DIVISION 02

SITEWORK

SECTION 02080
PIPED UTILITIES – MATERIALS AND METHODS

1.00 GENERAL

1.01 SCOPE

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Piped utility demolition.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Metal supports and anchorages.

1.02 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.03 SUBMITTALS

A. Welding certificates.

1.04 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

2.00 PRODUCTS

2.01 JOINING MATERIALS

A. Refer to individual Division 2 piping Sections for special joining materials not listed below.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

D. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

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

F. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

G. Brazing Filler Metals: AWS A5.8, BCuP Series, or BAg1, unless otherwise indicated.

H. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

I. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.

2. CPVC Piping: ASTM F 493.

3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

4. PVC to ABS Piping Transition: ASTM D 3138.

J. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

2.02 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solderjoint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, fullface- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.03 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

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

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.04 IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

B. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure sensitive vinyl type with permanent adhesive.

D. Plastic Duct Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cold-air supply.
2. Yellow: Hot-air supply.
3. Blue: Exhaust, outside, return, and mixed air.
4. Hazardous Material Exhausts: Use colors and designs recommended by ASME A13.1.
5. Terminology: Include direction of airflow; duct service such as supply, return, and exhaust; duct origin; duct destination; and design flow.

E. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

F. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick, polished brass.
2. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

G. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch, unless otherwise indicated.
3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

H. Plastic Equipment Markers: Manufacturer's standard laminated plastic. Use colors and designs recommended by ASME A13.1.

1. Terminology: Match schedules as closely as possible. Include the following:

a. Name and plan number.

b. Equipment service.

c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

2. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

2.05 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

3.00 EXECUTION

3.01 PIPED UTILITY DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 2 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

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

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

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

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 50mm (2 inches) above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. PVC Pipe Sleeves: For pipes smaller than NPS 6.

b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

J. Verify final equipment locations for roughing-in.

K. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.03 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 2 Sections specifying piping systems.

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

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using leadfree solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

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

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.

3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.

6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.04 PIPING CONNECTIONS

A. 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. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.06 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
2. Locate pipe markers on exposed piping according to the following:
   a. Near each valve and control device.
   b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
   c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
   d. At manholes and similar access points that permit view of concealed piping.
   e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 6mm (1/4 inch) high for name of unit if viewing distance is less than 600 mm (24 inches), 13 mm (1/2 inch) high for distances up to 1800 mm (72 inches), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.

2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.07 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.08 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.09 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 02080

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02100
SITE PREPARATION

1.00 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, equipment, plant, tools required to complete:
   - Demolition of existing structures
   - removable of salvage materials
   - clearing of shrubs
   - disposal of resulting trash, waste, timber stumps, and other vegetation.

B. Do not cut down any trees without the approval of the Owner. Secure permit from proper authorities in the transfer and cutting of trees. See drawings for coverage of work involved.

1.02 EXAMINATION OF SITE

Visit the site of the work and examine the premises to fully understand all existing conditions relative to the work. No increase of cost or extension of performance time will be considered for failure to verify and know actual site conditions.

1.03 PERMITS

Secure and pay for all necessary permits needed for the work.

1.04 PROTECTION

Provide adequate measures to protect workmen and passers-by in the areas. Protect adjacent properties and existing facilities on site, persons, shrubs, trees, lawns, structures and utilities therein against harm or damage. Provide surface drainage in a manner to avoid creating nuisance to adjacent areas during the period of construction.

2.00 PRODUCTS

2.01 DISPOSAL OF MATERIALS

A. All salvageable materials shall remain the property of the Owner. Hauling and stacking of salvaged material within a 300 meter radius to Owner's specified storage shall be for the account of the Contractor. However, upon Owner's written instructions, salvageable materials may be disposed of by the Contractor at the Contractor's expense.

B. All debris and other materials resulting from clearing and grubbing work shall be immediately removed from the premises and dumped at sites provided by the Contractor in manner approved by the Architect.

3.00 EXECUTION

3.01 SELECTIVE DEMOLITION

A. The Owner shall be responsible for removal of existing structures on the project site, and for capping all existing utility lines.

B. The Contractor shall be responsible for selective demolition of existing concrete and asphalt for trenching to connect new building to existing utilities. Where existing concrete on ground is to be demolished, remove all existing concrete and other obstructions to a depth of 610 mm (24") below grade

3.02 CLEARING AND GRUBBING

A. Do not uproot or cut down trees unless specifically shown in the plans or as directed by the Owner. Secure permit to cut when necessary.

B. Protect trees indicated in the plans as "trees to be preserved."

C. Cut down trees in manner to avoid damage to trees to be preserved, prevent injury to structures or minimize danger to traffic.

D. Remove tree stumps and roots. Holes left behind shall be filled with suitable material and compacted in accordance with item Section 02200 EARTHWORK.

E. Grub up or clear undergrowth, bushes, vegetation rubbish and all objectionable and dispose in accordance with item 2.01 of this Section.

3.03 REPAIRS:

A. Repair damage done to existing on-site facilities or to property of any person or persons off the premises by reason of the required work for demolition, clearing and grubbing. All expenses arising from the above scope of work shall be at the expense of the Contractor.

END OF SECTION 02100

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02115
SOIL EROSION AND SEDIMENT CONTROL

1.00 GENERAL

1.01 SCOPE

1.02 SUMMARY

A. This Section includes the following:

1. Standard control measures including:

a. Storm structure protection

b. Gravel construction entrance

c. Silt fences

d. Block and gravel inlet protection

2. Temporary Seeding

B. Related Sections include the following:

1. Division 2 Section “Site Clearing & Demolition”

2. Division 2 Section “Earthwork”

3. Division 2 Section “Storm Drainage”

1.03 QUALITY ASSURANCE

A. Perform erosion and sediment control in compliance with applicable requirements of the national and local governing authorities having jurisdiction.

1.04 PRODUCT DELIVERY AND STORAGE

A. Take all required measures to ensure that all materials are protected from damage.

B. Special care shall be exercised during delivery and storage, to avoid damage to the products.

C. All materials shall be delivered and stored within the Contractor’s work limits or in an area approved by the Owner.

2.00 PRODUCTS

2.01 INLET PROTECTION FILTER FABRIC

A. Inlet protection filter fabric shall be a polypropylene filter fabric.

2.02 SILT FENCE

A. Siltation fence shall be a polypropylene filter fabric backed with industrial netting and steel posts.

2.03 TEMPORARY SEEDING

A. Erosion control seeding is required where grading results in sloped greater than 5%.

3.00 EXECUTION

3.01 GENERAL EROSION CONTROL

A. Install construction erosion control features, as indicated on drawings and specifications prior to topsoil stripping, earthwork, and removal of existing vegetation. Keep the disturbance to a minimum.

B. When required at areas sloping more than 5%, start temporary seeding within seven (7) calendar days of the completion of grading on all non paved areas. If adverse weather conditions prevent good germination, repeat seeding until the area is stabilized.

C. Until a disturbed area is stabilized, trap runoff sediment by the use of methods acceptable to governing authorities.

D. Provide erosion controls on slopes and swales traversing, bordering, or leaving the site. Limit the water flow to a non-erosive velocity.

E. Inspect all erosion and sediment control measures immediately after each rainfall and at least daily during prolonged rainfall. Make required repairs immediately.

F. Remove sediment deposits when they reach approximately one half of the height of the barrier. Dispose sediment in a manner that does not result in additional erosion or pollution.

G. The Contractor is responsible for prompt removal and disposal of all rubbish and debris in accordance with the governing authorities.

3.02 SILTATION FENCE

A. Excavate a 6 inch x 6 inch trench along the lower perimeter of slopes along the contract limit line, or as indicated on the site plan. Place excavated material on uphill side of trench for backfilling.

B. Drive 36 inch minimum length posts into the downhill side of trench so that minimum 400 mm (16 inches) of post height is in the ground. If prefabricated silt fence with fabric attached to posts is used, drive stakes so that at least 200 mm (8 inch) of fabric will be buried in the ground.

C. Backfill trench with excavated material so that at least 200 mm (8 inch) of fabric is securely tied into the ground to prevent undermining.

D. Join sections by overlapping fabric between two posts and setting posts simultaneously. Overlap by minimum 760 mm (18 inches).

E. Attach siltation fence securely to 2 inch x 2 inch metal posts spaced no more than 8 inches on center. Secure fence fabric to post with three one inch staples.

3.03 SEEDING

A. Sloping sites with grades of greater than 5% will require temporary seeding to protect runoff and excess soil from draining into adjacent creeks, streams and drainage canals.

3.04 CLEAN UP

A. During the Contract period and at intervals as directed by the Owner's Representative, as erosion, sediment and pollution control procedures are completed, clear the site of all extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 02115

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02160
EXCAVATION SUPPORT SYSTEMS

1.00 GENERAL

1.01 SCOPE

Furnish all materials, labor, equipment, plant, tools required to support excavation against loss of ground or caving embankments.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.
2. Maintenance of shoring and bracing.
3. Removal of shoring and bracing, as required.
4. Underpinning as required to protection the foundations of adjacent buildings that have foundations which will be affected by the new construction. Design of underpinning shall be provided by professional engineer.

B. Types of shoring and bracing systems include, but are not limited to, the following:
1. Steel H-section (soldier) piles.
2. Timber lagging.
3. Steel sheet piles.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Layout drawings for excavation support system and other data prepared by, or under the supervision of, a qualified professional engineer. System design and calculations must be acceptable to local authorities having jurisdiction.

1.05 QUALITY ASSURANCE

A. Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where Project is located, and experienced in providing successful engineering services for excavation support systems similar in extent required for this Project.

B. Supervision: Engage and assign supervision of excavation support system to a qualified professional engineer foundation consultant.

1. Submit name of engaged consultant and qualifying technical experience.

C. Regulations: Comply with codes and ordinances of governing authorities having jurisdiction.

1.06 JOB CONDITIONS

A. Before starting work, verify governing dimensions and elevations. Verify condition of adjoining properties. Take photographs to record any existing settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs, and signed by Contractor and others conducting investigation.

B. Survey adjacent structures and improvements, employing qualified professional engineer, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

C. During excavation, resurvey benchmarks weekly, maintaining accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident.

1.07 EXISTING UTILITIES

A. Protect existing active sewer, water, gas, electricity and other utility services and structures.

B. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuing of services.

2.00 PRODUCTS

2.01 MATERIALS

A. General: Provide adequate shoring and bracing materials which will support loads imposed. Materials need not be new, but should be in serviceable condition.

B. Structural Steel: ASTM A 36 (ASTM A 36M).

C. Steel Sheet Piles: ASTM A 328 (ASTM A 328M).

D. Timber Lagging: Any species, rough-cut, mixed hardwood, nominal 3 inches (75 mm) thick, unless otherwise indicated.

3.00 EXECUTION

3.01 SHORING

A. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.

B. Shoring systems retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of work.

3.02 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Architect.

C. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

D. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

E. Remove sheeting, shoring, and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.

F. Repair or replace, as acceptable to Architect, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

END OF SECTION 02160

Read and accepted as part of the Contract:

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Bidder / Contractor

SECTION 02200
EARTHWORK

1.00 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, equipment, plant, tools required to complete:
- Stripping
- Site grading
- Excavation
- Trenching
- Earthfilling and Backfilling
- Compaction
- Dewatering

B. See drawings for location and extent of work required.

1.02 VERIFICATION OF EXISTING CONDITIONS

A. Verify and examine the site of work to familiarize with the character of materials to be encountered and all other existing conditions affecting the work.

1.03 PROTECTION

A. Provide adequate protection measures to protect materials, men and adjoining property.

B. Provide shoring, sheeting and bracing to prevent caving, erosion or gullying of sides or excavation.

C. Provide for surface drainage during the period of construction in such manner as to avoid creating a nuisance to adjacent areas. Keep all excavation free of water at all times.

2.0 PRODUCTS

2.01 SUMMARY

See Section 01020 Summary of Materials and Finishes.

2.02 SOIL MATERIALS

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

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups ML, CL, SP, and SM; free of rockCor gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups CH, and MH, according to ASTM D 2487, or a combination of these groups.

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

3.00 EXECUTION

3.01 PREPARATION

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

B. Preparation of sub-grade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Soil Erosion," during earthwork operations.

3.02 STRIPPING

A. Strip top soil only in areas required as shown in the plans or as directed by the University. Remove top soil to depths indicated or as required by the Architect but in no case less than 150 mm (6") in depth, prior to start of regular excavation or backfilling work.

B. Stockpile the removed top soil separate from other excavated materials in locations designated by the Architect. Spread and compact with a light roller in areas indicated in the plans or where directed by the Architect.

3.03 SITE GRADING

A. Cut or fill and machine grade the site area. Deposit material in horizontal layers not exceeding 200 mm (8") in depth and compact in accordance with method A of ASTM D 1557- 66T. Rough grade elevations and levels shall be approximately 150 mm (6") below the bottom of slabs on grade, 250 mm (10") below paving finish grades and 100 mm (4") below finish grades in areas to be lawn sodded or landscaped.

3.04 STAKES AND BATTER BOARDS

A. Stake out building accurately and establish grades.

B. Batter boards and reference marks shall be erected at locations where they will not be disturbed during the construction.

C. Construct two permanent bench marks of previously known elevations near the site of construction.

3.05 EXCAVATION

A. Excavate to the dimensions and elevations indicated on the Construction Drawings. Carry excavation to depths directed by the Civil/ Structural Engineer. Should unsuitable bearing be encountered at elevations indicated, contract price shall be adjusted according to the unit price agreed upon by the Owner and the Contractor.

B. Excavation carried to a greater depth or size indicated or required through error, shall be corrected by filling such additional depth or size with class "D" concrete at Contractor's expense.

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

E. 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.

C. Bottom of excavation shall be level, free from loose material and brought to indicated or required levels in undisturbed earth or in compacted fill.

F. Excavate with proper allowance made for floor slabs, from erection, shoring, drain tile, waterproofing, masonry and adequate space for inspection of foundations.

3.06 SUBGRADE INSPECTION

A. Notify Owner and Architect when excavations have reached required subgrade.

B. If Owner and Architect determine that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment 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.

2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or stone fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

3.07 DEWATERING

A. Control grading around building so that ground is pitched to prevent water from running into excavated areas of buildings or damaging other structures.

B. Pump water out of excavated areas throughout the construction period. Water shall not be conducted into adjacent developed property.

C. General: Dewatering is provided under Specification Section 02240.

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

3.08 TRENCHING FOR SUB-DRAINAGE

A. Excavate trenches for underground utility systems and drain lines. Grade and tamp to provide firm bed trenches for drain lines.

B. When rock is encountered, excavate to a depth of 150 mm (6") below the bottom elevation of the pipe and fill with sand and gravel or crushed stones thoroughly compacted before laying pipe.

3.09 EARTHFILLING AND BACKFILLING

A. Prior to earthfilling/backfilling around structures, remove all forms, trash and debris. Use only approved earthfill/backfill material and place symmetrically on all sides in layers, moistened in accordance with Item 3.08 of this Section.

B. Earthfill/Backfill around structures only after the concrete has attained sufficient strength to resist lateral pressure resulting from the earthfill/backfill.

3.10 SOIL COMPACTION

Filling material to be used inside the building shall be placed in loose layers not exceeding 200 mm (8") thick. Each layer shall be moisture conditioned as necessary and compacted in accordance to AASHO methods in the following schedule:

a) For vehicular traffic areas (parking and driveways ----- 95% maximum dry density (mdd).
b) For areas inside Buildings and pumphouse structures and outside up to 2.00 M away from line of exterior wall of buildings and in hard landscaped areas---------- 95% mdd.
c) For pedestrian areas --------- 95 % mdd.
d) For areas designated for future expansion --------- 95% mdd.
e) Non vehicular traffic areas (open/ green areas) ------- 90% mdd.

3.11 DISPOSAL OF EXCAVATED MATERIAL

Surplus material resulting from all earthwork operations not required or unsuitable for fill or backfill shall be disposed of by the Contractor at his expense in areas off the site provided by the Contractor.

See Division 1 section on “Alternates” or “LEED certification” if contract for the project includes USGBC certification, in which case disposal of excavated materials and waste will require additional record-keeping and the use of USGBC LEED format for data collection.

4.00 SOIL BEARING CAPACITY

Read and accepted as part of the Contract:

Bidder / Contractor

4.01 UNCONFIRMED CONDITIONS

If during excavation, conditions discovered at the site do not conform to the findings of the "SOIL INVESTIGATIONS REPORT" submitted by the Soils Engineer, the Contractor shall immediately notify the Owner or his representative, Architect, and Construction Manager, in writing, of such conditions.

4.02 SOILS/STRUCTURAL ENGINEERS

The Soils Engineer and the Structural Engineer shall visit the site and make the changes in foundation design, as necessary. Any changes in the foundation design and drawings shall be treated as EXTRA WORK covered under Article 23 of the GENERAL CONDITIONS of the Contract.

4.03 WRITTEN NOTICE TO PROCEED

The Contractor may proceed with excavation work but foundation forms and reinforcement shall not be installed until after the receipt of written notice to proceed from the Owner.

4.04 FOOTINGS

No footings shall rest on fill.

END OF SECTION 02200

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02230
SITE CLEARING AND DEMOLITION

1.00 GENERAL

1.01 SCOPE

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements, including but not limited to: Asphalt and concrete paving; retaining walls; and light pole bases.
6. Disconnecting, capping or sealing, and removing site utilities.

B. Related Sections:

1. Division 1 Section “Construction Waste Management”.
2. Division 1 Section "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities.
3. Division 1 Section "Execution Requirements" for field engineering and surveying.
4. Division 2 Section “Soil Erosion” for temporary erosion and sedimentation control procedures.
5. Division 2 Section “Earthwork” satisfactory use of soil material.

1.02 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 50mm (2 inches) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

E. Demolition (demolish): Means the complete wrecking of buildings or site features with little or no regard for salvaging materials or construction items for reuse, except as desired by the Owner for the project site.

F. Selective Demolition: Means the demolition of specific portions of an existing site improvement together with subsequent removal of resulting debris.

G. Protection (protect): Means to provide for the prevention of injury to persons and site features, including or site improvements, subsurface utilities, finishes, and mechanical/electrical systems.

1.03 MATERIAL OWNERSHIP

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

1.04 SUBMITTALS

A. Existing Conditions: Documentation of existing on-site and adjacent off-site materials and improvements to remain that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing and demolition.

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.

1.05 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site.

1.06 PROJECT CONDITIONS

A. Explosives: Use of explosives will not be permitted.

B. 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.

3. Ensure safe passage of persons around area of demolition and erect temporary passageways as required by authorities having jurisdiction.

4. Conduct operations to prevent damage to adjacent structures and injury to pedestrians.

C. Improvements on Adjoining Property: Authority for performing site clearing and demolition indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

D. Utility Locator Service: Notify UP Manila CPMDO for area where Project is located before site clearing.

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

F. 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.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

J. Damages: Promptly repair damages caused to adjacent facilities by demolition operations.

K. Utility Services: Maintain existing utilities indicated to stay in service and protect against damage during demolition operations. Located and identify existing utilities entering site. Expose utilities using hand-tools; confirm depth, direction, and status of each respective utility. Do not interrupt existing utilities serving occupied facilities. Cooperate with owner and utility companies in keeping services and facilities in operation. Restore all damaged utilities to the satisfaction of the utility owner. Disconnecting and sealing indicated utilities before starting demolition is part of this work.

2.00 PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 2 Section "Earthwork."

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

3.00 EXECUTION

3.01 PREPARATION

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

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 25mm (1-inch) blue vinyl tie tape flag around each tree trunk at 1370 mm (54 inches) above the ground.

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

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

3.02 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements shown or indicated.

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

3.03 EXISTING UTILITIES

A. Arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing,

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate and coordinate with drawings, identify, disconnect, and seal or cap utilities indicated to be removed.

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

2. Owner will arrange to shut off indicated utilities when requested by Contractor.

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 5-days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

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

3.04 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.

2. Grind down stumps and remove roots, obstructions, and debris to a depth of 760 mm (18 inches) below exposed sub grade.

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

3.05 TOPSOIL STRIPPING

A. Remove all plant material and grass before stripping topsoil.

B. Strip topsoil to depth of 150mm (6 inches) in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 50mm (2 inches) 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 1830mm (72 inches).

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 re-spreading deeper topsoil.

3.06 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. Break-up and remove concrete slabs and masonry in small sections.

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.

C. Pollution Control: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt rising and scattering in the air. Comply with governing regulations pertaining to environmental protection.

D. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

E. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.07 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.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

C. Recycled Materials: Separate and recycle waste materials including but not limited to concrete and asphalt paving. Monitor and provide documentation confirming amount of recycled material (by weight or volume) diverted from the landfill compared to the overall amount of material not diverted. Coordinate documentation to comply with the Waste Management Plan.

END OF SECTION 02230

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02240
DEWATERING

1.00 GENERAL

1.01 SCOPE

A. Section includes construction dewatering to be used if ground water is discovered on site. The geotechnical report did not indicate any ground water in any borings completed within the building foot print. If ground water is discovered on-site, it will be necessary to have water tested for possible contamination.

B. Related Sections:

1. Division 1 Section "Construction Progress Documentation" for recording preexisting conditions and dewatering system progress.
2. Division 2 Section "Earthwork" for excavating, backfilling, site grading, and for site utilities.

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 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Remove dewatering system when no longer required for construction.

1.04 SUBMITTALS

A. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For qualified Installer and professional engineer.

C. Field quality-control reports.

D. Other Informational Submittals:

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to dewatering including, but not limited to, the following:

a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.

b. Geotechnical report.

c. Proposed site clearing and excavations.

d. Existing utilities and subsurface conditions.

e. Coordination for interruption, shutoff, capping, and continuation of utility services.

f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

g. Testing and monitoring of dewatering system.

h. Testing of ground water to determine contamination.

1.06 PROJECT CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and

results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. If ground water is disturbed on-site in the course of the work, then the contractor must have the water tested to determine if any contamination exists. If contaminated ground water is discovered, additional dewatering operations would be needed. The contractor shall obtain testing services to determine extend of contamination and appropriate remediation strategies. All test reports must be turned over to the owner.

2. The geotechnical report was used in the preparation of construction drawings.

2.00 PRODUCTS (Not Used)

3.00 EXECUTION

3.01 PREPARATION

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

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

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

B. Install dewatering system to ensure minimum interference with roads, streets, walks, streams, and other adjacent occupied and used facilities.

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

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Monitor dewatering systems continuously.

E. Promptly repair damages to adjacent facilities caused by dewatering.

F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 1 Section "Temporary Facilities and Controls" during dewatering operations.

3.02 INSTALLATION

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

1. Space well points or wells at intervals required to provide sufficient dewatering.

2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

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

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

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

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

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

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

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

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 910mm (36 inches) below overlying construction.

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

3.03 FIELD QUALITY CONTROL

A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION 02240

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02280
TERMITE PROOFING

1.00 GENERAL

1.01 SCOPE

The Contractor shall hire the services of an approved or accredited pesticide company to furnish all labor, materials, equipment, plant, tools, and services to complete the termite proofing work hereinafter described.

1.02 EXAMINATION OF SITE

Visit the site of the work and examine the premises to fully understand all existing conditions relative to the work involved. Prior to soil stripping, excavation or filling, all termite mounds within the area should be demolished, removed and treated. No increase of cost or extension of performance time will be considered for failure to verify and know actual site conditions.

2.00 PRODUCTS

See Section 01020 Summary of Materials and Finishes

3.00 EXECUTION

3.01 CONTRACTOR LICENSE AND CERTIFICATION REQUIREMENT

A. The pesticide company should have a valid license from the Fertilizer and Pesticide Authority of the Department of Agriculture.
B. All pesticides shall be applied by or under the direct supervision of a certified pesticide applicator.

3.02 ENVIRONMENTAL AND SAFETY CONDITIONS

A. Formulation, treatment, storage and disposal of pesticides shall be in accordance with label directions. Water for formulation shall be drawn only from site/s designated by the Architect, and the filling hose shall be fitted with a backflow preventor meeting local plumbing codes and standards. The filling operation shall be under the direct and continuous observation of the Construction Manager to assure that overflow is prevented.

3.03 APPLICATION

A. Termite Control
Application of solution shall be done by means of power sprayers fitted with flow meters for accurate monitoring of actual quantity used. At the time of soil treatment application, the soil shall be preferably in a friable condition with low moisture content to allow uniform distribution of the treatment solution throughout the soil. Do not allow pesticide during or

immediately following heavy rains, or when conditions will cause runoff and create an environmental hazard. Cover treated area with waterproof sheeting if concrete is not poured on the same day as the soil treatment. Take precautions to prevent disturbance of pesticide barrier. Before the placement of structural components, re-treat where soil or fill is disturbed after treatment. Apply pesticide prior to placement of gravel base, vapor barrier or waterproof membrane.

1. Slab on Grade Construction: Establish a horizontal pesticide barrier over areas intended for covering by floors, porches, attached entryways, garages, carports and terraces. Apply treatment solution with a low pressure coarse spray at the rate of four (4) liters per square meter. Apply at the rate of seven (7) liters solution per square meter if the gravel fill is washed gravel or other coarse material. Establish a continuous chemical barrier in the voids of hollow block foundation or voids of masonry. Apply treatment at the rate of seven (7) liters per three (3) linear meters. Make pesticide band at least 150 mm wide with the pesticide evenly distributed throughout. Treat buildings constructed with basement slabs in the same manner.
2. Crawl Space Construction: Establish a vertical pesticide barrier inside of foundation walls, both sides of interior partition walls, around piers, plumbing and roddings and utility conduits. Apply treatment solution by rodding or rodding and trenching the fill at the rate of fifteen (15) liters solution per three (3) linear meters, and 300 mm deep from grade to bottom of foundation. Treat both sides of foundation and around all piers and pipes. Make treated barrier of fill at least 150 mm wide with the pesticide evenly distributed throughout.
3. Dry pipes and Conduits: Establish pesticide barrier on various dry pipes and conduits such as electrical service entrance, raceways, pipe chase, vents. Use powder type termiticide by injecting it inside the pipe.
4. Termite Mounds: Demolish and treat all termite mounds within the property found after construction.

3.04 OWNER'S AND ARCHITECT'S APPROVAL

The Contractor shall submit to the Owner and Architect for approval, a copy of the pest control company's proposal and chemical application, method/procedure including the description of the equipment to be used before the start of work.

3.05 INSPECTION AND TEST

Sampling shall be done only in the presence of the Construction Manager.

Amount of sample to be taken: LENTREK TC or approved equal and Pentachlorophenol (from Original container) 50 cc each.

3.06 CONTRACTOR'S GUARANTEE

Upon completion of work, and as a condition for final acceptance, the Contractor shall submit to the Owner a written guarantee from the pesticide company which shall provide that:

A. The soil poisoning treatment shall prevent subterranean termites from attacking the building and its contents for a period of not less than five (5) years.

B. The contractor shall thereby warrant all works in pest control; that all materials and workmanship applied under the contract are of good quality in every respect and will remain as such for not less than five (5) years.
C. Should there be termite infestation within a one (1) year period, the Contractor thereby agrees to do all necessary repairs on the damaged portions of the building caused by termite infestation to the satisfaction of the Owner and at the Contractor's expense. Re-treatment shall also be done by the Contractor after completion of the repairs and at his expense. Such repairs and corrective works shall be done within five days after a written notice from the Owner has been received by the Contractor.
D. Should there be infestation within the one (1) year period up until the five (5) year guarantee, the pesticide company agrees to do all the necessary repairs at their expense. The pesticide company shall conduct annual inspection of the building and the surroundings to check any infestation during the guarantee period. Notice shall be given by the pesticide company to the Owner in case there is presence of termites in the surroundings.

END OF SECTION 02280

Read and accepted as part of the Contract:

Bidder/Contractor

SECTION 02290
INTEGRATED PEST MANAGEMENT

1.00 GENERAL

1.01 SCOPE

A. Section includes: Integrated Pest Management (IPM) to address the following pests:

1. Indoor populations of rodents, insects (including termites), arachnids, and other arthropods.
2. Outdoor populations of potentially indoor-infesting species that are within the property boundaries.
3. Nests of stinging insects within 20 (twenty) feet of the building and within the property boundaries.
4. Individuals of all excluded pest populations that are incidental invaders inside the building.

a. Excluded Pest Populations:
1) Birds, bats, snakes, and all other vertebrates other than commensal rodents.
2) Pests that primarily feed on outdoor vegetation.

B. Integrated Pest Management (IPM) shall include the following:

1. Initial building and site inspection.
2. Developing an IPM Plan appropriate to the building, site, and local ecosystems.
3. Implementing the approved IPM Plan.
4. Documenting IPM services.

1.02 DEFINITIONS

A. Definitions pertaining to sustainable development: As defined in ASTM E2114.

B. Action Threshold: The level at which action is initiated as determined by how many pests can be tolerated.

1. The action threshold reflects the pest management objective for the site. The presence of some pests does not, in itself, necessarily require action. When pest populations exceed established action thresholds, action must be taken.

C. Biological Control: The use of living organisms—parasites, predators, or pathogens—to maintain pest populations.

D. Cultural Control: The manipulations of the site ecosystem that make it less friendly to the establishment and proliferation of pest populations.

E. Exclusion: The practice of structural and procedural modifications to reduce access used by pests.

F. Integrated Pest Management (IPM): An approach to pest management that uses current, comprehensive information on the life cycles of pests and their interactions with the environment to identify and implement effective methods of pest control with the least possible hazard to people, property, and the environment.

G. Mechanical Control: The use of one or more physical components of the environment, such as temperature, humidity, or light, to the detriment of the pest.

H. Phenology: The annual cycles of plants and animals and how they respond to seasonal changes in their environment.

1.03 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Experience: Minimum of 3 years experience in performing the types of services specified herein.

2. Certification: Contractor personnel providing on-site pest control service must maintain certification as Commercial Pesticide Applicators in the category of Industrial, Institutional, Structural, and Health Related Pest Control. Uncertified individuals working under the supervision of a Certified Applicator may be permitted to provide service under this contract.

B. Pesticides:

1. Contractor shall be responsible for application of pesticides.

2. Regulatory compliance:

a. All pesticides used by the Contractor must be approved by the Owner for use in the campus location which adjacent to occupied buildings. Products be acceptable for use by the Department of Environmental and Natural Resources (DENR), and Department of Agriculture (DA).

b. Transport, handling, and use of all pesticides shall be in strict accordance with the manufacturer's label instructions and all applicable laws and regulations.

3. Contractor shall not store any pesticide product in the project building and site.

4. Prohibited Pesticides - Contractor shall not apply any pesticide product that has not been approved in writing by the Owner.

5. Minimization of Risk:

a. When pesticide use is necessary, Contractor shall employ the least risk pesticide, most precise application technique, and minimum quantity of pesticide necessary to achieve control.

b. Application of pesticides in any inside or outside area shall not occur unless visual inspection or monitoring devices indicate the presence of pests in that specific area.

c. Recommendations for preventive pesticide treatments in areas where inspection indicates a potential insect or rodent infestation will be evaluated by the Owner on a case-by-case basis. Written approval must be granted by the Owner prior to any preventive pesticide application.

d. Notification: Contractor shall notify Owner at least 48 hours in advance of the application of any pesticide. Exceptions may be made for applications made for emergencies, where an imminent threat to health exists (e.g., stinging insects). For emergency applications, notification must be made as soon as practical.

C. Key Pests and Action Thresholds:

1. birds 1 bird 1 nest on building
2. rats any evidence any evidence
3. flies - 1 complaint (when one or more become a nuisance
4. ants - 1 fire ant mound within 100 feet of building/ pavement
5. cockroaches - 1 cockroach in public areas or fresh food areas n/a
6. pantry pests (meal moth) 1 complaint n/a
7. crickets 1 complaint n/a

D. Coordination with construction operations:

1. IPM is most successful when the project site is maintained appropriately during construction to minimize both pests and pesticides. Coordination with Contractor operations during construction is critical.

2. Open waste bins, partially consumed soda pops and food wrappers, for example, can attract numerous pests that may take up residence during construction and become extremely problematic to dislodge with basic IPM procedures. No Food shall be allowed in the construction site unless allowed by the Owner.

a. Review Contractor's Waste Management Plan to verify sanitation levels are appropriate to anticipated IPM Plan.

b. Review Contractor's progress cleaning methods to verify sanitation levels are appropriate to anticipated IPM Plan.

E. Coordination with Owner's operations:

1. Coordinate with Division 1 – Operation and Maintenance Data: Sanitation information consistent with approved IPM plan.

2. Coordinate with Division 2 – Planting: Landscape maintenance program.

1.04 PRECONSTRUCTION MEETING

A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Architect to discuss the proposed IPM Plan and to develop mutual understanding relative to details of environmental protection.

1.05 SUBMITTALS

A. Integrated Pest Management (IPM) Plan: Not less than 10 days before the Preconstruction meeting, prepare and submit an IPM Plan including, but not limited to, the following:

1. Verify key pests and action thresholds for each key pest are appropriate to project, local ecosystem, and climate.

2. Proposed IPM Strategies: Provide for each key pest, appropriate to the building, site, and local ecosystems.

   a. Indicate strategies for inspection, prevention and for response to identified pest problems.

      1) Inspection: Describe methods and procedures to be used for identifying sites of pest harborage and access, and for making objective assessments of pest population levels throughout the term of the contract.

      2) Prevention: Describe methods and procedures recommended for prevention of pest harborage and access.

      3) Response: Indicate prioritization of strategies such that nonchemical controls are utilized before chemical controls; and lesser risk options are used before resorting to actions with greater risk factors.

3. Proposed Materials and Equipment:

   a. Provide brand names of pesticide application equipment, rodent bait boxes, insect and rodent trapping devices, pest monitoring devices, pest detection equipment, and other pest control devices or equipment that may be used to provide service.

   b. Commercial Pesticide Applicator Certificates or Licenses: The Contractor shall provide photocopies of State-issued Commercial Pesticide Applicator Certificates or Licenses for every Contractor employee who will be performing on-site service under this contract.

   c. Pesticides: For all pesticides to be used, submit:

      1) Product data indicating conformance to U.S. National Organics Program (NOP) Final Rule list.

      2) Current EPA-registered label.

      3) Material Safety Data Sheet. MSDSs shall be prepared/updated within the previous five years.

4. Service Schedule: Provide a complete service schedule that includes weekly or monthly frequency of Contractor visits, specific day(s) of the week of Contractor visits, and approximate duration of each visit.

   a. Start of Service Schedule: Start of construction.

5. Revise and resubmit Plan as required by Owner - Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

B. Baseline IPM Reports: Prior to beginning implementation of approved IPM Plan, submit the following:

1. Initial Building Inspection Report. Conduct a site visit to verify the pest control needs of all locations and identify problem areas and any equipment, structural features, or management practices that may contribute to pest infestations.

a. Submit Report summarizing observations. Indicate proposed revisions, if any, to approved IPM Plan that may be necessary based upon results of Initial Building Inspection.

2. Summary of Conventional Pest Management Controls for Key Pests: Submit summary of conventional pest management materials and methods that would be applicable to the building and site for key pests. Include the types of pesticide, application rates, estimated annual quantity required, and environmental issues of concern for each.

C. Operations and Maintenance Information: Submit instructions for Owner's personnel regarding Owner operations and maintenance procedures associated with Contractor provided IPM services.

D. Field Quality Control Documentation.
1. IPM Inspection Reports
2. IPM Deficiency Reports
3. IPM Log Book.

2.00 PRODUCTS

2.01 CHEMICAL CONTROLS

A. Prohibited Pesticides:

1. Pesticides containing active ingredients classified as known, likely or probable carcinogens or reproductive toxins according to any of the following lists: State of California EPA List of Chemicals Known to Cause Cancer or Reproductive Toxicity, State of Illinois EPA List of Known Endocrine Disrupters, US EPA List of Chemicals Evaluated for Carcinogenic Potential.

2. Pesticides containing inert ingredients included on US EPA's List 1: Inerts of Toxicological Concern.

3. Pesticide formulations and uses presenting a potential physical hazard or dust/powder inhalation hazard to building occupants.

4. Pesticides with label precautionary statements including "toxic" or "extremely toxic" to bees, birds, fish or wildlife. *Does not apply to pesticides used as per label directions to control bird, fish, wildlife or stinging insect pests.*

5. Pesticides with label precautionary statements including specific warnings regarding ground or surface water contamination.

B. Lesser Risk Pesticides: Materials listed on the U.S. National Organic Program's Final Rule, US Code of Federal Regulations 7CFR 205, list of acceptable materials and as follows:

1. Crawling insects: Boric acid based or plant based pesticides.

a. Botanical pesticides: Pyrethrum, neem formulations, rotenone, and others as approved by Owner.

3.00 EXECUTION

3.01 NON-CHEMICAL PEST MANAGEMENT

A. Provide IPM in accordance with approved IPM Plan and as follows:

1. Cultural Controls:

a. Sanitation and exclusion: Recommend structural and procedural modifications as appropriate to reduce food, water, harborage, and access used by pests.

b. Habitat for beneficial organisms: Recommend modifications as appropriate to promote healthy habitat for beneficial organisms. Habitat enhancement may include flowering annual or perennial plants that provide pollen and nectar needed during certain parts of the insect life cycle, overwintering sites, and wind protection.

c. Phenology: Determine correlation with insect emergence and pest control. Develop recommendations as appropriate.

2. Mechanical Controls

a. Traps:

1) Rodents: Trapping devices shall be the standard method for indoor rodent control. All such devices shall be concealed out of the general view and in protected areas so as not to be affected by routine cleaning and other operations.

2) Insects: Trapping devices shall be the standard method for indoor fly control.

b. Vacuums:

1) Insects: Portable vacuums shall be the standard method for initial cleanouts of cockroach infestations, ants, termites, and for control of spiders in webs.

3. Biological Controls:

a. Lady bugs, nematodes, and other biological controls: Permitted only for control of exterior ants, aphids, and/or other insects as appropriate.

b. Bats: Permitted only for control of exterior insects as appropriate.

3.02 CHEMICAL PEST MANAGEMENT

A. Chemical Controls: Unless otherwise approved by Owner, Contractor shall use nonchemical methods of control. When pesticide use is necessary, the Contractor shall employ the least risk, NOP-listed pesticide; most precise application technique; and minimum quantity of pesticide necessary to achieve control.

B. Baits Boxes: Bait boxes shall be maintained with an emphasis on the safety of nontarget organisms.

1. Bait boxes shall be placed out of the general view, in locations where they will not be disturbed by routine operations.

2. Lids shall be securely locked or fastened shut.

3. Bait boxes shall be securely attached or anchored to floor, ground, wall, or other immovable surface, so that the box cannot be picked up or moved.

4. Bait shall be secured in the feeding chamber of the box and never placed in the runway or entryways of the box.

5. Bait boxes shall be labeled on the inside with the Contractor's business name and address, and dated by the Contractor's technician at the time of installation and each servicing.

3.03 PEST REMOVAL

A. Pest Removal: Remove traps, bait boxes, and their contents according to the approved IPM Plan and as requested by Owner.

3.04 SPECIAL REQUESTS AND EMERGENCY SERVICE

A. On occasion, the Owner may request that the Contractor perform corrective, special, or emergency service(s) that are beyond routine service requests. The Contractor shall respond to these exceptional circumstances and complete the necessary work within three (3) hours after receipt of the request.

3.05 FIELD QUALITY CONTROL

A. Inspection: Inspect building and site for pests and beneficials to gather information about the health of the landscaping and local ecosystem, pests, and natural enemies.

1. Methods: Use methods indicated in approved IPM Plan and as follows:

a. Sweep nets, sticky traps, and pheromone traps may be used to collect insects for both identification and population density information.

b. Leaf counts may be used for recording plant growth stages.

c. Square-foot or larger grids laid out in a field may provide a basis for comparative weed counts.

d. Records of rainfall and temperature may be used to help predict the likelihood of disease infections.

2. Schedule: Inspect at regular intervals and at critical times in accordance with approved IPM Plan.

3. Reports: Document results of inspections.

B. Recommendations: Throughout the term of this contract, the Contractor shall be responsible for advising the Owner about any structural, sanitary, or procedural modifications that would reduce pest food, water, harborage, or access.

1. The Contractor shall be responsible for adequately suppressing all pests included in this contract regardless of whether or not the suggested modifications are implemented.

2. The Contractor will not be held responsible for carrying out structural modifications as part of the pest control effort. However, minor applications of caulk and other sealing materials by the Contractor to eliminate pest harborage or access may be approved by the Owner on a case by case basis. The Contractor shall obtain the approval of the Owner prior to application of sealing material and other structural modification.

C. Log Book: The Contractor shall maintain a pest control logbook or file. These records shall be kept on-site and maintained on each visit by the Contractor or Contractor's representative. Each logbook or file shall include:

1. IPM Plan: A copy of the approved IPM Plan.

2. IPM Contact List: Include contact information for Contractor and Owner contact. Indicate emergency contact information for Contractor.

3. Schedule: Contractor's service schedule for the property. Identify IPM activity that has been performed.

4. IPM Inspection Reports and Deficiency Reports.

5. Pest Diagrams: Plans and site drawings noting the location of pest activity, including the location of all traps, trapping devices, and bait stations in or around the site.

END OF SECTION 02290

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02350
SANITARY SEWERAGE

1.00 GENERAL

1.01 SCOPE

A. This Section includes sanitary sewerage outside the building and includes the following:

1. Ductile iron piping and fittings.
2. Polyvinyl chloride plastic (PVC) piping and fittings.
3. Precast concrete manholes, frames and covers.
4. Excavation and backfill for pipe.

B. Related Sections include the following:

1. Division 2 Section “Earthwork”.
2. Division 3 Section “Cast-in-Place Concrete” for concrete structures.
3. Division 15 Sections for sanitary sewer inside building including grease trap.

1.02 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.03 SUBMITTALS

A. Product Data: For the following:

1. Manhole cover inserts.

B. Shop Drawings: Include plans, elevations, details, and attachments for the following:

1. Precast concrete manholes, including frames and covers.
2. Cast-in-place concrete manholes and other structures, including frames and covers.

C. Coordination Drawings: Show manholes and other structures, pipe sizes, locations, and elevations. Include details of underground structures and connections. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between piping and proximate structures.

D. Coordination Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate underground structures and pipe. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Design Mix Reports and Calculations: For each class of cast-in-place concrete.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.05 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. Locate existing structures and piping to be closed and abandoned.

C. 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 and Construction Manager not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner's written permission.

2.00 PRODUCTS

2.01 PIPES AND FITTINGS

A. Ductile Iron Pipe and Fittings: Shall be in accordance with AWWA Standard C-150 and C-110, Class 50 or a greater class as may be required based on depth of cover and laying conditions.

1. Joints shall be push-on type manufactured in accordance with AWWA C-111-95.

2. Exterior of pipe and fittings shall have a bituminous coating.

3. Pipe and fittings shall have a minimum working class of 250 psi.

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

1. PVC Sewer Pipe and Fittings, NPS 15 (DN375) and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.

a. Gaskets: ASTM F 477, elastomeric seals.

2.02 MANHOLES

A. Normal-Traffic Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.

1. Diameter: 1200 mm (48 inches) minimum, unless otherwise indicated.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

3. Base Section: 150 mm (6-inch) minimum thickness for floor slab and 100 mm (4-inch) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

4. Riser Sections: 100 mm (4-inch) minimum thickness, and lengths to provide depth indicated.

5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

6. Gaskets: ASTM C 443 (ASTM C 443M), rubber.

7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and cover.

8. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 300 mm to 400 mm (12- to 16-inch) intervals. Omit steps for manholes less than 1500 mm (60 inches) deep.

9. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.

B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 660 mm (26-inch)- diameter cover. Include indented top design with lettering "SANITARY SEWER" cast into cover.

2.03 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.

C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    a. Invert Slope: as indicated in the profiles
2. Benches: Concrete, sloped to drain into channel.
    a. Slope: 8 percent.

2.04 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass foot-traffic areas.
2. Medium Duty: In paved foot-traffic areas.
3. Heavy Duty: In vehicle-traffic service areas.
4. Extra-Heavy Duty: In roads.
5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

3.00 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.02 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.03 PIPING APPLICATIONS

A. General: Include watertight joints.

B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.

C. Gravity-Flow Piping: Use the following:

1. Ductile iron pipe in accordance with AWWA Standards C-150 and C110. Minimum pressure class shall be Class 250 or greater.

3.04 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

1. Use the following pipe couplings for nonpressure applications:

a. Sleeve type to join piping, of same size, or with small difference in OD.

b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.

c. Bushing type to join piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.05 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

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

D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.

2. Install piping with 960 mm (36-inch) minimum cover.

F. Extend sanitary sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

3.06 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.

B. Refer to Division 2 Section "Utility Materials" for basic piping joint construction and installation.

C. DIP Sewer Pipe and Fittings:

1. Ductile iron fittings shall be in accordance with AAWA Standards C-150 and C-110.

2. Pipe fittings shall have a minimum working pressure of 250 psi and a minimum strength of 30,000 psi.

3. Pipe joints shall be push-on type manufactured in accordance with AWWA C-111-95.

D. PVC Sewer Pipe and Fittings: As follows

1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.

2. Join profile sewer pipe fittings with gaskets according to ASTM D 2321 and manufacturer's written instructions.

3. Install according to ASTM D 2321.

E. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

F. Install with top surfaces of components, except piping, flush with finished surface.

3.07 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Form continuous concrete channels and benches between inlets and outlet.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

D. Install precast concrete manhole sections with gaskets according to ASTM C 891.

3.08 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.09 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 457x457x300 mm (18 by 18 by 12 inches) deep. Set with tops 1 inch above surrounding grade.

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

3.10 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. Place plug in end of incomplete piping at end of day and when work stops.

2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:

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

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

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

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate reports for each test.

5. If authorities having jurisdiction do not have published procedures, perform tests as follows:

a. Sanitary Sewerage: Perform hydrostatic test.

1) Allowable leakage is maximum of 50 gal. per inch of nominal pipe size per mile of pipe, during 24-hour period.

2) Close openings in system and fill with water.

3) Purge air and refill with water.

4) Disconnect water supply.

5) Test and inspect joints for leaks.

6. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).

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

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

END OF SECTION 02350

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02500
ROADS AND PARKING

1.00 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, equipment, plant and tools required to complete
   - driveways
   - roadways
   - parking

B. See drawings for location and extent of work.

C. Related works specified elsewhere. See Division 3 CONCRETE

1.02 PROTECTION

Protect all materials from dirt and all injurious substances that may affect the strength of concrete and cement.

2.00 PRODUCTS

2.01 MATERIALS

Refer to Section 01020 Summary of Materials and Finishes.

3.00 EXECUTION

3.01 SUBGRADE PREPARATION

A. Prior to commencing the preparation of the subgrade complete all installations of sub-drainage lines, manholes and catch basins and all other utilities underneath the subgrade, including their fully compacted backfill.

B. Compact all materials immediately below subgrade level on embankment to a depth of 150 mm (6"), or to such greater depth as may be specified, in accordance to the requirements of AASHTO T-180 Method D.

3.02 BASE COURSE

A. Placing and Spreading of Base Course: The sub-base and/or base material shall be placed in loose layers not exceeding 200 mm. (8 "), moisture conditioned as necessary and compacted to a minimum of 95% of its maximum dry density.

B. Rolling Base Course:

1. Immediately following spreading, compact materials to the full by rolling with a 3 wheeled or tandem roller weighting at least 8 tons or with a multiple wheeled rubber tired roller loaded as directed to give satisfactory compaction.
2. Progress rolling gradually from the sides to the center, parallel with the centerline of the road and it shall continue until compaction is satisfactory to the Engineer.
3. After rolling all the base course materials blade or smoothen the surface. Blade and roll alternately as required or directed to maintain a smooth, even surface.
4. Machine tamp base course materials along curbs, headers or walls and at all places not accessible to the rollers.
5. Sprinkle all layers of base course materials with water during rolling, tamping and blading.

C. Spreading of Choker Aggregate:
1. After final rolling of base course aggregates, evenly spread choker aggregates over the surface until the voids are filled to within approximately 10 mm of the surface, and if possible, the surface shall be broomed with push brooms or diagonal brooms. Continue to spread, broom and roll until a smooth surface is obtained.

3.03 CONCRETE PAVEMENT

A. See DIVISION 3 CONCRETE for concrete proportions and consistency, form works, methods of placing concrete, compaction, finishing and curing concrete.

B. JOINTS:
1. WEAKENED PLANE JOINTS
With the use of a power driven saw, cut a groove in the pavement, at locations shown in the Plans, to a minimum depth of 50 mm. and a maximum width of 5 mm. within 24 hours after the concrete was placed.
2. TRANSVERSE EXPANSION JOINTS
Use pre-moulded expansion joint fillers for transverse expansion joints as detailed and shown in the Plans or as directed by the Engineer.

C. SURFACE FINISHING
Finish the pavement surface to the required roughness by passing over the concrete a drag of one or two burlap cloths or by other approved means.

D. CURING AND PROTECTION
Immediately after the finishing operations, exposed concrete surfaces shall be cured by one of the following methods as the Contractor may elect.
1. Mat Method. The entire exposed surface shall be covered with two or more layers of burlap. Mats shall overlap each other at least 150 mm (6”). The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

2. Impervious Sheeting Method. The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 300 mm (12") when a continuous sheet is not used. The curing medium shall not be less than 450 mm (18") wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or by placing a bank of moist earth along edges, and laps in the sheets. Sheets shall be satisfactory repaired or replaced if torn or otherwise damaged. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.
3. Membrane-Curing Method: The entire exposed surface shall be covered with a membrane-forming curing compound. Where type 1 curing compound is used, the concrete surface shall be shaded from the direct rays of the sun for a period of 3 days immediately after spraying. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. Apply an additional coat to all surfaces showing discontinuity, pinholes or other defects. Concrete surfaces that are subjected to heavy rainfall within 3 hours after curing compound has been applied shall be resprayed by the above method and at the above coverage at no additional cost to the Owner. Expansion-joint openings shall be sealed at the top by inserting moistened paper or fiber rope or covering with strips of waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected for 7 days from pedestrian and vehicular traffic and from any other action that might disrupt the continuity of the membrane. Any area covered with curing compound and damaged by subsequent construction operations within the 7-day curing period shall be resprayed as specified above at no additional expense to the Owner.

E. OPENING TO TRAFFIC

Preclude any or all kinds of traffic over the concrete pavement for a period of 10 days or longer if the Engineer deems it necessary to extend this time. Maintain satisfactory barricades to exclude all traffic on the pavement. Repair of damage to the pavement due to traffic is at the expense of the Contractor.

END OF SECTION 02500

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02510
WATER SYSTEMS

1.00 GENERAL

1.01 SCOPE

A. This Section includes water systems piping for potable water service and fire protection service outside the building and includes the following components:

1. Ductile – iron pipe and fittings.
2. Copper pipe and fittings.
3. Water meters and boxes, backflow preventers, and blow-off assemblies.
4. Fire hydrants and fire department connection.
5. Other accessories as required for a complete installation.
6. Excavation and backfill for pipe.
7. Meter and tap fees.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 2 Section “Earthwork”.
2. Division 15 Sections for water distribution systems inside building.

C. Utility Service Company -furnished products include water meters that will be furnished to the site and ready for installation.

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 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements for water system piping.

1. Underground Piping: 150 psig .
2. Underground Piping, Downstream of Fire Department Connections: 200 psig .

1.04 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data, including pressure rating, rated capacity, and settings of selected models for the following:

1. Fire hydrants and fire department connection.

2. Water meter boxes.

3. Backflow preventers.

4. Blow-off assemblies.

5. Valves.

6. Identification materials and devices.

C. Shop drawings for cast-in-place concrete valve and meter pits. Include frames and covers. Include drains when indicated.

D. Coordination drawings showing pipe sizes and valves, meter and specialty locations and elevations. Include details of underground structures, connections, anchors, and reaction backing. Show other piping in same trench and clearances from water system piping. Indicate interface and spatial relationship between piping and proximate structures.

E. Record drawings at Project closeout of installed water system piping and products according to Division 1 Section "Project Closeout."

F. Test reports specified in "Field Quality Control" Article in Part 3.

H. Maintenance data for inclusion in "Operating and Maintenance Manual" specified in Division 1 Section "Project Closeout." Include data for the following:

1. Backflow preventers.

2. Valves.

1.05 QUALITY ASSURANCE

A. Comply with requirements of utility supplying water. Include tapping of water mains and backflow prevention.

B. Comply with standards of authorities having jurisdiction for fire protection systems. Include materials, hose threads, installation, and testing.

C. Comply with standards of authorities having jurisdiction for potable water piping and plumbing systems. Include materials, installation, testing, and disinfection.

D. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

E. Listing and Labeling: Provide equipment and accessories that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in "National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

F. Product Options: Water systems specialties and accessories are based on specific types, manufacturers, and models indicated. Components by other manufacturers but having equal performance characteristics may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or

intended performance as judged by Architect/Engineer of Record. The burden of proof of equality of products is on Contractor. Refer to Division 1 for product substitutions guidelines. Any substitutions shall be listed in the bid form and approved prior to contract award.

G. All underground private fire service mains shall be installed and tested in accordance with NFPA-24 current edition.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves for shipping as follows:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends, flange faces, and weld ends.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. Storage: Use the following precautions for valves, including fire hydrants, during storage:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect valves from weather. Store valves indoors and maintain temperature higher than ambient dew point temperature. Support valves off ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and piping specialties from moisture and dirt.

G. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Verify that water system piping may be installed in compliance with original design and referenced standards.

C. Site Information: Reports on subsurface condition investigations made during the design of the Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions

(between soil borings). Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate connection to water main with Construction Manager, the Owner's representative and the water service utility company.

B. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building fire protection systems piping.

C. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building water distribution systems piping.

D. Coordinate with other utility work.

E. Coordinate electrical requirements of actual equipment furnished with requirements specified in Division 16.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Substitutes are allowed and shall be identified in bid package forms..

1. Drilling Machine Corporation Stops:
   a. Ford Meter Box Co., Inc.
   b. Mueller Co., Grinnell Corp.
   c. A.Y. McDonald Mfg. Co.

2. Bronze Corporation Stops and Valves:
   a. Ford Meter Box Co., Inc.
   b. Hays Div., Romac Industries.
   c. A.Y. McDonald Mfg. Co.
   d. Mueller Co., Grinnell Corp.

3. Tapping Valves:
   a. Kennedy Valve Div., McWane, Inc.
   b. Mueller Co., Grinnell Corp.
   c. American Darling Valve Div., American Cast Iron Pipe Co.

4. Gate Valves:
   a. American Darling Valve Div., American Cast Iron Pipe Co.
   b. Clow Valve Co. Div., McWane, Inc.
   c. Mueller Co., Grinnell Corp
   d. Waterous Co.

5. Backflow Preventers:
   a. Ames Co., Inc..
   b. Conbraco Industries, Inc.
   c. Febco.
   d. Hersey Products, Inc., Grinnell Corp.

e. Watts Regulator Co.
f. Wilkins Regulator Div., Zurn Industries, Inc.

6. Fire Hydrants and Fire Department Connection: Shown on Drawings.

2.02 PIPES AND TUBES

A. Ductile-Iron Pipe: AWWA C151, Classes 150, 200, and 250.

1. Lining: AWWA C104, cement mortar, seal coated.

2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.

3. Push-On-Joint-Type Pipe: AWWA C111, rubber gaskets.

4. Mechanical-Joint-Type Pipe: AWWA C111, rubber gaskets, ductile- or cast-iron glands, and steel bolts and nuts.

B. Copper Pipe: Type “K” soft copper meeting ASTM B-88.

2.03 PIPE AND TUBE FITTINGS

A. Refer to Part 3.03 Article "Piping Applications" for identification of systems where pipe and tube fitting materials specified below are used.

B. Ductile-Iron and Cast-Iron Pipe Fittings: AWWA C110, ductile-iron or cast-iron, 250-psig minimum pressure rating; or AWWA C153, ductile-iron compact fittings, 350-psig pressure rating.

1. Lining: AWWA C104, cement mortar.

2. Gaskets: AWWA C111, rubber.

C. Ductile-Iron and Gray-Iron Flanged Fittings: AWWA C110, 250-psig minimum pressure rating, with AWWA C104 cement-mortar lining.

D. Copper Fittings: Provide flared copper type brass of compression type.

2.04 JOINING MATERIALS

A. Refer to Part 3.03 Article "Piping Applications" for identification of systems where joining materials specified below are used.

B. Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: The following materials apply:

1. Push-On Joints: AWWA C111 rubber gaskets and lubricant.

2. Mechanical Joints: AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.

3. Flanged Joints: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.

a. Gaskets: Rubber, flat face, 1/8 inch thick except where other thickness is indicated; and full-face or ring type except where other type is indicated.

b. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.

C. Pipe Couplings: Iron-body sleeve assembly, fabricated to match outside diameters of pipes to be joined.

1. Sleeve: ASTM A 126, Class B, gray iron.

2. Followers: ASTM A 47, Grade 32510, or ASTM A 536 ductile iron.

3. Gaskets: Rubber.

4. Bolts and Nuts: AWWA C111.

5. Finish: Enamel paint.

6. Encasement: AWWA C105, polyethylene film tube or sheet.

D. Magnetic-Type Warning Tape: Provide type as approved by pipe manufacturer.

2.05 VALVES

A. Nonrising Stem Gate Valves 76 mm (3 inches) and Larger: AWWA C509, resilient seated; bronze stem, cast-iron or ductile-iron body and bonnet, stem nut, 200-psig working pressure, mechanical joint ends.

B. Valve Boxes: Cast-iron box having top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 130 mm (5 inches) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.

1. Provide a steel tee-handle operating wrench with each valve box. Wrench shall have tee handle with one pointed end, stem of length to operate valve, and socket-fitting valve operating nut.

C. Curb Stops: Bronze body, ground key plug or ball, and wide tee head, with inlet and outlet to match service piping material.

D. Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine.

1. Tapping Sleeve: Cast-iron or ductile-iron 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may have mechanical joint ends with rubber gaskets or sealing rings in sleeve body. Use sleeve that mates with size and type pipe material being tapped. Outlet flange shall be size required for branch connection.

E. Service Clamps and Corporation Stops: Complete assembly, including service clamp, corporation stop, and bolts and nuts. Use service clamp and stop compatible with drilling machine.

1. Service Clamp: Cast iron or ductile iron with gasket and AWWA C800 threaded outlet for corporation stop, and threaded end straps.

2. Corporation Stops: Bronze body and ground key plug, with AWWA C800 threaded inlet and outlet matching service piping material.

3. Manifold: Copper with 2 to 4 inlets as required, with ends matching corporation stops and outlet matching service piping.

2.06 WATER METERS

A. Water meters will be furnished by the Contractor.

B. General: Provide water meter with registration in gallons and liters.

C. Meter Box: Cast-iron body, cast-iron cover having lettering "WATER METER," and base section of length to fit over service piping. Base section is open at bottom, slotted, and shall be cast iron. Submit meter box shop drawing to the Owner's Representative showing the MWSS approval.

2.07 ANCHORAGES

A. Clamps, Straps, and Washers: ASTM A 506, steel.

B. Rods: ASTM A 575, steel.

C. Rod Couplings: ASTM A 197, malleable iron.

D. Bolts: ASTM A 307, steel.

E. Cast-Iron Washers: ASTM A 126, gray iron.

F. Concrete Reaction Backing: Portland cement concrete mix, 3000 psi.
1. Cement: ASTM C 150, Type I.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

3.00 EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.02 SERVICE ENTRANCE PIPING

A. Extend water system piping and connect to water supply source and building water distribution and fire protection systems at outside face of the building wall in locations and pipe sizes indicated.

1. Terminate water system piping at building wall until building water systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water systems when those systems are installed.

B. Water distribution systems and fire protection systems are specified in Division 15 Sections. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install restrained joints for buried piping within 60 inches of building. Use restrained-joint pipe and fittings, thrust blocks, anchors, tie-rods and clamps, and other supports at vertical and horizontal offsets.

3.03 PIPING APPLICATIONS

A. Refer to Part 2 of this Section for detailed specifications for pipe and fittings products listed below. Use pipe, tube, fittings, and joining methods according to the following applications. Piping in pits and inside building may be joined with flanges or couplings, instead of joints indicated, for grooved-end AWWA-size piping.

B. Use pipe, tube, fittings, and joining methods according to following applications.

1. 4 Inches to 8 Inches: Class 250, ductile-iron pipe, ductile-iron compact fittings, and push-on or mechanical joints.

3.04 VALVE APPLICATIONS

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

1. Buried Valves 3 Inches and Larger: AWWA, gate valves, nonrising stem, with valve box.

3.05 JOINT CONSTRUCTION

A. Ductile-Iron Piping Gasketed Joints: Construct joints according to AWWA C600.

B. Flanged Joints: Align flanges and install gaskets. Assemble joints by sequencing bolt tightening. Use lubricant on bolt threads.

C. Threaded Joints: Thread pipes with tapered pipe threads according to ASME B1.20.1, apply tape or joint compound, and apply wrench to valve ends into which pipes are being threaded.

D. Dissimilar Materials Piping Joints: Construct joints using adapters that are compatible with both piping materials, outside diameters, and system working pressure. Refer to "Piping Systems - Common Requirements" Article for joining piping of dissimilar metals.

3.06 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated except where deviations to layout are approved on coordination drawings.

B. Install piping at indicated slope.

C. Install components having pressure rating equal to or greater than system operating pressure.

D. Install piping free of sags and bends.

E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

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

G. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

1. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inch or smaller threaded pipe connection.

2. Install flanges, in piping 2-1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

3. Install dielectric fittings to connect piping of dissimilar metals.

3.07 PIPING INSTALLATION

A. Water Main Connection: Arrange for tap in water main, of size and in location indicated, from the local utility provider.

B. Comply with requirements of NFPA 24 for materials and installation.

C. Install ductile-iron pipe and ductile-iron and cast-iron fittings according to AWWA C600.

D. Bury piping at minimum depth of 960mm (36 inches) below finished grade.

E. Magnetic-Type Warning Tape: Install at least 150 mm (6 inches) below grade over all underground water lines.

3.08 ANCHORAGE INSTALLATION

A. Anchorages: 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 Piping: According to AWWA C600.

2. Fire Service Piping: According to NFPA 24.

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

3.09 VALVE INSTALLATION

A. General Application: Use mechanical-joint-end valves for 3-inch and larger buried installation. Use threaded- and flanged-end valves for installation in pits and inside building. Use non-rising stem UL/FM gate valves for installation with indicator posts. Use bronze corporation stops and valves, with ends compatible with piping, for 2-inch and smaller installation.

B. AWWA-Type Gate Valves: Comply with AWWA C600. Install buried valves with stem pointing up and with cast-iron valve box.

3.10 ROUGHING-IN FOR WATER METERS

A. Install roughing-in piping and specialties for water meter installation according to utility company's instructions and requirements.

3.11 FIELD QUALITY CONTROL

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

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.

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

3.12 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 prior to use.

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

a. Comply with NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

b. Fill system or part of system with water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) system or part thereof and allow to stand for 24 hours.

c. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 parts per million of chlorine; isolate and allow to stand for 3 hours.

d. Following allowed standing time, flush system with clean, potable water until chlorine does not remain in water coming from system.

e. Submit water samples in sterile bottles to authority having jurisdiction. Repeat procedure if biological examination made by authority shows evidence of contamination.

B. Prepare reports for purging and disinfecting activities.

END OF SECTION 02510

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02520
ROADS AND SIDEWALKS:
CONCRETE CURBS, GUTTER AND PAVED WALKS

1.00 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, equipment, plant and tools required to complete
   - concrete curbs
   - gutters
   - paved walks and other concrete pavements

B. See drawings for location and extent of work.

C. Related works specified elsewhere. See Division 3 CONCRETE

1.02 PROTECTION

Protect all materials from dirt and all injurious substances that may affect the strength of concrete and cement.

2.00 PRODUCTS

2.01 MATERIALS

See Section 01020 Summary of Materials and Finishes.

3.00 EXECUTION

3.01 SUBGRADE PREPARATION

A. Prior to commencing the preparation of the subgrade complete all installations of sub-drainage lines, manholes and catch basins and all other utilities underneath the subgrade, including their fully compacted backfill.

B. Compact all materials immediately below subgrade level on embankment to a depth of 150 mm (6"), or to such greater depth as may be specified, in accordance to the requirements of AASHTO T-180 Method D.

3.02 BASE COURSE

A. Placing and Spreading of Base Course: The sub-base and/or base material shall be placed in loose layers not exceeding 200 mm. (8 "), moisture conditioned as necessary and compacted to a minimum of 90% of its maximum dry density.

B. Rolling Base Course:
   1. Immediately following spreading, compact materials to the full by rolling with a 3 wheeled or tandem roller weighting at least 8 tons or with a multiple wheeled rubber tired roller loaded as directed to give satisfactory compaction.
   2. Progress rolling gradually from the sides to the center, parallel with the centerline of the road and it shall continue until compaction is satisfactory to the Engineer.
   3. After rolling all the base course materials blade or smoothen the surface. Blade and roll alternately as required or directed to maintain a smooth, even surface.

4. Machine tamp base course materials along curbs, headers or walls and at all places not accessible to the rollers.
5. Sprinkle all layers of base course materials with water during rolling, tamping and blading.

C. Spreading of Choker Aggregate:
1. After final rolling of base course aggregates, evenly spread choker aggregates over the surface until the voids are filled to within approximately 1 cm. of the surface, and if possible, the surface shall be broomed with push brooms or diagonal brooms. Continue to spread, broom and roll until a smooth surface is obtained.

3.03 CONCRETE PAVEMENT

A. See DIVISION 3 CONCRETE for concrete proportions and consistency, form works, methods of placing concrete, compaction, finishing and curing concrete.

B. JOINTS:
1. WEAKENED PLANE JOINTS
With the use of a power driven saw, cut a groove in the pavement, at locations shown in the Plans, to a minimum depth of 50 mm. and a maximum width of 5 mm. within 24 hours after the concrete was placed.
2. TRANSVERSE EXPANSION JOINTS
Use pre-moulded expansion joint fillers for transverse expansion joints as detailed and shown in the Plans.

C. SURFACE FINISHING
Finish the pavement surface to the required roughness by passing over the concrete a drag of one or two burlap cloths or by other approved means.

D. CURING AND PROTECTION
Immediately after the finishing operations, exposed concrete surfaces shall be cured by one of the following methods as the Contractor may elect.
1. Mat Method. The entire exposed surface shall be covered with two or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.
2. Impervious Sheeting Method. The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 300 mm when a continuous sheet is not used. The curing medium shall not be less than 450 mm wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or by placing a bank of moist earth along edges, and laps in the sheets. Sheets shall be satisfactory repaired or replaced if torn or otherwise damaged. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.
3. Membrane-Curing Method: The entire exposed surface shall be covered with a membrane-forming curing compound. Where type 1 curing compound is used, the concrete surface shall be shaded from the direct rays of the sun for a period of 3 days immediately after spraying. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats. The second coat shall be applied in a direction approximately at right

angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. Apply an additional coat to all surfaces showing discontinuity, pinholes or other defects. Concrete surfaces that are subjected to heavy rainfall within 3 hours after curing compound has been applied shall be resprayed by the above method and at the above coverage at no additional cost to the Owner. Expansion-joint openings shall be sealed at the top by inserting moistened paper or fiber rope or covering with strips of waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected for 7 days from pedestrian and vehicular traffic and from any other action that might disrupt the continuity of the membrane. Any area covered with curing compound and damaged by subsequent construction operations within the 7-day curing period shall be resprayed as specified above at no additional expense to the Owner.

E. OPENING TO TRAFFIC

Preclude any or all kinds of traffic over the concrete pavement for a period of 10 days or longer if the Engineer deems it necessary to extend this time. Maintain satisfactory barricades to exclude all traffic on the pavement. Repair of damage to the pavement due to traffic is at the expense of the Contractor.

END OF SECTION 02520

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02630
STORM DRAINAGE

1.00 GENERAL

1.01 SCOPE

A. This Section includes gravity-flow, non-pressure storm and foundation drainage outside the building, with the following components:

1. Cleanouts.
2. Drains.
3. Precast concrete manholes and other drainage structures.
4. Cast iron gratings and frames including trench drains.
5. Excavation and backfill for pipe and drainage structures.
6. Concrete pipe and fittings including flared end sections (FES).
7. HDPE pipe (corrugated) and fittings.
8. Perforated and solid PVC pipe for foundation drainage.

B. Related Sections include the following:

1. Division 2 Section “Earthwork” properly prepared subgrade.
2. Division 2 Section “Soil Erosion”.

1.02 SUBMITTALS

A. Shop Drawings: For the following:

1. Catch Basins and Stormwater Inlets and manholes. Include plans, elevations, sections, details, and frames, covers, and grates.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle catch basins, curb inlets and manholes according to manufacturer's written rigging instructions.

1.04 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage 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 service according to requirements indicated:

1. Notify Owner’s Representative or Construction Manager no fewer than five (5) days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner’s written permission.

2.00 PRODUCTS

2.01 CONCRETE PIPE

A. Reinforced-Concrete Pipe (RCP): Shall conform to AASHTO Specification M-170-81-1 and ASTM C 76, Class III, as indicated on the drawings. Joints shall be standard tongue and groove with mastic and butyl sealants in accordance with ASTM C990-96.

2.02 POLYETHYLENE PIPE

A. Corrugated HDPE Pipe and Fittings: ADS N-12 WT IB HDPE pipe with smooth interior and annular exterior corrugations. Pipe shall meet AASHTO M294, Type S, or ASTM F2306.

1. Soiltight Couplings: AASHTO M294, corrugated, matching pipe and fittings to form soiltight joints.

2.03 PVC PIPE AND FITTINGS

A. PVC Pipe: AWWA C900, Class 200, for gasketed joints and using ASTM F 477, elastomeric seals.

1. Fittings NPS 4 to NPS 8: PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.

2. Perforated pipe for foundation drains.

3. Solid pipe between foundation drains and daylight or drainage structures.

2.04 CLEANOUTS

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

2.05 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated.

2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

3. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.

4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

5. Joint Sealant: ASTM C 990 bitumen or butyl rubber.

6. Steps: Individual FRP steps, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.

B. Manhole Frames and Covers: Ferrous, 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER".

1. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

2.06 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.

3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum, unless otherwise indicated.

2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2.07 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

B. Frames and Grates: Heavy-duty frames and grates according to utility standards.

2.08 TRENCH DRAINS

A. Highway traffic duty frames and grates equal to Neenah Foundry R-4990-HX. Size as shown on drawings.

2.09 FOUNDATION DRAINAGE

A. Drainage Filter Fabric: Non-woven geotextile fabric of 3.5 oz. polypropylene or polyester fibers, or a combination thereof. Substitutes are allowed subject to approval.
1. Supac 4 NP by Phillips Fibers.
2. Enkafilter Type E35 by Enka.
3. Amoco 4545 by Atlantic Construction Fibers.

B. Washed Gravel: No. 4 or 5 clean gravel installation around perforated pipe.

2.10 EARTH FILL

A. Backfill shall be as specified in Division 2 Section "Earthwork" and be substantially free from organic materials, loam, wood, trash and other objectionable materials which may

be compressible, or which cannot be properly compacted. Additionally, the fill material shall not contain stones or rocks larger than 2 inches in diameter, blocks, broken concrete, masonry rubble, snow, ice, frozen earth or other similar materials. Compact in layers as specified in Division 2 Section "Earthwork".

2.11 STORMWATER RETENTION SYSTEM

A. The capture of stormwater for re-use in toilet flushing and roof garden irrigation shall to comply with sustainable design concepts shall be confirmed. The cost of the feature shall be provide in Division 1 section "Alternates".

3.00 EXECUTION

3.01 EXCAVATION

A. General: Only that portion of line which can be laid and backfilled in that day will be excavated at one time. Excavation shall be made to pipe grade by machine or hand as required and shall be left for fine grading by the pipe laying crew.

B. Width of trench shall be as required to install storm drainage lines as sized on drawings. Trench width shall be kept to that required for safe construction. All applicable regulations for worker saftey such as trench depth and sheathing shall be followed by the Contractor.

C. Trench Bottoms: Excavate trenches 100 mm (4 inches) deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

D. All trenching and backfilling work shall conform to applicable occupational safety standards and Contractor shall be responsible for enforcing worker safety measures.

3.02 SUBGRADE INSPECTION

A. Notify Construction Manager when excavations have reached required subgrade.

B. If Construction Manager determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed on the unit price basis.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment 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.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location, arrangement and type of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets,

seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

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

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

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

1. Install piping pitched down in direction of flow.

2. Install piping with 36-inch minimum cover.

3. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and

Fittings Handbook."

4. Install ductile-iron and special fittings according to AWWA C600 or AWWA M41.

5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

6. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.04 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

2. Join ductile-iron and special fittings according to AWWA C600 or AWWA M41.

3. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric seal joints or ASTM D 3034 for elastomeric gasket joints.

4. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual".

3.05 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

3.06 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections according to ASTM C 891.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 80 mm (3 inches) above finished surface elsewhere, unless otherwise indicated.

3.07 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.08 STORMWATER INLET/OUTLET AND TRENCH DRAIN INSTALLATION

A. Construct trench drain, inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

3.09 FOUNDATION DRAIN INSTALLATION

A. General: Place filter fabric on compacted subgrade. Place perforated pipe with holes down and filter sock on drainage fill so that pipe has minimum slope of 1:1200. Surround pipe with drainage fill and carefully compact prior to covering with rock. See foundation plan for location of foundation drainage lines.

3.10 UTILITY TRENCH BACKFILL

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

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

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section “Cast-in-Place Concrete”.

D. Provide 100 mm (4 inch) thick, concrete-base slab support for piping or conduit less than 900mm (30 inches) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 100 mm (4 inches) of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of subbase material, free of particles larger than 25mm (1 inch) in any dimension, to a height of 300 mm (12 inches) over the utility pipe or conduit.

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

F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 300 mm (12 inches) over the utility pipe or conduit.

G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

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

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Defects requiring correction include the following:

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

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

3. Reinspect and repeat procedure until results are satisfactory.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 02630

SECTION 02700
SITE DRAINAGE

1.00 GENERAL

1.01 SCOPE

Furnish all materials, labor, equipment, plant, tools required to complete the storm drainage system external to the building.

1.02 PROTECTION

Protect materials from loss, injury or defacement. Lost or damaged materials shall be replaced by the Contractor at his own expense.

2.00 PRODUCTS

See Section 01020 Summary of Materials and Finishes.

3.00 EXECUTION

3.01 EXCAVATION

A. Excavate trenches for all underground pipe lines to require depths, slope and grades.
B. Rest pipes on well-tamped solid bedding along its entire length.
C. Lay water and sewer pipes in separate trenches.
D. See SECTION 02200: EARTHWORK, ITEM 3.06

3.02 BACKFILLING

A. Pipe lines shall be tested by Contractor and by Owner's representative prior to backfilling.
B. Clean and free all excavation from trash and debris.
C. Backfill shall consist of same material excavated or other approved materials. Free backfill of debris and big stones. Place backfill in horizontal layers not exceeding 300 mm (12") or as indicated or directed.
D. Carefully place and tamp backfill under and around pipe barrel in such manner so as not to disturb pipe line and joints.
E. Properly moisten each backfill layer and compact by hand or machine to an optimum density that will present excessive settlement and shrinkage.

END OF SECTION 02700

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02741
ASPHALT PAVING

1.00 GENERAL

1.01 SCOPE

A. This Section includes the following:

1. Aggregate base material.
2. Hot-mix asphalt paving.
3. Pavement-marking paint.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" properly prepared subgrade.
2. Division 2 Section "Cement Concrete Pavement" for concrete paving, walks, wheel stops, and curbs and concrete bands.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and Division 1 Specification Sections, apply to this Section.

1.03 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of the Department of Public Works and Highways (DPWH).

1.04 SUBMITTALS

A. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix asphalt proposed for the Work. Certificate shall state all pavement materials are DPWH certified and comply with specifications herein.

1.05 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

1. Review condition of sub-grade and preparatory work.
2. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

B. Source and type of aggregate base material shall be approved by the Owner's Representative prior to placement.

C. Asphalt materials shall comply with the DPWH Standard Specifications for Roads and Structures and the Am. Association of State Highway Transportation Officials (AASHTO).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if sub-grade is wet or excessively damp or if the following conditions are not met:

1. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.

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

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

2.00 PRODUCTS

2.01 AGGREGATE BASE

A. Aggregate base course material shall consist of crushed stone or crushed gravel and shall conform to the requirements of DPWH Design Guidelines.

1. Thickness: As shown on drawings.

2.02 AGGREGATES FOR ASPHALT MIX

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.03 ASPHALT MATERIALS

A. Asphalt Binder: Type I19.OB as per NCDOT, plant mixed, layered to a compacted thickness as shown on the site drawings.

B. Asphalt Surface Coat: Type S9.5A as per NCDOT, plant mixed, layered to a compacted thickness as shown on the site drawings.

C. Prime Coat: Asphalt emulsion prime coat complying with DPWH requirements

D. Water: Potable

E. Under sealing Asphalt: ASTM D 3141, pumping consistency.

2.04 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 3 minutes.

1. Color: White and Yellow.

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

2.05 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by DPWH designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types."

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:

a. Base Course: 25 mm.

b. Surface Course: 12 mm.

3.00 EXECUTION

3.01 EXAMINATION

A. Verify that sub-grade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll sub-base using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

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

3.02 AGGREGATE BASE PLACEMENT

A. The aggregate base material shall be placed on the subgrade to the specified depth and in such a manner as to prevent segregation. Where the required compacted thickness of base is 8 inches or less, the base material may be spread and compacted in one layer. Where the compacted thickness is more than 8 inches, the base material

shall be spread and compacted in two or more lifts approximately 4-6 inches. Each layer of material shall be compacted tested, and approved before placing succeeding layers of base material or pavement.

B. No aggregate material shall be placed on frozen subgrade or base. Hauling equipment shall not be operated on subgrade or a previously completed layer of base material soft enough to rut or weave beneath the equipment. The maximum speed of trucks traveling over any part of the subgrade or base shall be 20 miles per hour.

C. The Contractor shall utilize methods of handling, hauling, and placing aggregate material which will minimize segregation and contamination. If segregation occurs, the Architect may require that changes be made in the Contractor's methods to minimize segregation, and may also require mixing in place which may be necessary to correct any segregated material. No additional compensation will be allowed for work of in-place mixing as may be required. Aggregate which is contaminated with foreign materials to the extent the base course will not adequately serve its intended use shall be removed and replaced by the Contractor at no additional cost to the Owner regardless of prior acceptance.

D. Each layer shall be maintained to the required cross section during compacting and each layer shall be compacted to a density of at least 100% of that obtained by compacting a sample of the material in accordance with AASHTO T99. The base material shall be compacted at a moisture content which is approximately that required to produce the maximum density indicated by the above test method. The Contractor shall dry or add mixture to the material when required to provide a uniformly compacted and acceptable base.

E. The final layer (or top surface for a single layer) of the aggregate base material shall be shaped to conform to the lines, grade, and typical sections shown on the plans or established by the Owner's Representative and Architect/Engineer of record. When completed, the base course shall be smooth, hard, dense, unyielding, and well bonded, and level-with adjacent materials.

3.03 SURFACE PREPARATION

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

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.

3.04 HOT-MIX ASPHALT PLACING

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

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.

2. Place hot-mix asphalt surface course in single lift.

3. Spread mix at minimum temperature of 250 deg F.

4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.

5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

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

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt 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 hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.05 JOINTS

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

1. Clean contact surfaces and apply tack coat to joints.

2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.

3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.06 COMPACTION

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

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

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated

crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

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

1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.07 INSTALLATION TOLERANCES

A. Aggregate Base Course: Minimum specified thickness or up to 1/2 inch plus.

B. Asphalt Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 12mm (1/2 inch).

2. Surface Course: Plus 6 mm (1/4 inch).

C. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 3050 mm (10-foot) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 6 mm (1/4 inch).

2. Surface Course: 3 mm (1/8 inch).

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 6 mm (1/4 inch).

3.08 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with the Owner's Representative and Site Architect.

B. Sweep and clean surface to eliminate loose material and dust.

C. Apply paint in a two-coat application with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of aggregate base and hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.

b. 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.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 02741

SECTION 02751
CEMENT CONCRETE PAVING

1.00 GENERAL

1.01 SCOPE

A. This Section includes exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Curbs and concrete bands.
3. Walkways.
4. Concrete wheel stops.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.
2. Division 2 Section “Asphalt Paving” for pavement-marking paint.
3. Division 2 Section "Pavement Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.
4. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

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 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Joint fillers.

E. Field quality-control test reports.

F. Minutes of preinstallation conference.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

D. Concrete Testing Service: Owner will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete producer.
d. Concrete pavement subcontractor.

1.06 PROJECT CONDITIONS

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

2.00 PRODUCTS

2.01 MANUFACTURERS

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

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

2.02 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.03 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

D. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length

with ends square and free of burrs.

E. Plain Steel Wire: ASTM A 82, galvanized.

F. Deformed-Steel Wire: ASTM A 496.

G. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

H. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I or II. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.05 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; manufactured for application to fresh concrete.

1. Products:
a. Axim Concrete Technologies; Cimfilm.

b. Burke by Edeco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
h. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
i. Sika Corporation, Inc.; SikaFilm.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Products:
a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. Burke by Edoko; Aqua Resin Cure.
c. ChemMasters; Safe-Cure Clear.
d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
f. Euclid Chemical Company (The); Kurez DR VOX.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; Aqua Kure-Clear.
i. L&M Construction Chemicals, Inc.; L&M Cure R.
j. Meadows, W. R., Inc.; 1100 Clear.
k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
l. Symons Corporation; Resi-Chem Clear.
m. Tamms Industries Inc.; Horncure WB 30.
n. Unitex; Hydro Cure 309.
o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.06 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.07 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115 or AASHTO M 248.

1. Color: White and Yellow.

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

2.08 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

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

2.09 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi.

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.

3. Slump Limit: 4 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals as follows:

1. Fly Ash or Pozzolan: 25 percent.

2. Ground Granulated Blast-Furnace Slag: 50 percent.

3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.

2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.

3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 2 Section "Earthwork."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.

2. Provide tie bars at sides of pavement strips where indicated.

3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.

2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.

4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: Tool edges of pavement, concrete band, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or

side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

J. Screed pavement surfaces with a straightedge and strike off.

K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

L. Curbs and Concrete Bands: When automatic machine placement is used for curb and concrete bands placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and concrete band to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

N. 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.

O. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.

b. Continuous water-fog spray.

c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

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

3.09 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

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

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with the site Architect/Engineer of record.

B. Allow concrete pavement to cure for 30 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.11 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to 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 two days before date scheduled for final inspections.

END OF SECTION 02751

SECTION 02764
PAVEMENT JOINT SEALANTS

1.00 GENERAL

1.01 SCOPE

A. This Section includes sealants for the following type of joints:

1. Expansion and contraction joints within cement concrete pavement.

B. Related Sections include the following:

1. Division 2 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
2. Division 2 Section "Cement Concrete Pavement" for constructing joints in concrete pavement.
3. Division 7 Section "Joint Sealants" for sealing non-traffic in locations not specified in this Section.

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. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain joint-sealant manufacturers written instructions for corrective measures including use of specially formulated primers.

5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36- month period preceding the Notice to Proceed with the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.

2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.

3. When joint substrates are wet.

4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Products: Substitutes are allowed subject to approval.
   a. Crafco Inc.; RoadSaver Silicone.
   b. Dow Corning Corporation; 888.
   c. Pecora Corporation; 301 NS.

B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Products: Substitutes are allowed subject to approval.
   a. Crafco Inc.; RoadSaver Silicone SL.
   b. Dow Corning Corporation; 890-SL.
   c. Pecora Corporation; 300 SL.

C. Multi-component Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

1. Products: Substitutes are allowed subject to approval.
   a. Meadows, W. R., Inc.; Sof-Seal.
   b. Pecora Corporation; Urexpan NR-300.
   c. Marneco International, Vulkem 202.

2.04 HOT-APPLIED JOINT SEALANTS

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Products: Substitutes are allowed subject to approval.
   a. Crafco Inc.; Superseal 444/777.
   b. Meadows, W. R., Inc.; Poly-Jet 3406.
   c. Chemque, Inc., Q-Seal 295A

B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

1. Products: Substitutes are allowed subject to approval.
   a. Chemque, Inc., Q-Seal
   b. Koch Materials Company; Product No. 9030.
   c. Meadows, W. R., Inc.; Sealtight Hi-Spec.

2.05 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.06 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance.

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

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturers written installation instructions for products and applications indicated, unless requirements that are more stringent apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.

2. Do not stretch, twist, puncture, or tear backer materials.

3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes. Sealants shall be without deterioration or damage at time of final acceptance. If, despite such protection, damage or deterioration occurs, cut out, remove damaged or deteriorated joint sealants immediately, and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 02764

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02780
UNIT PAVERS

1.00 GENERAL

1.01 SCOPE

A. This Section includes the below listed work:

1. Concrete pavers set in sand leveling course.

B. Related Sections include the following:

1. Division 2 Section "Cement Concrete Pavement" for concrete substrate under unit pavers.

1.02 SUBMITTALS

A. Product Data: For the following:

1. Pavers.

B. Samples for Verification:

1. Full-size units of each type and size of unit paver indicated.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of final acceptance.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

2.00 PRODUCTS

2.01 CONCRETE PAVERS

A. Concrete Pavers: Solid paving units, made from normal-weight concrete with a compressive strength not less than 5000 psi, water absorption not more than 5 percent according to ASTM C 140, and no breakage.

1. Thickness: 100 mm (4 inches).

2. Paving Key/Pattern:

a. Paver A: Size: 18 x 3 inches, Color: Almond, Finish Natural

b. Paver B: Size: 18 x 3 inches, Color: Espresso Brown, Finish Natural

2.02 ACCESSORIES

A. Aluminum Edge Restraints: Straight, 3/16-inch thick by 4-inch high extruded-aluminum edging with loops pressed from face to receive stakes at 12 inches o.c., and aluminum stakes 12 inches long for each loop.

2.03 CONCRETE BASE

A. Concrete substrate furnished under Section 02751.

2.04 AGGREGATE SETTING-BED MATERIALS

A. Manufacturer: Subject to compliance with requirements, provide products for Polymeric Sand:

B. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.

C. Sand for Joints: polymeric sand – mason grade sand (ASTM C-144) with polymeric additive

1. Color – tan

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.02 PREPARATION

A. Clean concrete substrates to remove dirt, dust, debris, and loose particles.

3.03 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern: As indicated.

E. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

3.04 AGGREGATE LEVELING COURSE APPLICATIONS

A. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

B. Treat leveling course with herbicide to inhibit growth of grass and weeds.

C. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers.

D. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:

1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.

2. Before ending each day's work, fully compact installed concrete pavers to within 36 inches of the laying face. Cover pavers that have not been compacted, and leveling course on which pavers have not been placed, with nonstaining plastic sheets to protect them from rain.

E. Spread polymeric sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Do not allow traffic on installed pavers until sand has been vibrated into joints.

F. Do not apply to wet or damp surfaces. All surfaces must be completely dry before application.

G. Surface must be free of polymeric sand before wetting. Wetting should take place in sections no larger than 500 sq ft at a time with a fine mist to a depth of 1 ½" depth. Do not flood the surface.

H. Repeat joint-filling process 30 days later.

I. Apply polymeric sand under dry weather when no rain is forecasted for 24 hrs, and temperatures are above 55 F.

3.05 REPAIRING AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Cleaning: Remove excess sand from exposed paver surfaces.

END OF SECTION 02780

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02781
POROUS PLASTIC UNIT PAVING

1.00 GENERAL

1.01 SCOPE

A. This Section includes the following:

1. Porous plastic paving units set in aggregate setting beds.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for excavation and compacted subgrade.
2. Division 2 Section "Lawns and Grasses" for grass planted in porous paving.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and Division 1 Specification Sections, apply to this Section.

1.03 SUBMITTALS

A. Product Data: For the following:

1. Pavers.
2. Geotextiles.

B. Samples for Initial Selection:

1. Each type of unit paver indicated.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of porous paver from one source that has resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Final Acceptance.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store at a location and in such a manner as to prevent damage to the pavers.

B. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

2.00 PRODUCTS

2.01 PLASTIC PAVER UNITS

A. Plastic Grid Pavers: Provide "invisible" pavers made from 100% recycled plastic materials. Pavers consist of thin-walled independent plastic rings connected by an interlocking geogrid structure. Features include:

1. Strength: 5,720 psi
2. Color: Black
3. Resin: 100% recycled HDPE (standard)
4. Roll Sizes: Range from 3 feet 3 inches wide x 33 feet long to 8 feet 2 inches wide to 164 feet long.
5. Approved Products: Substitutions allowed with approval.
   a. GrassPave 2 by Invisible Structures, Inc.
   b. GeoBlock by Presto Products Company.
   c. EcoGrid E50 TerraFirm Enterprises.

2.02 ACCESSORIES

A. Precast Concrete Fire Lane Marker: Made from normal-weight concrete with a compressive strength not less than 5000 psi and water absorption not more than 5 percent, in shapes and sizes indicated.

1. Size: 610 mm (24 inches) square, 64 mm (2-1/2 inches) thick.
2. Spacing: 15.4 meters (50 feet) on center.

2.03 AGGREGATE SETTING-BED MATERIALS

A. Graded Aggregate for Base Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 57.

B. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.

C. Soil for Porous Paver Fill: Planting soil mix

D. Grass Seed:

E. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications; made from polyolefins or polyesters, with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
3. Permittivity: 0.02 per second, minimum; ASTM D 4491.
4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

3.00 EXECUTION

3.01 PREPARATION

Read and accepted as part of the Contract:

Bidder / Contractor

A. Proof-roll prepared subgrade according to requirements in Division 2 Section "Earthwork" to identify soft pockets and areas of excess yielding. Proceed with plastic paver installation only after deficient subgrades have been corrected and are ready to receive base course for plastic pavers.

3.02 INSTALLATION, GENERAL

A. Cut plastic pavers as may be required to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.

B. Tolerances:

1. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch unit-to-unit offset from flush.

2. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches and ¼ inch in 10 feet or a maximum of 1/2 inch.

C. Provide precast fire lane markers as indicated. Install markers after placing plastic pavers.

1. Install precast concrete markers on a bedding of compacted base-course material over compacted subgrade. Set markers at elevations indicated, accurately aligned, and place and compact base-course material under markers as indicated.

3.03 SETTING-BED INSTALLATION

A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.

B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. 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.

C. Place aggregate base, compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.

D. Place drainage geotextile over compacted base course, overlapping ends and edges at least 300 mm (12 inches).

E. Place leveling course and screed to a thickness of 25-38 mm (1 to 1-1/2 inches), taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

3.04 PAVER INSTALLATION

A. Set plastic pavers on leveling course, being careful not to disturb leveling base. Use string lines to keep straight lines.

B. Lay plastic pavers onto the leveling course as per manufacturer's directions.

C. Place soil fill as follows, immediately after placement of plastic pavers. Spread and screed soil fill level with tops of pavers. Vibrate pavers and add soil fill until paving is filled to about 20 mm (3/4 inch) from top surface; remove excess soil fill if any.

D. After filling pavers with soil, sow seed to comply with requirements in Division 2 Section "Lawns and Grasses," except sow seed at half the rate specified for seeding lawns.

1. Within 24 hours after sowing seed, spread an additional 5 mm (3/16 inch) of soil fill over seed and soak with water.

3.05 MAINTENANCE AND PROTECTION

A. Water newly planted grass and keep moist until grass is established. Maintain grass that is planted in paving to comply with requirements in Division 2 Section "Lawns and Grasses."

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades for 60 days after planting.

END OF SECTION 02781

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02810
IRRIGATION SYSTEMS

1.00 GENERAL

1.01 SCOPE

A. This Section Includes: Materials and labor for irrigation system that cover the interior landscaped courtyard and roof garden adjacent to the Executive Dining area.

B. Related Sections Include the following: Division 1 “Water Systems”.

1.02 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

1.03 PERFORMANCE REQUIREMENTS

A. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100% irrigation coverage of areas indicated.

B. Delegated Design (Design/Build type contract): Design 100% coverage irrigation system, unless otherwise specified, using performance requirements and design criteria indicated.

C. Working Pressures: The following are pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: maximum 90 psi, minimum 60 psi.

2. Circuit Piping: maximum 70 psi, minimum 60 psi.

1.03 SUBMITTALS

A. General: Submit the following in accordance with conditions of the contract and Section 01330, Submittal Procedures.

B. Product Data: All pipe and tubing materials, valves, emitters, bubblers, sprinkler heads, equipment, and accessories shall be submitted for approval. Data shall indicate the maximum allowable operating pressures of each component and any related manufacturing standards and recommendations. Submit manufacturer's literature, technical data, and recommendations for the system components as specified. Any product requested as an "equal" must have cut sheets submitted with the request.

C. Construction Drawings: Submit detailed shop drawing showing complete system layout to include backflow preventer, irrigation piping and sizes, sprinkler and bubbler heads,

emitters, wiring diagram for controller and, if applicable, the specified backflow preventer, valves, and controllers (to include mounting detail).

D. Red-Line Drawings:

1. Record drawings noting any variations from the Contract Documents shall be corrected daily during the construction project. Submit one copy of record "Red-Line" prints prior to expiration of the required maintenance period to the Project Lead (PL).

E. Controller Chart:

1. Provide a Controller Chart that is 8-1/2 inches x 11 inches and hermetically sealed. Chart shall be legible [adjust format accordingly] and color-coded for each zone, keying stations of the Controller to valve locations and to irrigation heads served by the station. Place Chart inside door of Controller. If chart details are not legible when reduced, the drawings shall be divided so that the drawing components become more legible when reduced to 8-1/2 inches x 11 inches.

F. Operation & Maintenance (O&M) Manual:

1. The O&M Manual shall include manufacturer's recommended instructions and maintenance schedule for the complete irrigation system.

2. Provide a copy of the color-coded Controller Chart in the Manual.

1.07 QUALITY ASSURANCE

A. Contractor shall be have a minimum of five years' experience in the type and scale of work required in this Section.

B. Irrigation System: Provide underground irrigation system as a complete unit, including sprinklers, bubblers, drip irrigation heads, controllers, and accessories – produced by acceptable manufacturers as specified herein.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

B. Product Handling: Follow manufacturer's published recommendations for handling materials and equipment. PVC pipe shall lay flat during transport and storage.

1.10 WARRANTY

A. General: Warranty underground irrigation system through the specified warranty period [one 12-month calendar period] against operational deficiencies due to inferior material or workmanship. Repairs shall be completed within ten business days of notification from the Construction Manager.

2.00 PRODUCTS (Not Used)

3.00 EXECUTION

Read and accepted as part of the Contract:

Bidder / Contractor

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 02200 – Earthwork.

B. Manual Drain Pockets: Excavate to sizes indicated on drawings. Backfill with cleaned gravel or crushed stone, graded from 3/4 inch to 1-1/2 inches (19 mm to 75 mm), to 36 inches (300 mm) below grade. Cover gravel or crushed stone with sheet of weed-barrier fabric, and backfill remainder with excavated material. Manual drain valves shall be installed in an 11-inch x 17-inch valve box.

C. Trenching:

1. Stake out all sprinkler head and valve locations prior to trenching for review and approval by the Owner's Representative Landscape Architect/Site Horticulturist.

2. Keep bottom of trench or excavation free and clear of water.

3.02 PREPARATION

A. Installation: Prior to installing irrigation heads, stake or otherwise locate trees and shrub planting areas. DO NOT install irrigation lines within 5 ft. of any newly installed plant root ball. Install irrigation material and equipment and provide necessary hardware in accordance with the Contract Drawings.

3.03 FIELD QUALITY CONTROL

A. Inspection – Test and Flushing: Upon completion of the irrigation system, the entire system shall be flushed, tested, and inspected.

1. Flushing: Prior to testing, the entire system shall be partially backfilled, leaving all joints and connections exposed and the entire System shall be flushed clear of all debris, dirt and foreign matter.

2. Testing: A hydrostatic pressure test of main and lateral lines at 100 psi for one hour is required.

3. Back Flow Testing: Provide test results of RP or PVB testing to Construction Observer.

4. Following system testing and adjusting, operate the entire installation to demonstrate the complete and successful operation of all equipment. Re-adjust as required, all valves, sprinkler heads, bubblers, and emitters for proper operating pressures, uniform coverage and even flow.

B. Any irrigation product will be considered defective if it does not pass tests and inspections. Defective work or materials shall be corrected satisfactorily.

C. Prepare test and inspection reports.

3.04 BACKFILLING

A. Prior to backfilling trenches, contact the Construction Observer to have controller, valves, and wires located.

B. After pipe joints have been visually inspected, flushing and pressure testing performed and accepted, backfilling may begin.

C. Backfill material shall be free from construction rubbish, rock, large stones, brush, sod, frozen material or any material that would damage the pipe or wires. When material from excavation or trenching is unsuitable for use as backfill it shall be disposed of, and suitable material which is capable of attaining the required relative density shall be furnished. This material shall be inspected prior to backfilling.

3.05 COMMISSIONING

A. Landscape and Irrigation Commissioning shall be conducted by the Design Landscape Architect/Site Horticulturist and CxA, who will conduct the commissioning in conjunction with the General Contractor, Landscape Contractor. At a minimum, the following irrigation equipment and systems shall be commissioned:

1. Hydrostatic Pressure Test – Main, Laterals, and Control Valves.
2. Flow Meter Pumps, if applicable.
3. Cisterns, if applicable.
4. Sprinkler, Drip, and Bubbler Heads – Placement, Coverage, and Operating Pressures prior to planting.
5. Backflow Preventer.
6. Heater or Heat Tape – Used in Backflow Preventer Enclosure.
7. Irrigation System Audit – Confirm audit of turf areas 2,500 sf or larger as per this specification 1.6 G.

3.06 DEMONSTRATION AND MAINTENANCE

A. Train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controller.

B. Maintain and adjust the irrigation system in coordination with the plant materials requirements until substantial completion. Irrigation maintenance shall include repair and replacement of parts or workmanship not operating properly and adjustment of timing and coverage of heads.

C. Record Drawings and Controller Chart:

1. Maintain a complete set of up-to-date Red-Line drawings, and provide a copy to the Construction Manager.
2. Prepare a controller chart (color coded map) hermetically sealed in plastic showing: Location of all sections, valves, lateral lines, and routes of control wires. Identify all valves by size, station, and number.

3.07 FINAL INSPECTION AND ACCEPTANCE.

A. Upon written request by the Contractor, an inspection of the irrigation system will be made by the Owner’s Representative and the Design Landscape Architect/ Site Horticulturist. The Contractor will be notified in writing of the Final Acceptance, or of

work required. The Contractor will be responsible for all maintenance until ALL punch list items are completed and Final Acceptance is granted at which time the Owner will assume responsibility.

B. Where inspected irrigation work does not comply with the requirements of the Specification and Contract Drawings, replace rejected work and continue specified maintenance until reinspected by the Owner's Representative and found to be acceptable. Promptly remove rejected equipment.

END OF SECTION 02100

Read and accepted as part of the Contract:

Bidder / Contractor

02900
LANDSCAPING

1.00 GENERAL

1.01 SCOPE

A. Contractor to coordinate and protect the installation of the following Owner's plants and related materials during construction:

1. Trees.
2. Shrubs.
3. Ground covers.
4. Lawns.
5. Topsoil and soil amendments.
6. Fertilizers and mulches.
7. Filter Blanket
8. Stakes and guys.
9. Root Control Devices
10. Landscape Edgings

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. See Division 1, Section 01230 Alternates requesting bid alternate for Bidders to include Landscaping within the scope of work.
2. Section 02110 Site Clearing: for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.
3. Section 02200 Earthwork: for excavation, filling, rough grading, and subsurface aggregate drainage and drainage backfill.

1.02 COORDINATION

A. General: Coordinate and cooperate with others to enable the works to proceed as rapidly and efficiently as possible.

1.03 INTENT OF DRAWINGS AND SPECIFICATIONS

A. General: It is the intent of the Drawings and Specifications that the Contractor provide planting with plants in vigorous growth, ready for Landscape Architect's use.

1.04 SUBMITTALS

A. Provide 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 address of architects and owners, and other information specified.

B. Provide maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

1.05 SOILS ANALYSIS

A. Obtain soils analysis of existing topsoil from accredited soils laboratory at Contractor's cost. Submit results of soils analyses and recommendations for achieving adequate fertility to the Landscape Architect for review six (6) months prior to initiation of landscape works. Soils laboratory recommendations for achieving adequate fertility will supercede recommendations specified in 2.03 Topsoil unless otherwise approved by the Landscape Architect.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Handle balled and burlapped stock by the root ball.

C. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

B. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.08 WARRANTIES

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Warranty After Final Acceptance: The Contractor shall warrant the following living planting materials for a period of twelve (12) months after date of Final Acceptance, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions, or incidents that are beyond Contractor's control.

1. Trees and Palms
2. Shrubs.
3. Ground covers.
4. Lawns

C. Remove and replace, without cost to the Owner and as soon as weather conditions permit, all dead plants and all plants not in a vigorous, thriving condition, as determined by the Landscape Architect during and at the end of the Warranty Periods. Plants shall be free of dead or dying branches and branch tips, and shall bear foliage of a normal density, size and color. Replacements shall closely match adjacent specimens of the same species and shall be subject to all requirements of this Specifications. A limit of

one replacement of each plant material will be required, except for losses or replacements due to failure to comply with requirements.

1.09 FINAL ACCEPTANCE

A. General. The Work of this Section will be accepted by the Owner upon satisfactory completion of all works, including maintenance, but exclusive of replacement of plant materials under the Warranty Period.

B. Perform corrective Work and materials replacement in accordance with the Contract Documents. A twelve (12) - month Maintenance Period shall be commenced for all replacement plants.

C. After corrective Work is completed, an inspection for Final Acceptance as outlined above shall again be requested. Upon Final Acceptance, the Owner will assume responsibility of maintenance of the Work.

2.00 PRODUCTS

2.01 GENERAL

A. Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of the Project for at least one (1) year. Unless specifically noted otherwise, all plants shall be exceptionally heavy, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry. Plants shall be sound, healthy and vigorous, well-branched and densely foliated when in leaf.

2.02 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

2.03 GROUND COVERS

A. Provide ground covers established and well rooted in removable containers or integral peat pots and with not less than the minimum number and length of runners required by ANSI Z60.1 for the pot size indicated.

2.04 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth.

1. On-site Topsoil: Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil when quantities are insufficient. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

2. Amended Topsoil: Amend existing surface soil to produce topsoil. Supplement with imported topsoil when required.

2.05 SOIL AMENDMENTS

A. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth. Mix at the rate of 1 part manure per 1 part soil.

2.06 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:

2.07 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following: Type: Wood and bark chips.

2.08 STAKES AND GUYS

A. Guy Cable: 5-strand, 3/16-inch (4.8-mm) diameter, galvanized-steel cable, with zinc-coated turn buckles, 3-inch- (75-mm-) long minimum, with two 3/8-inch- (10-mm-) galvanized eyebolts.

B. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch (13 mm) in diameter, black, cut to lengths required to protect tree trunks from damage.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, and secure Landscape Architect's acceptance before the start of planting work. Make minor adjustments as may be required.

3.03 PLANTING SOIL PREPARATION

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

B. For planting beds and lawns, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting. Apply phosphoric acid fertilizer, other than that constituting a portion of complete fertilizers, directly to subgrade before applying planting soil and tilling.

3.04 GROUND COVER BED PREPARATION

A. Loosen subgrade of planting bed areas to a minimum depth of 6 inches (150 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials.

B. Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.

3.05 EXCAVATION FOR TREES AND SHRUBS

A. Root Control Device: Excavate circular pit to accept vertically 1.00 m diameter x 1.00 m length Reinforced Concrete Culvert, with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.

B. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Lay drainage fill and filter blanket on top of compacted subgrade.

1. Balled and Burlapped Trees and Shrubs: Excavate approximately 1-1/2 times as wide as ball diameter and equal to ball depth, plus the following setting layer depth. Setting Layer: Allow 12 inches (300 mm) of planting soil.

2. Container-Grown Trees and Shrubs: Excavate to container width and depth, plus the following setting-layer depth. Setting Layer: Allow 6 inches (150 mm) of planting soil.

C. Dispose of subsoil removed from landscape excavations. Do not mix with planting soil or use as backfill.

E. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

F. Fill excavations with water and allow to percolate out, before placing setting layer and positioning trees and shrubs.

3.06 PLANTING TREES AND SHRUBS

A. Set balled and burlapped stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

B. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

C. Set bare-root stock on cushion of planting soil. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots. Remove injured roots by cutting cleanly; do not break.

D. Dish and tamp top of backfill to form a 3-inch- (75-mm-) high mound around the rim of the pit. Do not cover top of root ball with backfill.

3.07 TREE AND SHRUB GUYING AND STAKING

A. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

B. Guying and Staking: Guy and stake trees exceeding 14 feet (4.2 m) and more than 3-inch (75-mm) caliper unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches (760 mm) long, driven to grade. Attach flags to each guy wire, 30 inches (760 mm) above finish grade.

3.08 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.

B. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems. Thickness: 2 inches (50 mm).

3.09 CLEANUP AND PROTECTION

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, as described in Section “Site Clearing”.

END OF SECTION 02900

_____

Read and accepted as part of the Contract:

_____

Bidder/Contractor

SECTION 02920
LAWNS AND GRASSES

1.00 GENERAL

1.01 SCOPE

A. The Design-Build Contractor shall provide bid allowance for the labor and materials to provide lawn and grass seeds, seeding, grass preservation mix and erosion-control materials.

B. Related Sections:
   1. Division 2 Section “Alternates”
   1. Division 2 Section "Site Clearing & Demolition" for topsoil stripping and stockpiling.
   2. Division 2 Section "Earthwork" for excavation, filling and backfilling, and rough grading.
   3. Division 2 Section "Soil Erosion”.

1.02 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.03 SUBMITTALS

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

B. Certification of Grass Seed: From seed vendor for each grass-seed mono-stand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Product Certificates: For soil amendments and fertilizers, from manufacturer.

E. Planting Schedule: Indicating anticipated planting dates for each type of planting.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil. Report suitability of topsoil for lawn growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

C. Preinstallation Conference: Conduct conference at Project site.

D. Written approval shall be obtained from Architect before proceeding with planting.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1.06 PROJECT CONDITIONS

A. Planting Restrictions: Plant during the rainy season. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Final Acceptance.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

2.00 PRODUCTS

2.01 SEED

A. Grass Seed and Preservation Seed Mix: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Certified seed of grass species.

1. Full Sun: Proportioned by weight as follows:

a. 90 percent Tall Fescue (Festuca arundinacea) approved varieties – Apache II, Rebel 2000, Rebel Sentry, Falcon, Renegade.

b. 10 percent Kentucky bluegrass (Poa pratensis) approved varieties – Thermal Blue, Baron, Bartitia, or North Star,

2. Sun and Partial Shade: Proportioned by weight as follows:

a. 80 percent Tall Fescue (Festuca arundinacea) approved varieties – Apache II, Rebel 2000, Rebel Sentry, Falcon, Renegade

b. 10 percent Kentucky bluegrass (Poa pratensis) approved varieties – Thermal Blue, Baron, Bartitia, or North Star

c. 5 percent Hard Fescue (Festuca variety) approved varieties – Discovery, Aurora Gold d. 5 percent Fine Fescue/Chewings fescue (Festuca variety) approved varieties - Windward

2.02 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 6 percent organic material content; free of stones 50 mm (1/2 inch) or larger in any dimension and other extraneous materials harmful to plant growth.

B. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 100 mm (4 inches) deep; do not obtain from agricultural land, bogs or marshes.

2.03 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.

2. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.04 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through ¾-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.05 PLANTING ACCESSORIES

A. Selective Herbicides: US EPA registered and approved, of type recommended by manufacturer for application.

2.06 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition: otassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.07 MULCHES

A. Mulch: A protective cover shall be placed over all newly seeded areas. It shall consist of either hay, straw, wood cellulose fiber and non-toxic asphaltic emulsion condition and suitable for placing with mulch blower equipment.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

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 Architect and replace with new planting soil.

3.02 PREPARATION

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

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

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.

3.03 PERMANENT SEEDING

A. Sow seed with spreader or seeding machine (or hydroseeder – refer to “Hydroseeding”). Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not use wet seed or seed that is moldy or otherwise damaged. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total minimum rate of 5 lb/1000 sq. ft..

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes 3:1 and greater with erosion-control blankets installed and stapled according to manufacturer's written instructions.

1. Slopes where hardwood mulch is proposed with plantings do not require erosion control blankets.

E. Protect seeded areas with slopes not exceeding 3:1 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

3.04 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.

3.05 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period. Areas where trapped sediment has been removed, and distributed areas resulting from the disposition of temporary erosion control areas shall be permanently seeded.

END OF SECTION 02920

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 02930
EXTERIOR PLANTS

1.00 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, equipment, plant, tools required to complete:

- Protection of selected existing historical tree.
- And planting of new trees in accordance with UP System requirements.
- New top soil and plant materials at the roof deck that will be accessible from the Executive Dining area.
- New plants and hardscape to be designed by a landscape architect for low maintenance planting scheme requiring minimal watering.

B. Do not cut down any trees without the approval of the Landscape Architect and the Owner. Secure permit from proper authorities in the transfer and cutting of trees. See drawings for coverage of work involved.

1.02 EXAMINATION OF SITE

Visit the site of the work and examine the premises to fully understand all existing conditions relative to the work. No increase of cost or extension of performance time will be considered for failure to verify and know actual site conditions.

1.03 PROTECTION

Protect adjacent interior dining area flooring which will be accessed from the service elevator. Provide surface drainage in a manner to avoid creating nuisance to adjacent areas during the period of construction.

2.00 PRODUCTS

2.01 TOP SOIL AND VEGETATION

A. Owner shall approve the Landscape Plans prior to start of construction.

B. Coordinate plant selection and required top soil quantity with the Architect of Record and the Construction Manager.

C. All debris and other materials resulting from clearing and grubbing work shall be immediately removed from the premises and dumped at sites provided by the Contractor in manner approved by the Construction Manager.

3.00 EXECUTION

3.01 DEMOLITION

A. Demolish and remove from existing structures and other obstructions within the building area as indicated in the Plans.

B. Where existing concrete on ground is to be demolished, remove all existing concrete and other obstructions to a depth of 610 mm (24") below grade

C. Cap all existing utility lines. Consult Owner before commencing work.

3.02 CLEARING AND GRUBBING

A. Do not uproot or cut down trees unless specifically shown in the plans or as directed by the Architect and/or Owner. Secure permit to cut when necessary.

B. Protect trees indicated in the plans as "trees to be preserved."

C. Cut down trees in manner to avoid damage to trees to be preserved, prevent injury to structures or minimize danger to traffic.

D. Remove tree stumps and roots. Holes left behind shall be filled with suitable material and compacted in accordance with item Section 02200 EARTHWORK.

E. Grub up or clear undergrowth, bushes, vegetation rubbish and all objectionable and dispose in accordance with item 2.01 of this Section.

3.03 REPAIRS:

A. Repair damage done to existing on-site facilities or to property of any person or persons off the premises by reason of the required work for supplying exterior planting.

B. All expenses arising from the above scope of work shall be at the expense of the Contractor.

END OF SECTION 02100