. Secure non-woven geotextile at least four feet (4’) outside of trench and take steps necessary to prevent any runoff or sediment from entering the trench.
3. After installation of geotextile as specified above, install base layer of minimum six inches (6”) of AASHTO #57 stone across footprint of modular structure. Compact stone to 75-80% relative density per ASTM D4253, and level as necessary to produce a consistent surface. Subgrade shall be visually inspected and approved prior to continuing installation.
4. Place geotextile fabric and/or impermeable liner if required as specified to full extents of excavation. Geotextile shall be installed per manufacturer’s directions. Geotextile and other liners shall be placed such that seaming shall be minimized.

Additional material to be utilized for wrapping above the structure shall be protected from damage until use. Geotextile used shall be in accordance with modular stormwater unit manufacturer's specifications.

5. Utilize a soluble paint to outline the footprint of the modular units to be placed. Care should be taken to note any connections, observation or maintenance ports, or other irregular units to be placed.
6. Install modules by placing side-by-side, attaching per manufacturer's instructions. Use caution to avoid debris or soil intrusion to the system components.
7. Attach all pipe connections, observation or maintenance ports, pass-through conduits, or other intrusions to the system. No penetrations other than manufacturer approved ports shall be placed in top or bottom panels of the system. Support pipe in trenches and during backfill operations to prevent damage. Pipe Connections should extend into the modular system a minimum of 6".
8. Upon completion of the layer course, wrap geotextile or impermeable liner as specified and backfill around the structure with AASHTO #57 to a minimum of twelve inches (12") width. Side backfill shall be laid in maximum twelve-inch (12") depth lifts and compacted to 75-80% relative density per ASTM D4253. Use caution to avoid damage to the geotextile and other components.
9. Repeat steps 1-6 as necessary to complete the full modular stormwater system.
10. Complete geotextile or liner wrap of system. Add any port connections to surface, ensuring a proper seal with geotextile or liner wrap.
11. Install detectable underground utility marking tape around perimeter of system to mark the area for future utility detection.
12. Prior to final backfilling and surface restoration, the structure shall be inspected by owner or authorized representative. Survey or acceptable measurement shall verify the finished elevations of the storage structure in accordance with the construction plans.
13. Upon approval under the provisions of step 10, install a twelve inch (12") lift of AASHTO #57 stone over the modular system. Compact to a 95% Proctor using vibrating plates or walk-behind non-vibratory rollers (do not use drivable rolling compactors). Driving on modules is prohibited until a minimum twenty-four inches (24") of cover is established.
14. Install remaining cover to a minimum finished cover depth of twenty-four inches (24") as indicated on the plans. Maximum overall depth from surface to invert of system is eleven feet (11'). Complete surface restoration as indicated on the Drawings and as described in Related Work Sections of these specifications.

3.10 INSTALLATION OF ANTISEEP COLLARS (WATERSTOPS)

A. Antiseep collars shall be installed at transitions between stormwater storage areas and surrounding substances as depicted on the Drawings, or as directed by owner/authorized representative. Geotextile or impermeable liners in place at the interface shall be minimally cut to allow for the pass-through section and then sealed within the solid external sheets of the antiseep collar. All fittings and seals shall be installed to manufacturer's specifications for a watertight seal.

B. All antiseep collars shall be placed continuously to form a watertight joint. All bends, corners, and splicing shall be made by standard rubber waterstop fittings or by

vulcanizing. All collars projecting from the side of the joint shall be protected from damage during construction and be free from defects when the concrete on the adjacent side of the joint is poured in place. All waterstops shall be placed in the center of the joint, with 1/2 of the waterstop on each side of the joint.

C. All waterstops shall be placed strictly in accordance with the manufacturer's specifications and requirements.

3.11 CLEANING

A. Perform cleaning during the installation of work and upon completion of the work.

B. Remove from the site all excess materials, debris, and equipment.

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