Project Manual

Bid Package 02

(SITE DEMOLITION AND UTILITIES)



Cherokee Nation Replacement Hospital

Tahlequah, Oklahoma

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| 10/07/22 | 0 | 26 51 19 | LED Interior Lighting |
| 10/07/22 | 0 | 26 52 13 | Emergency and Exit Lighting |
| 10/07/22 | 0 | 26 56 13 | Lighting Poles and Standards |
| 10/07/22 | 0 | 26 56 19 | LED Exterior Lighting |

DIVISION 27 – COMMUNICATIONS

| 10/07/22 | 0 | 27 05 00 | Common Work Results for Communications |
|----------|---|-------------|--|
| 07/29/22 | 0 | 27 05 28 | Pathways for Communications Systems |
| 10/07/22 | 0 | 27 28 28.29 | Hangers and Supports for Communications Systems |
| 10/07/22 | 0 | 27 05 36 | Cable Trays for Communications Systems |
| 10/07/22 | 0 | 27 05 43 | Underground Pathways and Structures for Communications Systems |
| 10/07/22 | 0 | 27 05 44 | Sleeves and Sleeve Seals for Communications Pathways and Cabling |
| 10/07/22 | 0 | 27 10 00 | Structured Cabling |
| 10/07/22 | 0 | 27 11 00 | Communications Equipment Room Fittings |
| 10/07/22 | 0 | 27 41 16 | Integrated Audio-Video Equipment |
| 10/07/22 | 0 | 27 51 16 | Public Address System |
| 10/07/22 | 0 | 27 52 23 | Nurse Call-Code Blue Systems |

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

| 10/07/22 | 0 | 28 13 00 | Access Control |
|----------|---|----------|---------------------------------|
| 10/07/22 | 0 | 28 23 00 | Video Surveillance |
| 10/07/22 | 0 | 28 44 00 | Refrigerant Detection and Alarm |
| 10/07/22 | 0 | 28 46 21 | Fire Alarm System |
| 10/07/22 | 0 | 28 50 00 | Infant Protection System |

DIVISION 31 – EARTHWORK

| 07/29/22 | 0 | 31 10 00 | Site Clearing |
|----------|---|----------|-----------------------------------|
| 07/29/22 | 0 | 31 22 00 | Grading |
| 07/29/22 | 0 | 31 23 00 | Excavation and Fill |
| 07/29/22 | 0 | 31 25 00 | Erosion and Sedimentation Control |
| 07/29/22 | 0 | 31 37 00 | Rip Rap |
| 10/07/22 | 0 | 31 63 29 | Drilled Concrete Piers and Shafts |

DIVISION 32 – EXTERIOR IMPROVEMENTS

| 07/29/22 | 0 | 32 11 00 | Base Courses |
|----------|---|----------|---------------------------------|
| 07/29/22 | 0 | 32 12 00 | Flexible Paving |
| 07/29/22 | 0 | 32 13 00 | Rigid Paving |
| 07/29/22 | 0 | 32 13 73 | Concrete Paving Joint Sealants |
| 10/07/22 | 0 | 32 14 13 | Precast Concrete Unit Paving |
| 07/29/22 | 0 | 32 16 13 | Curbs and Gutters |
| 07/29/22 | 0 | 32 17 00 | Paving Specialties |
| 10/07/22 | 0 | 32 84 00 | Quick Coupler System |
| 10/07/22 | 0 | 32 91 19 | Landscape Grading |
| 07/29/22 | 1 | 32 92 19 | Seeding (Native Drill) |
| 07/29/22 | 1 | 32 92 23 | Sodding |
| 10/07/22 | 0 | 32 93 00 | Trees, Shrubs, and Groundcovers |

DIVISION 33 – UTILITIES

| 10/21/22 | | 0 | 33 10 00 | Water Utilities |
|----------|-----------|---|----------|-------------------------------------|
| 10/21/22 | \square | 0 | 33 30 00 | Sanitary Sewer Utilities |
| 07/29/22 | | 0 | 33 31 23 | Sanitary Sewerage Force Main Piping |
| 07/29/22 | | 0 | 33 40 00 | Storm Drainage Utilities |
| 10/21/22 | \square | 0 | 33 46 00 | Subdrainage |
| 10/07/22 | | 0 | 33 46 16 | Subsurface Piping Systems |

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SECTION 03 45 00

PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Precast architectural concrete units.
 - 2. Precast architectural insulated concrete units
 - 3. Accessories indicated, specified, or required to complete installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Document Concept: Drawings and Specifications express concept of precast architectural concrete work, however, they may not indicate or specify total work that may be required, nor shall they be construed as engineered.
- B. Delegated Engineering Responsibility: Require manufacturer to employ a delegated engineering professional to provide engineering for each member and component of precast architectural concrete work, including attachment to building structural frame, required to meet concept expressed in Contract Documents that includes, but is not limited to, following:
 - 1. Comprehensive engineering analysis indicating location, type, magnitude, and direction of loads imposed on exterior wall and building structural frame.
 - 2. Preparation of engineering calculations, shop drawings, and other submittals with professional seal affixed according to respective jurisdictional licensing regulations.
- C. Fabricator shall provide a 2022 Revit model to allow for coordination between structural engineer and fabricator.
 - 1. Include correct locations of gravity connections and tie-back connections.
 - 2. Fabricator shall coordinate in BIM 360 coordination via Central Models.
 - 3. Fabricator shall place gravity connections as indicated on the Structural Drawings. If a different location is required, submit a written document to Structural Engineer for review and comments.
 - 4. Fabricator shall develop gravity and horizontal loads due to wind or seismic and submit to Structural Engineer.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each type of product necessary for installation.
 - 1. Include precast architectural concrete unit design mixtures indicating compressive strength and water-absorption tests for each precast concrete mixture.
- B. Shop Drawings:
 - 1. Detail fabrication and installation of architectural precast concrete units.
 - 2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
 - 3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
 - 4. Indicate details at building corners.
 - 5. Indicate separate face and backup mixture locations and thicknesses.

- 6. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
- 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
- 8. Include plans and elevations showing unit locations, dimensions, erection sequences, and bracing plans for special conditions.
- 9. Indicate relationship of architectural precast concrete units to adjacent materials.
- 10. Coordinate and indicate openings and inserts required by other trades.
- 11. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and indicate modified areas on Shop Drawings. Do not adversely affect the appearance, durability, or strength of units.
- C. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.
- D. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of one sample panel approximately 16 sq. ft. in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
 - 1. Locate panels as directed by Architect.
 - 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 - 3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
 - 4. Demolish and remove sample panels when directed.
- E. Delegated Engineering Submittal: Include analysis data signed and sealed by the professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 1. Designated at time of bidding as a one of the following:
 - a. PCI-certified plant for Category AC.
 - b. APA-certified plant for production of architectural precast concrete products.
- B. Certified Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category S2 (Complex Structural Systems) for load-bearing members.
- C. Preinstallation Conference: Conduct conference at Project site.
- D. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations similar to this Project, and, that has a record of successful in-service performance.
- E. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing, and protect units to prevent contact with soil, prevent staining, and prevent cracking, distortion, warping, or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120 applicable to types of architectural precast concrete units indicated.
- B. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Loads: As indicated on the Drawings.
 - 2. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
 - a. Upward and downward movement of 1/2 inch.
 - 3. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 120 deg F.
 - 4. Vehicular Impact Loads: Design spandrel beams acting as vehicular barriers for passenger cars to resist a single 6000 lb load applied horizontally in any direction to the spandrel beam, with anchorages or attachments capable of transferring this load to the structure. Design spandrel beams assuming the load to act at a height of 18 or 27 inches above the floor or ramp surface, whichever is more severe, on an area not to exceed 1 sq. ft.

2.2 PRECAST ARCHITECTURAL CONCRETE UNITS

A. Provide unit types as indicated on Drawings, including wall panels and insulated wall panels.

2.3 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
- B. Form-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

2.4 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A184, fabricated from ASTM A615, Grade 60, deformed bars, assembled with clips.
- C. Supports: Suspend reinforcement from back of mold. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place may only be used if they are not visible in the finished face.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or Type III.
 - 1. For surfaces exposed to view in finished structure, use gray cement, of same type, brand, and mill source.
 - a. Standard gray cement is acceptable for use where not exposed to view.
- B. Supplementary Cementitious Materials: Include one or more of the following based on delegated design concrete mixture:
 - 1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C618, Class N.
 - 3. Silica Fume: ASTM C1240, with optional chemical and physical requirement[, white].
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C989/C989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Coloring Admixture: ASTM C979, synthetic or natural mineral-oxide pigments or colored waterreducing admixtures, temperature stable, and nonfading.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117 and ASTM C1602.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture. Include one or more of the following based on delegated design concrete mixture:
 - 1. Water-Reducing Admixtures: ASTM C494, Type A.
 - 2. Retarding Admixture: ASTM C494, Type B.
 - 3. Water-Reducing and -Retarding Admixture: ASTM C494, Type D.
 - 4. Water-Reducing and -Accelerating Admixture: ASTM C494, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
 - 6. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494, Type G.
 - 7. Plasticizing Admixture: ASTM C1017, Type I.
 - 8. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
 - 9. Corrosion-Inhibiting Admixture: ASTM C1582.

2.6 STEEL CONNECTION MATERIALS

- A. Carbon Steel Shapes and Plates: ASTM A36.
- B. Carbon Steel Plate: ASTM A283, Grade C.

- C. Malleable Iron Castings: ASTM A47, Grade 32510 or Grade 35028.
- D. Carbon Steel Castings: ASTM A27, Grade 60-30.
- E. High-Strength, Low-Alloy Structural Steel: ASTM A572.
- F. Carbon Steel Structural Tubing: ASTM A500, Grade B or Grade C.
- G. Wrought Carbon Steel Bars: ASTM A675, Grade 65.
- H. Deformed-Steel Wire or Bar Anchors: ASTM A1064 or ASTM A706.
- I. Carbon Steel Bolts and Studs: ASTM A307, Grade A, or ASTM F1554, Grade 36; carbon steel, hexhead bolts and studs; carbon steel nuts, ASTM A563; and flat, unhardened steel washers, ASTM F844.
- J. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, in accordance with requirements in SSPC-SP 3, and shop-apply SSPC-Paint 23 in accordance with SSPC-PA 1.
- K. Welding Electrodes: Comply with AWS standards.

2.7 INSULATED PANEL MATERIALS

- A. Provide board insulation with regularly spaced holes at connector placement locations.
- B. Extruded-Polystyrene (XPS) Board Insulation: ASTM C578, Type IV, 1.55 lb/cu. ft.; ship-lap edges; thickness as indicated on the Drawings.
- C. Wythe Connectors: One of following manufactured to connect wythes of precast concrete panels.
 - 1. Glass-fiber-reinforced vinylester connectors.
 - 2. Polypropylene pin connectors.
 - 3. Stainless steel pin connectors.
 - 4. Bent galvanized reinforcing bars or galvanized welded-wire trusses.
 - 5. Epoxy-coated carbon-fiber grid.
 - 6. Fiberglass trusses.

2.8 ACCESSORIES

- A. Bearing Pads: Provide one of the following for architectural precast concrete units as recommended by precast fabricator for application:
 - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D2240, minimum tensile strength 2250 psi, ASTM D412.
 - 2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer; Type A durometer hardness of 70 to 90, ASTM D2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 - 3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cottonduck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D2240; in compliance with AASHTO LRFDBDS, Division II, Section 18.10.2; or with MIL-C-882E.
 - 4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.

5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.9 GROUT MATERIALS

A. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, Grade A for dry pack and Grades B and C for flowable grout, and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content is to be less than 0.06 percent by weight of cement when tested in accordance with ASTM C1218.

2.10 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Use a single design mixture for units with more than one major face or edge exposed.
 - 2. Where only one face of unit is exposed, use either a single design mixture or separate mixtures for face and backup.
- B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.
- C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested in accordance with ASTM C1218.
- E. Normal-Weight Concrete Mixtures: Proportion full-depth mixture by either laboratory trial batch or field test data methods in accordance with ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi minimum.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- F. Water Absorption: Six percent by weight or 14 percent by volume, tested in accordance with ASTM C642, except for boiling requirement.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- H. When included in design mixtures, add other admixtures to concrete mixtures in accordance with manufacturer's written instructions.

2.11 FABRICATION OF MOLDS

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished Project.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.12 FABRICATION OF PRECAST ARCHITECTURAL CONCRETE

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
- B. Furnish loose hardware items, including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 - 2. Accurately position, support, and secure reinforcement against displacement during concreteplacement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcing steel to maintain at least 3/4 inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
- D. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- E. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- F. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
- G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
 - 1. Place self-consolidating concrete without vibration in accordance with PCI TR-6. Ensure adequate bond between face and backup concrete, if used.
- H. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- I. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.
- J. Cure concrete, in accordance with PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- K. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs comply with requirements in PCI MNL 117 and Architect's approval.

L. At exterior locations, provide where precast connections are attached to galvanized steel provide galvanized steel connections to meet the intended connection serviceability for exterior connections.

2.13 FABRICATION OF INSULATED PANELS

- A. Cast, screed, and consolidate bottom concrete wythe supported by mold.
- B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation holes, and consolidate concrete around connectors in accordance with connector manufacturer's written instructions.
- C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.
- D. Cast, screed, and consolidate top wythe to meet required finish.
- E. Maintain temperature below 150 deg F in bottom concrete wythe.

2.14 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.15 FINISHES

- A. Exposed Faces: Free of joint marks, grain, and other obvious defects. Corners, including false joints to be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample and sample panels and as indicated on the Drawings.
- B. Concealed Faces: As-cast finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - a. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
 - b. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION OF PRECAST ARCHITECTURAL CONCRETE UNITS

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Welding: Comply with applicable requirements in AWS D1.1 and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Welds not specified to be continuous fillet welds use no less than the minimum fillet as specified by AWS.
 - 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and repriming damaged painted surfaces.
 - 4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.
- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - 1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
- F. Grouting or Dry Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:
 - 1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
 - 2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
 - 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus 1/4 inch.
 - b. Nonexposed Individual Panel: Plus or minus 1/2 inch.

- 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/2 inch.
 - b. Maximum High: 1/4 inch.
- 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 ft.: 1 inch.
- 6. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
 - a. Exposed Panel Relative to Adjacent Panel: 1/4 inch
 - b. Nonexposed Panel Relative to Adjacent Panel: 1/2 inch.
 - c. Add 1/8 inch additional tolerance in the maximum jog for panels larger than 20 ft. per 10 ft. of additional height, up to a maximum tolerance of 1/2 inch.
- 7. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
- 8. Maximum Joint Taper: Plus or minus 3/8 inch but not more than 1/4 inch in 10 ft. length.
- 9. Joint Taper in 10 ft.: 1/4 inch.
- 10. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
- 11. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
- 12. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 REPAIR

- A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 ft.
- C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- D. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, in accordance with precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 33 1000 WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for WATER UTILITIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for WATER UTILITIES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Water Utilities Distribution Piping
- B. Water Distribution Equipment
- C. Disinfection of Water Utility Distribution

1.4 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. Tahlequah Public Works Authority (TPWA)
 - 2. Oklahoma Department of Environmental Quality

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pipe Pipe submittals shall include a notarized certification from the manufacturer that pipe is manufactured and tested in accordance with the applicable specifications. The certifications shall indicate the pipe diameter, the pressure rating, resin classification, and the batch number from which the pipe was manufactured.
 - 2. Valves
 - 3. Fire Hydrants
 - 4. Fittings
 - 5. Steel Casing
 - 6. Mechanical Joint Restraints
 - 7. Meters
 - 8. Tracer Wire
 - 9. Manholes, Vaults, and Covers
- B. Field quality-control test reports.

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 GUARANTEE

A. CONSTRUCTION MANAGER shall guarantee all materials and appurtenances furnished and work performed for a period of one (1) year from the date of substantial completion. CONSTRUCTION MANAGER shall warrant and guarantee for a period of one (1) year from the date of substantial completion the completed system is free from all defects due to faulty materials or workmanship and CONSTRUCTION MANAGER shall promptly make such corrections as may be necessary by reason of such defects or workmanship. TPWA or OWNER will provide notice of observed defects with reasonable promptness.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage
 - 1. Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials, and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves, and hydrants free of dirt and debris.
- B. Handling
 - Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take exceptional care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry do not drag pipe to the trench. Store plastic piping, jointing materials and rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

1.10 QUALITY ASSURANCE

- A. TPWA PRECONSTRUCTION CONFERENCT
 - 1. Conduct a preconstruction conference with TPWA prior to beginning any work.
- B. PRECONSTRUCTION CONFERENCE
 - Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ENGINEER one week (7 days) prior to the date of the meeting.
- C. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
 - 2. If the AHJ has not adopted specifications for materials and methods, the current edition of the AWWA and Oklahoma Department of Environmental Quality shall be used.

1.11 PERMITS

A. CONSTRUCTION MANAGER shall make application; pay permit fees; provide payment and performance bonds required of the CONSTRUCTION MANAGER by the AHJ.

1.12 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.13 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities, or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed, and accessible unless noted on the plan.

1.14 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or

horizontally. ARCHITECT and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.

- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.15 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.16 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and lookout guards for the safety of the public.
 - Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. 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 the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

 CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.17 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

A. All materials and products shall comply with the current edition of the AHJ's Standard Specifications for Construction of Public Improvements.

2.2 PIPE

- A. Ductile Iron Pipe
 - 1. All ductile iron pipe shall conform to ANSI Specification A21.51; AWWA Specification C151, and cement lining in accordance with ANSI Specification A21.4 and AWWA Specification C104. Pipe shall be pressure rated at 350-psi with surge allowance of 100-psi, with pipe thickness to conform with depth of cover and laying conditions.
- B. PVC Pressure
 - 1. Materials used to produce PVC pipe, couplings, and fittings shall be manufactured in accordance with ASTM D-2241, ASTM D-3139, Commercial Standard CS 256, and approved by the National Sanitation Foundation (NSF). The pipe shall be made from clean, virgin, class 12454-B PVC compound conforming to ASTM Resin Specifications D-1784 Type 1, Grade 1. Standard joint length shall be twenty (20) feet. The pipe shall have a minimum Standard Dimension ration (SDR) of twenty-one for Class 200-psi pipe. The pipe shall be marked continuously along the length with the following: manufacturer's name, nominal size, class pressure rating, PVC 1120, NSF, and identification code. Pipe certification sheets shall be submitted by the manufacturer to show compliance with these specifications.

2.3 POLYETHYLENE ENCASEMENT

- A. Ductile iron pipe and fittings shall be wrapped with polyethylene tube wrap.
- B. Polyethylene tube wrap shall be made from virgin polyethylene resin in accordance with ASTM Specification D1248. Thickness shall not be less than 8 mils (.008-in). The material shall be chemically inert and moisture resistant to form an effective seal against penetration by water or vapor. Tensile strength shall be 12.4 MPa (1800 psi) with elongation of 500 percent. The material shall be Polyetube, as manufactured by Polyetube Corporation, Birmingham, Alabama, or equal. The tube shall be of such length that a one-foot overlap is provided at each joint in the pipe.
- C. Minimum flattened polyethylene tube widths shall be as follows for specific pipe sizes and joint types:

| Nominal Pipe Sizes (inches) | Push-On Joint Flat Tube Width (inches) | Mechanical Joint Flat Tube Width (Inches) |
|--------------------------------|--|---|
| 4 | 14 | 16 |
| 6 | 17 | 20 |
| 8 | 21 | 24 |
| 10 | 25 | 27 |
| 12 | 29 | 30 |
| 14 | 33 | 34 |
| 16 | 37 | 37 |
| 18 | 41 | 41 |
| 20 | 45 | 45 |
| 24 | 53 | 53 |

D. Tape for polyethylene tube shall be plastic-backed adhesive tape, Polykan #900 or Scotchrap #50 or

equal, two inches (2-in) in width.

2.4 FITTINGS

- A. Fittings for all pipe 4-in or larger shall be standard mechanical joint ductile iron unless otherwise indicated on the plans or noted by details. Ductile Iron Fittings shall conform to ANSI Specifications A21.10 and A21.11 and AWWA Specifications C110.
- B. Fittings shall be manufactured in accordance with ANSI Specification A21.4 and AWWA Specification C104 and shall be furnished with a complete set of joint materials for each socket opening.

2.5 JOINTS

A. Mechanical joints shall conform to and be tested in accordance with ANSI Specification A21.11 and AWWA Specification C11.

2.6 JOINT RESTRAINTS

- A. Joint restraints at fire hydrants shall conform to ASTM A307.
- B. Joint restraints for PVC pipe shall be MIDCO's PERMA-GRIP Mechanical restrained fittings for Class 200, SDR-21 PVC pipe.
- C. Joint restraints for ductile iron pipe shall be MEGALUG joint restraints manufactured by EBAA Iron Sales.
- D. Flanged joints shall conform to ANSI Specification A21.15 and AWWA Specification C115 for 125 pounds flange with appropriate bolts per standard ASA specification for each flange size.

2.7 PVC PIPE COUPLINGS

A. Couplings including bell ends, shall be Ring-Tite, Bell-Ring, or Push Joint connected, with fittings furnished by the pipe manufacturer and certified to be suitable for use with the pipe furnished. Couplings shall have a minimum pressure rating of 200-psi and be constructed with deep sockets.

2.8 GATE VALVES

- A. Gate valves shall be manufactured by AVK.
- B. Gate valves shall conform to and be tested in accordance with the ASSW Standard for Resilient Seated Gated Valves for water and sewage systems and ANSI/AWWA Specification C509. Valves shall be bubble tight from either direction at a rated design working pressure of 200-psi. Valves shall have a single disc gate with synthetic rubber seat bonded or mechanically attached to the disc; a non-rising stem with 2-in AWWA operating nut; opening counterclockwise with O-ring stem seals. Valve interiors shall have a corrosion resistant coating acceptable for potable water and end connection to fit the pipe or connection to which it is attached. Valves installed with stems placed at depths greater than 36-iin shall have extension attached to the operating nut as part of the valve component.
- C. Each valve shall have the manufacturer's name or initials, pressure rating and year of manufacture cast on the body and shall be furnished complete with the set of joint materials for each socket.

2.9 BUTERFLY VALVES

- A. Butterfly valves shall be manufactured by AVK.
- B. Butterfly valves shall be meet or exceed the requirements of AWWA C504. Valve ends shall be mechanical joint and be rated for a rated design working pressure of 200-psi.

2.10 TAPPING SLEEVES AND VALVE

- A. Tapping sleeves manufactured by SMITH BLAIR or FORD are acceptable.
- B. Tapping valves shall be flanged by mechanical joint resilient seat conforming with AWWA C509.

2.11 VALVE BOXES

A. Valve boxes shall be the cast iron extension type with screw or slide adjustment and flared base. The minimum thickness of the metal shall be 3/16-in. The word WATER shall be cast in the cover. The boxes shall be of such length and will be adapted to the depth of cover over the pipe at the valve location, with bottom section, extension pieces, and top section as needed.

2.12 VALVE AND LINE MARKERS

A. Identification markers shall be of metal fabrication with baked enamel finish noting TPWA as the owner and the type of facility identified. Marker must be at least 80 square inches in area and shall have attachments to be firmly secured to a galvanized rod or post five (5) feet in length for erection at the location needed.

2.13 STEEL PIPE CASING

- A. All steel pipe casing shall be new, smooth walled, welding steel pipe. The pipe shall be straight, round, and sound with not dents or splits and shall be a standard wall thickness as noted:
 - 1. 18-in pipe and over 0.375-in minimum thickness
 - 2. 12-in pipe 0.330-in minimum thickness
 - 3. 10-in pipe 0.307-in minimum thickness
 - 4. 8-in pipe 0.277-in minimum thickness
- B. Pipe shall be delivered in lengths that will best fit the crossings as noted in the plans with a minimum number of joints to be welded. Pipe shall be subject to inspection by TPWA before, during, and after unloading of pipe at the job site. TPWA reserves the right to reject any and all pipe not in satisfactory conformance with the specifications.
- C. Casing spacers shall be manufactured by RACI Spacers, Inc., Tulsa; M-2 THINsulator by TD Williamson, Inc., Tulsa; or APS Casing Spacers by Advance Prod. & Systems, Inc. Lafayette, LA.

2.14 FIRE AND FLUSHING HYDRANTS

- A. Fire hydrants shall be AVK and shall conform to and be tested in accordance with the AWWA Standard for Dry-Barrel Fire Hydrants, AWWA C502.
- B. Fire hydrants shall have a 5-1/4-in compression main valve; 6-in inlet connection; mechanical joint hub; bury length as specified on the plans; two 2-1/2-in hose nozzles with TAHLEQUAH (e.g. Mueller 301 threads); one 4-1/2-in pumper nozzle with National Standard threads per the City of Tahlequah Fire Department; and safety Red finish paint above the ground line.
- C. Flushing hydrants shall have a 2-1/4-in main valve opening with on 2-1/2-in hose muzzle with TAHLEQUAH THREADS and Safety Red finish paint above the ground line.
- D. All other specifications shall meet the model requirements and size and have a 10-year guarantee.

2.15 AIR RELEASE VALVES

- A. Air release valves shall be manufactured by Val-Matic.
- B. Valves shall be a heavy-duty air release type for 150-psi working pressure, tested to 300-psi, and size shown on the plans. The body, cover and baffle shall be cast iron. All internal parts to be stainless steel and/or bronze, and the inside valve coated with rust inhibitor.
- C. Tapping saddle for air release valves shall be CLOW, twin seal brass saddle and corporation stop with IP threads on outlet piping connection. Valve and piping shall be offset from the main line and properly supported to avoid stresses on piping connections. The valve discharge shall have open end piping extended with a screened downward facing elbow. Valve shall be place in 24-in meter box with lid with keyed locking mechanism and TPWA lettering.

2.16 TRACER WIRE

A. Tracer wire shall be #12 AWG solid copper tracer wire, insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. Tracer wire shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities.

2.17 CAST-IN-PLACE CONCRETE

- A. Concrete for capping channel crossings, road crossings, and thrust blocking shall be per ACI 301 Concrete Standard Specifications for Concrete for Buildings.
- B. Concrete shall have a maximum slump of 4-in, a compressive strength of 3,500-psi at 28-days.

2.18 BEDDING MATERIALS

A. Sand, pea gravel, or 3/4-in washed rock shall be used as bedding.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

A. The installation of WATER UTILITIES shall comply with the current edition of the AHJ's Standard Specifications for Construction of Public Improvements.

3.2 PROTECTION OF MATERIALS

A. All materials for the project shall be transported, delivered, and stored in a manner to prevent damage to the materials. All damaged, broken or otherwise defective materials will be rejected. Store lubricants, gaskets, jointing materials, and other packaged materials in a dry, protected area in which the

manufacturer's name and all other applicable data is plainly marked and visible.

B. Pipe shall be delivered to the job site by means which will adequately support it and not subject it to undue stress. The load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be stored and protected and shall not be strung along the line of trenching more than two days prior to placing.

3.3 UTILITY CROSSINGS

A. Provide a minimum clearance of twenty-four (24) inches between the outer edges of the water pipe and crossing utility conduit unless conditions restrict such clearance.

3.4 SEPARATION OF WATER AND SEWER PIPELINES

- A. Horizontal: Water and sewer mains shall be separated by at least ten (10) feet, measured inside edge to inside edge. In cases where this separation is unattainable, water and sewer mains may be closer if the sewer line is built equal to the water main and located in a separate trench or on an undisturbed earth shelf in accordance with DEQ Regulation 252:626-19-2.
- B. Vertical: Water mains crossings sewer lines shall be laid at least twenty-four (24) inches above the top of the sewer, measured pipe to pipe. If water crossing above sewer is unattainable, the minimum vertical separation shall be twenty-four (24) inches and if the sewer main has non-resilient joints, lengths between joints less than 10 feet or shows evidence of damage or leakage, the sewer pipe shall be replaced with one full length of PVC or ductile water pipe with resilient joints sized to exactly match the existing pipe diameter in accordance with DEQ Regulation 252:626-19-2.
- C. Crossings: In all cases where water and sewer mains or services cross, one full length of ductile iron water pipe (minimum 20-foot section) shall be centered on the crossing of the sanitary sewer line in accordance with DEQ Regulation 252:626-19-2.
- D. Service Line Separation: Water and sewer services shall meet the horizontal separation requirements listed above, except where water and sewer services unavoidably must enter the building with less than 10-foot separation, the services shall diverge to achieve the required separation within 10 feet of the building wall. Water and sewer services crossing other services or mains shall meet the vertical separation requirements listed above, except PVC water pressure pipe (minimum 10-foot length) shall be used as encasement for sewer services crossing above water pipelines. Sewer services may also be laid between 18 inches and 12 inches below water mains or services if the sewer service is similarly encased in accordance with DEQ Regulation 252:626-19-2.

3.5 TRENCH

A. The trench wall shall be straight with a minimum trench width of eight (8) inches or three (3) times the pipe diameter, whichever is greater. At the grade line with the upper portion of the trench sloped to prevent cave-in or collapse of the trench. The bottom of the trench shall be finished to provide a uniform bearing for the pipe. Changes in grade in the trench bottom shall be made as shown on the drawings so the pipe will rest on the trench bottom.

3.6 PLACEMENT

A. In no case shall more than 300-feet of ditch be opened at one time in advance of the pipe laid, without consent of ARCHITECT. Each joint of pipe shall be swabbed clean and lubricated before being lowered into the trench and must be so lowered and handled as to ensure the pipe is being placed in an undamaged condition. Pipe must be lowered and entered one joint at a time to join two or more pipes before same are laid. Valves, special casting, etc., shall be placed where shown on the plans. Where necessary to cut pipes to place special castings, valves or for any other causes great care must be taken not to crack either piece of pipe and to mark out true and straight around the pipe. When pipe-laying is stopped at night or for any other causes or when special castings are left open for future connections, the Contractor shall close openings with iron or wood plug, lightly yarned into place to exclude dirt, water, small animals, etc. Pipe shall be so laid as to have a bearing for its entire length except at bells where holes shall be dug as specified. No pipe shall be laid when trench conditions or the weather are unsuitable or laid in water.

3.7 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be installed on ductile iron pipe and fittings.
 - 1. The polyethylene encasement shall be approximately twenty-four (24) inches longer than the length of the pipe section to provide a twelve (12) inch overlap on each adjacent pipe section. Tube ends shall be taped in place.
 - 2. Any rips, punctures, or other damages to the polyethylene shall be repaired with adhesive tape or

with a short length of polyethylene tube cut open, wrapped around the pipe, and secured with adhesive tape.

3.8 PIPE DEFLECTION

A. The maximum deflection in any pipe joint, made necessary by vertical and horizontal curves or offsets, shall not exceed the amount as recommended by the manufacturer of the pipe. Elbows shall be used if deflection exceeds the maximum recommended by the manufacturer.

3.9 PIPE BEDDING AND EMBEDMENT

- A. Bedding material shall be placed six (6) inches below and twelve (12) inches over the pipe.
- B. Bedding material shall be placed before the pipe is lowered into the trench.
- C. ODOT Type A aggregate backfill shall be used under paving.
- D. Sand shall be used in dry areas. Three-quarter (3/4) inch washed rock shall be used in wet areas.
- E. Backfill shall be carefully placed to avoid dropping rocks or large clods on the pipe. All backfill within eight (8) inches of the edges of the pipe shall contain no stones

3.10 PIPE COVER

A. Pipe shall have a minimum thirty-six (36) inches of cover over the top of the pipe unless approved by TPWA. Where ledge or solid rock is encountered, the pipe may be raised to a minimum depth of thirty (30) inches of cover over the top of the pipe.

3.11 TRENCH BACKFILL

- A. The trench shall be backfilled immediately after laying pipe to avoid leaving open ditches overnight. Any excavation that remains open overnight shall be properly barricaded and lighted to avoid any injury to persons or property.
- B. Trench backfill under pavement shall be ODOT Type A aggregate backfill.
- C. See 31 2300 Excavation and Fill for backfill and compaction requirements.

3.12 TRENCH SETTLEMENT

A. Wherever trenches have settled prior to final acceptance by TWPA, the trenches shall be backfilled to surface and compacted and smoothed to conform to the elevation of the adjacent ground surface.

3.13 VALVE BOX PROTECTION

A. All installed valve boxes shall have a minimum 24-in x 24-in x 6-in thick concrete pad set in place around the valve box. Concrete shall be Class A, 3,500-psi concrete at 28-days.

3.14 JOINT RESTRAINT

- A. Joint restraints for PVC pipe shall be MIDCO's PERMA-GRIP Mechanical restrained fittings for Class 200, SDR-21 PVC pipe.
- B. Joint restraints for ductile iron pipe shall be MEGALUG joint restraints manufactured by EBAA Iron Sales.
- C. Bell restraints shall be installed a minimum of 40-ft in all directions from a mechanical joint.

3.15 THRUST BLOCKING

- A. Concrete thrust blocking shall be installed at all points of lateral thrust such as tees, elbows, crosses, hydrants, dead ends, valves, etc., unless authorized by TPWA.
- B. Thrust blocking shall meet the following requirements:
 - 1. Place thrust block in such a manner around the piping so that the block will absorb the thrust forces in that location.
 - 2. Thrust blocks shall be poured-in-place high early strength concrete with a compressive strength of minimum 3,500 psi at 3 days.
 - 3. Thrust blocks shall extend from the piping to the undisturbed trench wall and shall meet the minimum restrictive areas in the table below.
 - 4. Blocking shall be placed so that the pipe and fittings will be accessible for repair.
 - 5. The following table is computed using a minimum thickness of 4" or the pipe diameter, whichever is greater. The length of contact surface with the pipe shall be the pipe diameter plus 4-inches.

| Minimum Restrictive Areas and Volumes for Thrust Blocking | | | | | | | | |
|---|--------------------|-----------------|--------------------|-----------------|--------------------|-----------------|--------------------|------------------------------|
| Pipe | 90 Degree Bend | | 45 Degree Bend | | 22 1/2 Degree Bend | | Dead End or Tee | |
| Size, in. | Res. Area (ft²) | Volume (ft³) | Res. Area (ft²) | Volume (ft³) | Res. Area (ft²) | Volume (ft³) | Res. Area (ft²) | Volume (ft ³) |
| 1.5 | 0.21 | 0.50 | 0.11 | 0.50 | 0.06 | 0.50 | 0.15 | 0.50 |
| 2.0 | 0.32 | 0.50 | 0.18 | 0.50 | 0.09 | 0.50 | 0.23 | 0.50 |
| 2.5 | 0.47 | 0.50 | 0.26 | 0.50 | 0.13 | 0.50 | 0.33 | 0.50 |
| 3.0 | 0.70 | 0.50 | 0.38 | 0.50 | 0.19 | 0.50 | 0.49 | 0.50 |
| 4.0 | 1.15 | 0.50 | 0.82 | 0.50 | 0.32 | 0.50 | 0.81 | 0.50 |
| 6.0 | 2.47 | 1.00 | 1.34 | 0.50 | 0.68 | 0.50 | 1.75 | 1.00 |
| 8.0 | 4.28 | 2.00 | 2.32 | 1.00 | 1.17 | 0.50 | 3.03 | 1.50 |
| 10.0 | 6.44 | 4.00 | 3.47 | 2.00 | 1.77 | 1.50 | 4.75 | 3.00 |

3.16 BORING

- A. Where so indicated on the Drawings, pipeline crossings of highways, roads, railroads, canals, and other structures shall be made by installation of a steel pipe casing under the structure.
 - 1. Crossings for water service lines and water mains shall be a minimum of six (6) feet below the surface of the roadway and two (2) feet below other structures and canal inverts, unless otherwise shown on the Drawings.
 - 2. Pipe within steel casing shall be adequately protected with redwood, cedar or plastic skids to prevent damage during installation and provide proper long-term line support. At least four skids, equally spaced around the perimeter of the pipe, shall be used. Each set of skids shall be 3" minimum in length. A spacing of one (1) foot will be used between skid sets. The skid shall be held to the pipe with stainless steel straps or clamps.
 - 3. After the carrier pipe is installed in the casing and tested, the void between the casing pipe and the carrier pipe shall be filled with a six (6) inch concrete plug at each end.
 - 4. When the casing pipe is to be installed by boring, the casing shall be kept inline and grade by suitable rails in the approach pit. The deviation from line and grade of the casing pipe shall provide installation of the carrier pipe within 1.0% horizontal deviation and 1.0% vertical deviation.
 - 5. Boring methods which involve jetting or washing techniques are not allowed.

3.17 TRACER WIRE

A. Tracer wire shall be installed for all PVC pipe installed by trenching. The tracer wire shall be attached to the water line and shall be brought to the surface and attached at all valve boxes, meter boxes, hydrants, and any other appurtenances where the wire can be accessed. Tracer wire shall be soldered to fuse wire breaks and to connect another strand of wire.

3.18 DETECTABLE WARNING TAPE

- A. Detectable warning tape for open cut/open ditch shall be placed approximately 12-18 inches beneath the ground surface and directly above the water line.
- B. See 31 2300 Excavation and Fill for warning tape specifications.

3.19 PAVEMENT REPAIR

- A. Any street or paved surface removed or damaged during water utility installation shall be replace or repaired as soon as possible, unless otherwise approved by ARCHITECT.
- B. Concrete and asphalt streets, parking lots, and driveways shall be cut in straight lines a minimum of twelve (12) inches on undisturbed soil from the excavated area and replaced per the construction drawings.

3.20 FIELD QUALITY CONTROL

- A. Flushing:
 - Waterlines shall be flushed clean prior to start of pressure testing or disinfection processes. The waterlines will be flushed again after disinfection of the lines to rid the lines of excessive chlorinated water. The duration of flushing shall be adequate to accomplish successful cleaning and removal of excessive chlorine in the lines.
- B. Hydrostatic Pressure Tests:

- 1. All pipelines shall be tested by means of hydrostatic pressure of not less than the pressure rating required in accordance with AWWA C605.
- 2. CONSTRUCTION MANAGER shall provide test plugs and all necessary anchors, braces, and other devices necessary to withstand the hydrostatic pressure on such plug or plugs without placing any hydraulic thrust on the pipeline or any part thereof. The CONSTRUCTION MANAGER shall be solely responsible for any and all damage to the pipeline and public and private property which might be caused by the failure of such test plugs or supports incidental thereto.
- 3. Water leakage shall not exceed 10 gallons per inch of pipe diameter per mile of pipe per 24 hours at a 150-psi test pressure.
- 4. After the section of line to be tested has been filled with water, the specified test pressure shall be applied by means of a force pump of such design and capacity that such pressure can be applied and maintained for the duration of the test period, which shall be not less than two (2) hours for 24" and smaller pipe; and not less than six (6) hours for 30" and larger diameter pipe.
- 5. All water supplied to the line after the initial filling thereof shall be metered by means of a tested water meter approved by the Engineer.
- 6. Any and all leaks on the line or lines constructed under this contract, which appear during the specified hydrostatic test or at any subsequent time before final acceptance of the whole works, shall be located and repaired by and at the expense of the CONSTRUCTION MANAGER.
- C. Disinfection:
 - 1. Disinfection of water lines shall be in accordance with the current edition of AWWA C651 "Disinfecting Water Mains".
 - 2. Upon completion of all construction activities, the CONSTRUCTION MANAGER shall disinfect all water mains with a chlorine solution having an active available chlorine concentration of 100 parts per million, maintaining the pipe full of solution and under normal pressure for 24 hours. The residual chlorine solution at the end of the 24-hour disinfecting period shall not be less than 10 ppm. Upon completion, the water mains shall be flushed until the residual chlorine is not greater than 0.4 parts per million. The method of disinfecting the mains shall comply with Oklahoma Department of Environmental Quality Standards. Disinfection must be in accordance with AWWA Standard Specifications and require obtaining safe bacteriological samples on 2 consecutive days before placing the waterline into service. A set of samples shall be collected every 1,200 feet along new waterlines.

END OF SECTION

SECTION 33 3000 SANITARY SEWER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SANITARY SEWER UTILITIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SANITARY SEWER UTILITIES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Sanitary Sewer Piping
- B. Sanitary Sewer Manholes
- C. Sanitary Sewer Clean-outs

1.4 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. Tahlequah Public Works Authority
 - 2. Oklahoma Department of Environmental Quality

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pipe
 - 2. Manholes
 - 3. Manholes Rings and Covers
 - 4. Manhole Coating
 - 5. Fittings
 - 6. Clean-outs
 - 7. Tracer Wire
- B. Field quality-control test reports.

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
 - 2. If the AHJ has not adopted specifications for materials and methods, the current edition of the AWWA and Oklahoma Department of Environmental Quality shall be used.

1.9 PERMITS

A. CONSTRUCTION MANAGER shall make application; pay permit fees; provide payment and performance bonds required of the CONSTRUCTION MANAGER by the AHJ.

1.10 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.11 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.12 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.13 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.

- 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
- 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - 1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. 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 the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.15 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

A. All materials and products shall comply with the current edition of the AHJ's Standard Specifications.

2.2 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. SOLID WALL PVC All solid wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below or as modified herein.
 - 1. ASTM D-3034
 - a. Standard Specification for "Type PSM Poly (Vinyl Chloride) (VC) Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from four (4") inches to fifteen (15") inches in diameter.
 - b. The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C or 12364-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM D-1784.
 - c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the

requirements of ASTM D-3212.

2.3 BEDDING AND EMBEDMENT MATERIAL

A. Bedding and embedment material shall be 3/4-inch washed rock.

2.4 BACKWATER VALVES

- A. Cast-Iron Backwater Valves
 - 1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
 - 2. Horizontal type; with swing check valve and hub-and-spigot ends.
 - 3. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
 - 4. Terminal type; with bronze seat, swing check valve, and hub inlet.
- B. Plastic Backwater Valves:
 - 1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.5 CLEANOUTS

- A. Cast-iron Cleanouts
 - 1. Manufacturers: Subject to compliance with requirements.
 - 2. Description: 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.
 - 3. Top-Loading Classification(s): Heavy Duty.
 - 4. Sewer Pipe Fitting and Riser to Clean-out: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts
 - 1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.6 MANHOLES

- A. Standard Precast Concrete Manholes
 - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 2. All concrete for manhole and base shall be Class A concrete with a minimum compressive strength of 4,000 psi.
 - 3. Diameter: 48 inches minimum.
 - 4. Wall Thickness:
 - a. The minimum wall thickness shall not less than 5-in and shall not be less than one-twelfth (1/12) of the internal diameter of the largest cone or riser.
 - b. Manholes with 60-in and 48-in diameters shall have a 5-inch minimum thickness, and lengths to provide depth indicated.
 - c. Manholes with 72-in diameters shall have a 6-inch minimum thickness, and lengths to provide depth indicated.
 - d. Manholes with 84-in diameters shall have a 7-inch minimum thickness, and lengths to provide depth indicated.
 - e. Manholes with 96-in diameters shall have an 8-inch minimum thickness, and lengths to provide depth indicated.
 - 5. Base section shall have a 9-inch minimum floor slab thickness. Floor slab shall be integral with base section. Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
 - 6. Provided riser sections as needed to achieve the required manhole depth.
 - 7. Top section shall be eccentric-cone type unless flat-slab-top type is indicated, and top of cone of size that matches grade rings.
 - 8. Joint sealant shall meet ASTM C 990, bitumen or butyl rubber.
 - 9. Pipe connectors shall be resilient pipe connectors per ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 - 10. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on

one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

- 11. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
- 12. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.
- B. Designed Precast Concrete Manholes:
 - 1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
 - 2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
 - 3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 - 4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 - 5. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615/A, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 - 6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
 - 7. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.
- C. Frames and Covers
 - 1. Manhole frames and covers shall be to the dimensions and specifications of the current AHJ's Standard Specifications.
- D. Manhole Coatings
 - 1. High-Build Epoxy Coatings
 - a. The coating material shall be a two (2) part, one hundred (100%) percent solids epoxy-resin with fibrous and flake fillers specifically designed for sanitary sewer applications. The coating material shall have the following minimum properties as listed below:
 - 1) Tensile Strength Minimum 8,000 psi ASTM D-638 (7-day cure at 25 deg C)
 - 2) Tensile Elongation Minimum 20% ASTM D-638 (7-day cure at 25 deg C)
 - 3) Compressive Strength Minimum 80 Shore D ASTM D-2240 (7-day cure at 25 deg C)
 - 25% Sulfuric Acid 28 days without deterioration after continuous contact with fresh chemical at 25 deg C ASTM C-267
 - 5) Solids by Volume 100%
 - 2. Polyurea Coating Systems
 - a. The coating material shall be urethane-based one hundred (100%) percent solids resin with chemically resistant fillers specifically designed for sanitary sewer applications. The coating material, tested at 25°C, shall have the following minimum properties as listed below:
 - 1) Tensile Strength Minimum 1,800 psi ASTM D-412 (7-day cure at 25 deg C)
 - 2) Recoverable Elongation Minimum 300% ASTM D-412 (7-day cure at 25 deg C)
 - 3) Surface Hardness Minimum 80 Shore D ASTM D-2240 (7-day cure at 25 deg C)
 - 20% Sulfuric Acid 28 days without deterioration after continuous contact with fresh chemical at 25 deg C ASTM C-267
 - 5) Solids by Volume 100%

2.7 CONCRETE

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

- 1. Cement: ASTM C 150, Type II.
- 2. Fine Aggregate: ASTM C 33, sand.
- 3. Coarse Aggregate: ASTM C 33, crushed gravel.
- 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.
- C. Manhole 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: 2 percent through manhole.
 - 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 8 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 4000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

A. The installation of SANITARY SEWERAGE UTILITIES shall comply with the current edition of the AHJ's Standard Specifications.

3.2 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 2300 Excavation and Fill.

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Provide a minimum of 6-inch of bedding material below the pipe. Provide a minimum of 12-inch of bedding material over the pipe.
- C. 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.
- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. 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.
- F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- G. Install gravity-flow, non-pressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
 - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 - 3. Install piping with 36-inch minimum cover.
 - 4. Install PVC pipe according to ASTM D 2321 and ASTM F 1668.

3.4 MANHOLE INSTALLATION

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

- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3-inch above finished surface elsewhere unless otherwise indicated.

3.5 CONCRETE PLACEMENT

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

3.6 BACKWATER VALVE INSTALLATION

- A. Install horizontal-type backwater valves in piping where indicated.
- B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.
- C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.7 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Light-Duty, top-loading classification cleanouts in earth areas.
 - 2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in cast-in-place concrete block, 18-inch by 18-inch by 12-inch deep.
- C. Set cleanout frames and covers in earth areas with tops 1-inch above surrounding earth grade.
- D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.8 CONNECTIONS

- A. Connect non-pressure, gravity-flow drainage piping to building's sanitary building drains.
- B. Make connections to existing piping and underground manholes.
- C. Use commercially manufactured wye or saddle fittings with stainless steel bands for piping branch connections. Remove section of existing pipe, install wye or saddle fitting into existing piping, and encase entire wye or saddle fitting with not less than 2 ft depth x 2.2 ft width x 2.0 ft length of concrete with 28-day compressive strength of 3000 psi.
- D. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
- E. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
- F. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
- G. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
- H. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9 MANHOLE COATINGS

- A. Surface Preparation
 - 1. The CONSTRUCTION MANAGER shall use cleaning methods that are adequate to remove loose material from the manhole. All existing manhole steps or ladder are to be removed. The CONSTRUCTION MANAGER shall take all necessary precautions to prevent falling debris from damaging the manhole trough and/or entering the sewer. Infiltration through existing manhole walls that would adversely affect the material used in the annular space shall be eliminated or reduced to an acceptable level.
 - 2. Mechanical cleaning shall be done to provide a good bond between the epoxy coating and the substrate. Water blasting with a minimum of five thousand (5,000 psi) pounds per square inch shall be done to remove oil, grease, and foreign materials from all surfaces to be coated. For brick manholes, use a minimum of six thousand (6,000 psi) pounds per square inch of water pressure. In areas where the concrete has become softened due to chemical attack, several millimeters of the wall surface shall be removed using water pressures of twenty-five thousand (25,000 psi) pounds per square inch to thirty-five thousand (35,000 psi) pounds per square inch, or as recommended by

the coating manufacturer, to ensure that a sound substrate is exposed. Surfaces shall be made damp or dry as required by the manufacturer before application of coating system begins.

- B. Application
 - 1. The material shall be mixed and applied, in two (2) or three (3) coats, in accordance with the manufacturer's written instructions, using approved equipment. When applying a Polyurea coating, all surfaces to be coated shall be primed as required by the manufacturer. The material shall be applied to all interior surfaces of the manhole with a minimum thickness of one hundred (100) mils.
 - 2. The CONSTRUCTION MANAGER shall allow a minimum of two (2) hours cure time before returning the manhole to active flow conditions or as recommended by the manufacturer. After seven (7) day cure, the liner's surface shall be free of runs, sags, and other irregularities that indicate improper application practice. When directed by the ARCHITECT, liner shall be repaired following the manufacturer's recommendation and to the ARCHITECT's satisfaction.

3.10 IDENTIFICATION

- A. Comply with requirements in Section 31 2300 Excavation and Fill for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
- B. Use warning tape or detectable warning tape over ferrous piping.
- C. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

- A. Deflection Testing
 - 1. Deflection tests shall be performed not less than thirty (30) days after backfill has been placed. The maximum allowable deflection shall not exceed five (5%) percent of the pipe's base internal diameter (Base ID). Tests must be run using a rigid ball or mandrel with a diameter equal to 95% of the inside diameter of the pipe taking into account manufacturing tolerances. Tests must be performed without mechanical pulling devices. Base ID for PVC pipes shall be calculated from measurements taken in accordance with ASTM D 2122 and according to procedures outlined in Appendix XI of ASTM D 3034. For PE pipes Base ID shall be calculated from measurements taken in accordance with ASTM D 2122 and according to procedures recommended by the manufacturer and approved by the ARCHITECT. For other flexible pipes, base ID shall be calculated in accordance with the manufacturer's recommended procedures and approved by the ARCHITECT.
 - 2. A mandrel (go/no-go) device cylindrical in shape shall be hand-pulled by the CONSTRUCTION MANAGER through all sewer lines. Any sections of pipe not passing the mandrel test shall be uncovered and the CONSTRUCTION MANAGER, at no additional cost to OWNER, shall replace the pipe to the satisfaction of the ARCHITECT. The repaired sections shall be re-tested. All tests for pipes twenty-four inch (24") and larger shall be performed in the presence of the ARCHITECT.
 - 3. In lieu of mechanical measurement of deflection by a mandrel, manual measurement can be performed using an internal micrometer or telescoping gage accurate to plus or minus (±) one-thousandth (0.001") inch. The manual measurement of the vertical internal diameter shall be taken at the centerline of the installed pipe.
- B. Leakage Testing
 - 1. After backfilling has been completed, the CONSTRUCTION MANAGER shall conduct infiltration, exfiltration, or air tests. All tests shall be performed in the presence of the ARCHITECT for pipes twenty-four inches (24") and larger. Immediately prior to conducting a test, the ground water level shall be determined by boring a vertical hole adjacent to the pipe and measuring the distance to the water level, or by the use of a one-inch (1-inch) diameter pipe installed horizontally through the upstream manhole wall with a clear plastic tube connected to the pipe and extending vertically.
 - 2. Infiltration Test
 - a. Where sewers are laid under the groundwater, infiltration testing shall be conducted. If at any time the infiltration between two adjacent manholes is observed and measured to exceed ten (10) gallons per inch of nominal pipe diameter per mile of sewer per day. The CONSTRUCTION MANAGER shall locate the leakage and shall make such repairs as are necessary to reduce the infiltration. The infiltration shall be measured under the direction of the ARCHITECT by use of a weir or other suitable flow rate-measuring device furnished and installed by the CONSTRUCTION MANAGER.
 - 3. Exfiltration Test

- a. Where sewers are laid above the groundwater table, exfiltration testing shall be conducted. Exfiltration tests shall be conducted by blocking off the other openings in the upper manhole and plugging the line where it enters the lower manhole of the reach to be tested, filling the line and the manhole with water at least five foot (5') higher than the top of the pipe or five feet (5') higher than the ground water elevation whichever is higher, and measuring the water required to keep the water level in the manhole at a constant elevation. The test section shall be filled not less than twelve (12) hours prior to testing. The total exfiltration shall not exceed ten (10) gallons per inch of nominal pipe diameter per mile (idm) of pipe per day for each reach tested. For purposes of determining the maximum allowable leakage, manholes shall be considered as sections of pipe having an idm equal to the diameter times depth of the manhole. The exfiltration test shall be maintained on each reach for at least two (2) hours or longer if, in the opinion of the ARCHITECT, this is necessary to locate all leaks.
- b. The CONSTRUCTION MANAGER shall provide all necessary piping between the reach to be tested and the source of water supply, together with equipment and materials required for the tests. The methods used and the time of conducting the exfiltration tests shall be subject to the approval of the ARCHITECT.
- c. If the leakage in any reach exceeds the allowable maximum, the CONSTRUCTION MANAGER shall locate the leakage and shall make such repairs as are necessary for the pipe to pass testing. The pipe reach shall be retested after the leaks are repaired.
- 4. Air Test
 - a. Air tests shall be conducted on each manhole-to-manhole section of sewer. The air test shall be performed in accordance with the following specifications.
 - b. Equipment Cherne Air-Loc Equipment as manufactured by Cherne Industrial of Hopkins, Minnesota or approved equal. Equipment used shall meet the following requirements:
 - 1) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
 - 2) Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking.
 - c. All air used shall pass through a single control panel.
 - d. Three (3) individual hoses shall be used for the following connections:
 - 1) From the control panel to pneumatic plugs for inflation;
 - 2) From the control panel to sealed line for introducing the low-pressure air; and
 - 3) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
- 5. Procedures
 - a. All pneumatic plugs shall be seal-tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to twenty-five (25 psi) pounds per square inch gauge. The sealed pipe shall be pressurized to five (5 psi) pounds per square inch gauge. If a ground water level over the top of the pipe is present, the pressure in psig shall be increased by the height of ground water level above top of pipe at upstream manhole divided by two and one third (2 1/3). The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
 - b. After a manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedures, the plugs shall be placed in the line at each manhole and inflated to twenty-five (25 psi) pounds per square inch gauge. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches four (4 psi) pounds per square inch gauge. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period (three and one half (3 ½ psi) pounds per square inch gauge minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from three and one half (3 ½ psi) to two and one half (2 ½ psi) pounds per square inch gauge is not less than that shown in the following table:

| Pipe Nominal | Minimum Test | Length for |
|---------------|----------------|--------------|
| Size (Inches) | Time (min:sec) | Minimum Time |
| | | (Feet) |
| 6 | 2:50 | 751 |
| 8 | 3:47 | 564 |
| 10 | 4:43 | 450 |
| 12 | 5:40 | 376 |

c. If the air leakage in any reach exceeds the allowable, it shall be re-tested after the leaks are repaired.

3.12 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION

SECTION 33 4600 SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SUBDRAINAGE as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SUBDRAINAGE shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Perforated-wall pipe and fittings.
- B. Drainage conduits.
- C. Geotextile filter fabrics.

1.4 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. Tahlequah Public Works Authority

1.6 ACTION SUBMITTALS

- A. Product Data:
 - 1. Drainage conduits, including rated capacities.
 - 2. Geotextile filter fabrics.
 - 3. Drainage aggregate.

1.7 DELIVERY, STORAGE, AND HANDLING

1.8 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
- C. PERMITS
 - 1. CONSTRUCTION MANAGER shall make application; pay permit fees; provide payment and performance bonds required of the CONSTRUCTION MANAGER by the AHJ.
- D. TOPOGRAPHIC SURVEY
 - OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONSTRUCTION MANAGER shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONSTRUCTION MANAGER shall be done at his expense.
- E. EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION
 - 1. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not

designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

- F. UNDERGROUND UTILITIES
 - 1. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
 - 2. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
 - 3. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
 - 4. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.
- G. CONSTRUCTION CONTROL
 - 1. Do not commence work until temporary erosion and sedimentation control measures are in place.
 - 2. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
 - 3. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.
- H. PROJECT CONDTIONS
 - 1. TRAFFIC
 - a. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - b. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - c. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - d. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any

existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

- 2. UTILITY INTERRUPTIONS
 - a. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- 3. SUBSURFACE CONDITIONS
 - a. 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 the data.

4. EXCAVATION AND TRENCH SAFETY SYSTEMS

- a. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.
- 5. HAZARDOUS CONDITIONS
 - a. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings:
 - 1. 3-inch through 24-inch: ASTM F 667, SCS 606, and AASHTO M 252, Type CP; corrugated, for coupled joints.
 - 2. Fittings shall comply with ASTM F 667.
 - Pipe material shall be high density polyethylene conforming with the minimum requirements of cell classification 424410C as defined and described in the latest version of ASTM D3350; or ASTM D1248 Type III, Class C, Category 4, Grade P33.
 - 4. Couplings: Manufacturer's standard, band type.
 - 5. Perforated PVC Sewer Pipe and Fittings: AASHTO M 278, ASTM D 2729, bell-and-spigot ends, for loose joints.
- B. SOLID WALL PIPES AND FITTINGS
 - 1. Solid Wall Pipes and Fittings shall be PE or PVC pipe according to the requirements of 33 4000 "Storm Drainage Utilities".

2.2 SOIL MATERIALS

A. Drainage Aggregate: Drainage aggregate shall be composed of hard, durable mineral particle free from organic matter, clay balls, soft particles and other impurities or foreign matter. The material shall conform to the following grading requirements:

| Sieve No. or Size | Percent passing by weight |
|----------------------|------------------------------|
| 1-1/2 in. | 100 |
| ¾ in. | 50 to 100 |
| No. 4 | 20 to 40 |
| No. 16 | 7 to 20 |
| No. 50 | 0 to 5 |
| No. 100 | 0 to 2 |

B. Satisfactory Soils shall be according to 31 2300 "Excavation and Fill".

2.3 GEOTEXTILE FILTER FABRICS

- A. Geotextiles for pipe underdrain and drainage systems shall meet the requirements of AASHTO M 288, "Subsurface Drainage Geotextile Requirements." Geotextile shall be according to AASHTO M 288, Table 2, with from 15 to 50 percent of in-situ soil passing the No. 200 sieve.
- B. Geotextiles shall have a flow rate range from 110 to 330 gpm/sq. ft, when tested according to ASTM D 4491.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and
- aboveground obstructions before beginning installation and avoid disruption and damage of services.C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 2300 Excavation and Fill.

3.3 FOUNDATION DRAINAGE INSTALLATION

- A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated on Drawings and manufacturer's requirements.
- F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 6 inches.
- J. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.4 UNDERSLAB DRAINAGE INSTALLATION

- A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

- E. Install drainage piping as indicated on Drawings and manufacturer's requirements.
- F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.5 RETAINING-WALL DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.
- C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- D. Install drainage piping as indicated on Drawings and manufacturer's requirements.
- E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 6 inches.
- I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.6 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
 - 2. Underslab Subdrainage: Install piping level.
 - 3. Retaining-Wall Subdrainage: When water discharges at end of wall into storm water piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
 - 4. Lay perforated pipe with perforations down.
- B. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- C. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- D. Install thermoplastic piping according to ASTM D 2321.

3.7 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.
- B. Join perforated PVC sewer pipe and fittings according to ASTM D 3212 with loose bell-and-spigot, pushon joints.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.8 BACKWATER VALVE INSTALLATION

- A. Comply with requirements for backwater valves specified in Section 33 40 00 Storm Drainage Utilities.
- B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.
- C. Install horizontal backwater valves in manholes or pits where indicated.

3.9 CLEANOUT INSTALLATION

- A. Comply with requirements for cleanouts specified in Section 33 4000 Storm Drainage Utilities.
- B. Cleanouts for Subdrainage:
 - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser

extensions to clean-out. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.

- 3. In non-vehicular-traffic areas, use NPS 4 cast-iron pipe and fittings for piping branch fittings and riser extensions to clean-out. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout 1 inch above grade.
- 4. Comply with requirements for concrete specified in Section 32 13 00 Rigid Paving.
- C. Cleanouts for Underslab Subdrainage:
 - 1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.10 CONNECTIONS

A. Comply with requirements for piping specified in Section 33 4000 Storm Drainage Utilities. Drawings indicate general arrangement of piping, fittings, and specialties.

3.11 IDENTIFICATION

- A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in 31 2300 Excavation and Fill.
 - 1. Install PE warning tape or detectable warning tape over ferrous piping.
 - 2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

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

3.13 CLEANING

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

END OF SECTION