SECTION 33 13 53 - SEPTIC SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Septic Tank
2. Grease Trap
3. Dosing Tank
4. Pipe and fittings
5. Absorption Trenches
6. Distribution Boxes

B. Related Sections include other Division 33 Sections.

1.03 DEFINITIONS

A. SSTS: Subsurface sewage treatment system.

B. PE: Polyethylene plastic.

C. PVC: Polyvinyl chloride plastic.

1.04 SUBMITTALS

A. Product Data: For the following:
1. Gravity pipe
2. Perforated pipe

B. Shop Drawings: Include manhole openings, covers, pipe connections, and accessories for the following precast concrete structures:

1. Septic tank.
2. Dosing tank.
3. Grease trap.
4. Distribution boxes.

C. Coordination Drawings: Show piping, underground structures, and other utilities. Indicate size and invert elevations of piping and structures.

D. Operation and Maintenance Data: For effluent pumps, include emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of septic system and are based on the specific system indicated.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 SEPTIC TANK

A. Precast Concrete Septic Tank: ASTM C 1227, two-chamber, precast, reinforced-concrete tank and covers.

1. Design: For A-16 (HS20-44) traffic loading according to ASTM C 890.
2. Manholes: 24” minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. Include manhole over the inlet and outlet pipe of each septic tank compartment top.
3. Inlet and Outlet Access: 24-inch minimum diameter, reinforced-concrete access lids with steel lift rings. Include access centered over inlet and outlet.
4. Resilient Connectors: Of size required for piping, fitted into inlet and outlet openings.

B. Capacity and Characteristics:

1. Capacity: 2,000 gallons
2. Inlet and Outlet Size: 5” NPS

2.03 DOSING TANK / HOLDING TANK

A. Precast concrete dosing tank: One-Chamber, precast, reinforced concrete tank and covers.

1. Design: For A-16 (HS20-44) traffic loading according to ASTM C 890.

2. Access:

a. 30” diameter cast iron frame and cover.

b. Precast concrete access riser.

3. Inlet and Outlet Access: 12-inch minimum diameter, reinforced-concrete access lids with steel lift rings. Include access centered over inlet and outlet.

4. Resilient Connectors: Of size required for piping, fitted into inlet and outlet openings.

B. Capacity and Characteristics:

1. Capacity: per plan

2. Inlet and Outlet Size: 5” NPS

2.04 GREASE TRAP

A. Precast concrete grease trap: Two chamber, precast, reinforced concrete tank and covers.

1. Design: For A-16 (HS20-44) traffic loading according to ASTM C 890.

2. Access:

a. Two 24” diameter cast iron frame and cover.
b. Precast concrete access riser.

3. Inlet and Outlet Access: 12-inch minimum diameter, reinforced-concrete access lids with steel lift rings. Include access centered over inlet and outlet.

4. Resilient Connectors: Of size required for piping, fitted into inlet and outlet openings.

B. Capacity and Characteristics:

1. Capacity: 1,000 gallons

2. Inlet and Outlet Size: 5” NPS

2.05 DISTRIBUTION BOXES

A. Description: Precast concrete, single-chamber box and cover.

1. Design: Made according to ASTM C 913, and for A-16 (HS20-44) traffic loading according to ASTM C 890.

2. Manholes: 24" minimum diameter opening cover with steel lift rings in center of distribution box.
3. Pipe Connections: Resilient adjustable connectors, of size required for piping, fitted into inlet and outlet openings. Include watertight plugs in outlets not required.

B. Capacity and Characteristics:

1. Type: Precast concrete distribution box.
2. Inlet Size: 4" NPS.
3. Number of Outlets: Fourteen.
4. Outlet Size: 4" NPS.

2.06 DISTRIBUTION PIPES AND FITTINGS

A. To be used from septic tank to pump pit.

B. Pipe: ASTM D 3034, PVC SDR 35, gasketed joints.

1. Gaskets: ASTM F 477, elastomeric seals.

C. Fittings: ASTM F 1336, PVC SDR 35, gasketed joints.

2.07 LEACHING PIPES AND FITTINGS

A. Pipe: PE, complying with ASTM F 810, perforated for absorption trenches, non-perforated from distribution boxes to absorption trenches.

1. Fittings: ASTM D 2729 PVC for loose joints.

2.08 ABSORPTION-TRENCH MATERIALS

A Filtering Material: 3/4 to 1-1/2 inches washed gravel or clean, dust free crushed stone.

B. Filter Mat: Geotextile woven or spun filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements and other conditions affecting performance of septic systems.

B. Verify compatibility with and suitability of soil structure and materials.

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

3.02 EARTHWORK

A. Excavating, trenching, and backfilling for piping are specified in Division 33 Section "Site/Utility Earthwork."

1. Stockpile topsoil for reuse in finish grading without intermixing with other excavated material. Stockpile materials away from edge of excavation and do not store within drip line of remaining trees.
2. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

B. Excavating and Backfilling for Septic Tank, pump pit and sewer forcemain cleanout manholes:

1. Excavate sufficient width and length to depth determined by inlet elevation. Provide level bottom.
2. Backfill with excavated soil, mounding soil above original grade without compacting.

C. Excavating and Backfilling for Absorption Trenches:

1. Excavate for absorption trenches 24 inches wide and 24 inches deep, minimum.
2. Backfill trench absorption fields with excavated soil, mounding soil above original grade without compacting.

3.03 SEPTIC TANK INSTALLATION

A. Install precast concrete septic tank level according to ASTM C 891.

B. Make direct connections to pump pit piping.

C. Fill septic tank with water.

3.04 DOSING INSTALLATION

A. Install pump pit level.

B. Set submersible effluent pumps on pump pit floor. Make direct connections to distribution piping.

3.05 DISTRIBUTION BOX INSTALLATION

A. Install precast concrete distribution boxes according to ASTM C 891 and at invert elevations indicated. Set level and plumb.

3.06 PIPING INSTALLATION

A. Install distribution piping according to the following:

1. PVC Sewer Pipe and Fittings: ASTM D 2321.

B. Install leaching piping according to the following:

1. Use perforated pipe and fittings for trench absorption fields with perforations at bottom.
2. PE Sewer Pipe: ASTM F 481.
3. PVC Sewer Pipe and Fittings: ASTM F 481.

3.07 PIPE JOINT CONSTRUCTION

A. Basic piping joint construction: Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join distribution piping according to or with the following:

1. PVC Sewer Pipe and Fittings: ASTM F 402 and ASTM D 2855 for solvent-cemented joints, or ASTM D 3212 and ASTM D 3034 for gasketed joints.

C. Join leaching piping with or according to the following:

1. Install leaching pipe and fittings for absorption trenches with closed joints, unless otherwise indicated.
2. PE Sewer Pipe: With PVC socket fittings and loose joints, with ABS gasketed fittings according to ASTM D 2751, or with PVC gasketed fittings and gasketed joints according to ASTM D 3034.

D. Join dissimilar pipe materials according to ASTM D 5926, with couplings and gaskets compatible with pipe materials being joined.

3.08 ABSORPTION TRENCHES INSTALLATION

A. Filtering Material: Place supporting layer of filtering material over the trench base to a compacted depth not less than 6 inches below bottom of pipe.

B. Refer to Part 3 "Piping Installation" and "Pipe Joint Construction" articles for specific piping material installation.

C. Install distribution piping at minimum slope of 1 percent.

D. Install leaching piping solidly bedded in filtering material, with full bearing for each pipe section throughout its length. Maintain pipe alignment and install pipe level (no slope).

1. Install perforated pipe with perforations down and joints tightly closed. Install collars and couplings as required.
2. Install elbow fittings with tight joints.
3. Place additional filtering material around sides to a minimum compacted depth of 2 inches above the top of leaching piping.

D. Install filter mat over filter material before backfilling.

E. Backfill according to Part 3 "Earthwork" Article.

3.09 IDENTIFICATION

A. Identification materials and their installation are specified in Division 31. Arrange for installation of green detectable warning tape directly over sewer forcemain piping.

3.10 CONNECTIONS

A. Piping installation requirements are specified in other Division 33 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Ground effluent pumps according to applicable regulations.

C. Connect wiring: Pump and control wiring shall be run from the pump pit to the adjacent above ground junction box/disconnect switch provided by the Electrical Contractor. All connections at the junction box/disconnect switch shall be made by the Electrical Contractor.

3.11 FIELD QUALITY CONTROL

A. System Tests: Perform testing of completed septic system piping and structures according to authorities having jurisdiction.

B. Additional Tests: Fill septic tank, grease tank, holding tank, dosing tank with water and let stand overnight. If water level recedes, locate and repair leaks and retest. Repeat tests and repair until no leaks exist.

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

1. Do not put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by Engineer with at least 48 hours' advance notice.
4. Submit separate reports for each test.
5. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

D. The dose system shall be tested once all other septic tank and SSTS components have been tested.

1. After the contractor has stated to the engineer that the installation is complete and ready for continuous operation, the contractor shall conduct a test of the dose tank in the presence of the Engineer to demonstrate proper operating condition.
2. All equipment and controls will be re-tested, adjusted, modified and/or replaced; and re-tested as often as necessary to meet the specified requirements to the satisfaction of the Engineer.

3.12 CLEANING

A. Clear interior of piping and structures of dirt and other superfluous material as work progresses.

B. 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 workday or when work stops.

END OF SECTION 331353

SECTION 33 14 00 - WATER UTILITY TRANSMISSION AND DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes piping and specialties for potable-water and fire-protection water service for the subdivision.

1.03 DEFINITIONS

A. The following are industry abbreviations for plastic and rubber materials:

1. NP: Nylon.
2. PE: Polyethylene.
3. PP: Polypropylene.
4. PTFE: Polytetrafluoroethylene.
5. PVC: Polyvinyl chloride.

1.04 SUBMITTALS

A. Product Data: For the following:
1. Pipe and fittings.
2. Flexible pipe fittings.
3. Valves.
4. Fire department connections.
5. Meter pit and appurtenances.

B. Record Drawings: At Project closeout of installed water-service piping.

C. Test Reports: As specified in "Field Quality Control" Article in Part 3.

D. Purging and Disinfecting Reports: As specified in "Cleaning" Article in Part 3.

1.05 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, and dimensional requirements of water-service piping specialties and are based on specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

B. Comply with standards of authorities having jurisdiction for potable water-service piping. Include materials, installation, testing, and disinfection.

C. Comply with NSF 61, "Drinking Water System Components--Health Effects," for materials for potable water.

D. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances," for materials, installations, tests, flushing, and valve and hydrant supervision.

E. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated devices.

F. Provide listing/approval stamp, label, or other marking on piping and specialties made to specified standards.

G. Listing and Labeling: Provide electrically operated specialties and devices specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:

4. Do not remove end protectors, unless necessary for inspection; then reinstall for storage.
5. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

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

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

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

E. Protect flanges, fittings, and specialties from moisture and dirt.

F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.07 PROJECT CONDITIONS

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

B. Verify that water-service piping may be installed to comply with original design and referenced standards.

C. Site Information: Reports on subsurface condition investigations made during design of Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions between soil borings. Owner assumes no responsibility for interpretations or conclusions drawn from this information.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Sleeves, and Corporation Stops:

a. Ford Meter Box Co., Inc.
b. Grinnell Corp.; Mueller Co.; Water Products Div.
c. Lee Brass Co.

2. Gate Valves:

a. Grinnell Corp.; Grinnell Supply Sales Co.
b. Grinnell Corp.; Mueller Co.; Water Products Div.
c. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa)
d. McWane, Inc.; Kennedy Valve Div.
e. Nibco, Inc.
f. Pratt: Henry Pratt Co.

2.02 PIPES AND TUBES

A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

B. Copper Tube: ASTM B 88 (ASTM B 88M), seamless water tube, annealed temper.

C. PVC Plastic, AWWA C900, pressure class 200 with a DR not to exceed 14. Include elastomeric seal according to ASTM F 477.

D. Pipe shall be furnished in standard 20 foot lengths with no more than 15 percent furnished in random lengths exceeding 10 feet each.

2.03 DUCTILE-IRON PIPE AND FITTINGS

A. Restrained joint pipe shall be ductile iron manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. Push-on joints for such pipe shall be in accordance with ANSI/AWWA C111/A21.11 “Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings”. Pipe thickness shall be designed in accordance with ANSI/AWWA C150/A21.50 “Thickness Design of Ductile-Iron Pipe” Class 52.

B. Restrained joint fittings and the restraining components shall be ductile iron in accordance with applicable requirements of ANSI/AWWA C110/A21.10 and/or C153/A21.53. Push-on joints for such fittings shall be in accordance with ANSI/AWWA C111/A21.11.

C. Restrained joint pipe and fittings shall be Field Lok 350 gaskets.

D. Cement mortar lining and seal coating for pipe and fittings shall be in accordance with ANSI/AWWA C104/A21.4. Asphaltic outside coating shall be in accordance with ANSI/AWWA C151/A21.51 for pipe and ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 for fittings.

E. Restrained push-on joints for pipe and fittings shall be designed for a water working pressure of 350 psi for sizes 4-inch through 24-inch.

F. Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly.

2.04 PE PIPE AND FITTINGS

A. PE, ASTM Pipe: ASTM D 2737, DR-9, DR-11 with PE compound number required to give pressure rating not less than 200 psig.

1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.

2. Molded PE Fittings: ASTM D 3350, PE resin, socket-or butt-fusion type, made to match PE pipe dimensions and class.

2.05 PVC PIPE AND FITTINGS

A. PE, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket, per ASTM F477 and with spigot end.

1. Polyvinyl Chloride Pipe shall be made from Class 12454-B materials or better in accordance with ANSI / ASTM D1784.

2. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, with MJ Field Lok gaskets, and steel bolts.

2.06 PIPE AND TUBE FITTINGS

A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

B. Copper Fittings: ASME B16.22; wrought-copper, solder-joint pressure type.

C. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300, as required for system operating pressure.

D. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Units have 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections. Include 250-psig (1725-kPa) minimum working-pressure rating; epoxy, interior coating according to AWWA C550; length for offset and expansion indicated; and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

E. Ductile-Iron, Deflection Fittings: Compound coupling fitting with sleeve and flexing sections, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include 250-psig (1725-kPa) minimum working-pressure rating; cement-mortar lining or epoxy, interior coating according to AWWA C550; deflection of at least 20 degrees (0.34 radians); and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

F. Ductile-Iron Fittings: AWWA C110, ductile-iron or cast-iron; or AWWA C153, ductile-iron, compact type; push-on- or mechanical-joint type. Include dimensions matching pipe, cement-mortar lining and seal coat according to AWWA C104, and rubber compression gaskets according to AWWA C111.

G. Mechanical joint restraining glands shall be “megalug 2000 PV” as manufactured by Ebaa Iron Sales, Inc. or approved equal.

2.07 PIPING SPECIALITIES

A. Dielectric Fittings: Assembly or fitting with insulating material isolating joined dissimilar metals to prevent galvanic action and corrosion.

1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

2. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C). Include insulating material isolating dissimilar metals and ends with inside threads according to ASME B1.20.1.

3. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum pressure to suit system pressures.

4. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure to suit system pressures.

5. Dielectric Couplings: Galvanized-steel couplings with inert and noncorrosive thermoplastic lining, with threaded ends and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

6. Dielectric Nipples: Electroplated steel nipples with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig (2070-kPa) working pressure at 225 deg F (107 deg C).

2.08 VALVES

A. Nonrising-Stem, Resilient-Seated Gate Valves, 3-Inch NPS (DN80) and Larger: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Include 200-psig (1380-kPa) minimum working-pressure design, interior coating according to AWWA C550, and push-on- or mechanical-joint ends.

B. Valve Boxes: Cast-iron box with top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5 inches (125 mm) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.

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

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

D. Service Boxes for Curb Stops: Cast-iron box with telescoping top section of length required for depth of bury of valve. Include cover with lettering “WATER”, and bottom section with base of size to fit over curb-stop and barrel approximately 3 inches (75 mm) in diameter.

1. Provide steel tee-handle shutoff rod with each service box. Include tee handle with one pointed end, stem of length to operate curb stop, and slotted end fitting curb-stop head.

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

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

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

2.09 FIRE HYDRANTS

A. Fire hydrants shall meet UL 262, FM 1120/1130, and ANSI/AWWA C502 standards. The main valve opening shall be 5 ¼" with two hose nozzles and one pumper nozzle. Hydrant shall be Super Centurion 250#A-423 as manufactured by Mueller or approved equal.

2.10 ANCHORAGES

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

B. Rods: ASTM A 575, steel.

C. Rod Couplings: ASTM A 197 (ASTM A 197M), malleable iron.

D. Bolts: ASTM A 307, steel.

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

F. Concrete Reaction Backing: Portland cement concrete mix, 3000 psig (20.7 MPa).

1. Cement: ASTM C 150, Type I.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

2.11 IDENTIFICATION

A. Use detectable warning tapes made of solid blue film with metallic core and continuously printed black-letter caption "CAUTION--WATER LINE BURIED BELOW."

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

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

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

C. Do not use flanges or keyed couplings for underground piping.

1. Exception: Piping in boxes and structures, but not buried, may be joined with flanges or keyed couplings instead of joints indicated.

D. Flanges, keyed couplings, and special fittings may be used on aboveground piping.

3.02 JOINT CONSTRUCTION

A. Copper Tubing, Brazed Joints: According to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

B. Copper Tubing, Soldered Joints: According to CDA's "Copper Tube Handbook."

C. PVC Piping, Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.

D. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, OD, and system working pressure. Refer to "Piping Systems - Common Requirements" Article below for joining piping of dissimilar metals.

3.03 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

B. Install components with pressure rating equal to or greater than system operating pressure.

C. Install piping free of sags and bends.

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

E. Piping Connections: Unless otherwise indicated, make piping connections as specified below:

1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.

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

3.04 PIPING INSTALLATION

A. Make connections, 2-inch NPS (DN50) and smaller, according to the following:

1. Install service clamps and corporation stops in size, quantity, and arrangement required and according to manufacturer's written instructions.

2. Install curb stop in service piping with head pointing up and with cast-iron service box.

B. Comply with NFPA 24 for fire-protection water-service piping materials and installation.

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

D. Install AWWA PVC plastic pipe according to AWWA M23 and ASTM F 645.

E. Bury piping with depth of cover over top at least 48 inches.

F. Install piping under streets and other obstructions that cannot be disturbed, by tunneling, jacking, or combination of both.

3.05 ANCHORAGE INSTALLATION

G. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, PVC Potable-Water Piping: According to AWWA M23.
2. Fire-Service Piping: According to NFPA 24.

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

3.06 VALVE INSTALLATION

A. General Application: Use mechanical-joint-end valves for 3-inch NPS (DN80) and larger underground installation. Use threaded- and flanged-end valves for installation in pits. Use non-rising-stem UL/FM gate valves. Use bronze corporation stops and valves, with ends compatible with piping, for 2-inch NPS (DN50) and smaller installation.

H. UL/FM-Type Gate Valves: Comply with NFPA 24. Install underground valves and valves in pits with stem pointing up and with vertical cast-iron indicator post.

I. Bronze Corporation Stops and Curb Stops: Comply with manufacturer's written instructions. Install underground curb stops with head pointed up and with cast-iron curb box.

3.07 IDENTIFICATION INSTALLATION

A. Install continuous detectable underground warning tape during back-filling of trench for underground water-service piping. Locate 12 inches (300 mm) below finished grade, directly over piping.

3.08 PRESSURE TEST

A. Pressure and leakage tests shall be performed in accordance with the latest revision of AWWA C600, Section 7.3, HYDROSTATIC TESTING.

B. Final tests must be performed in the presence of the certifying Engineer and prior to disinfecting. Do not conduct any hydrostatic tests until after all associated concrete work has set for a minimum of 7 days for standard concrete or at least 36 hours for high early strength concrete.

C. The test pressure shall be 150 percent of the maximum working pressure or 150 psi., whichever is greater.

D. The allowable leakage will be determined by the following formula.

$$\underline{SD \checkmark P}$$

$$L = \frac{148{,}000}{}$$

Where:

L = testing allowance (makeup water), in gallons per hour
S = length of pipe tested in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

E. All visible leakage must be repaired.

F. Following disinfecting, conduct operating tests in the presence of the certifying Engineer to verify all valves and hydrants are in proper working condition.

3.09 CLEANING

A. Clean and disinfect water distribution piping as follows:

1. Purge new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and continuous feed method disinfecting procedure only as described in the latest revision of AWWA C651.
   a. All work under this section shall be performed in the presence of the Design Engineer, and a representative of the public health authority having jurisdiction, as required.
   b. Chlorination shall be scheduled such that sampling and flushing will be performed during normal daylight working hours. The contractor shall provide acceptable backflow prevention on all supply water to prevent any potential backflow contamination or cross connection.
   c. Chlorination shall be by the use of a solution of water and liquid chlorine, calcium hypochlorite or sodium hypochlorite and the solution shall be contained in the pipe or structure as specified.
   d. Prior to chlorination, all dirt and foreign matter shall be removed by a thorough cleaning and flushing of the pipeline or structure.
   e. The chlorine solution shall be introduced to pipelines through corporation stops placed in the horizontal axis of the pipe, to structures by means of tubing extending directly into the structure, or other approved methods.
   f. The application of the chlorine solution shall be by means of a controlled solution feed device. The rate of chlorine solution flow shall be in such proportion to the rate of water entering the pipe or structure that the resulting free chlorine residual shall be between 25 and 50 parts per million (PPM), milligrams per liter (mg/l).
   g. The chlorine treated water shall be retained in the pipe or structure at least 24 hours, unless otherwise directed. During the retention period, all valves and hydrants within the treated sections shall be operated.
   h. The chlorine residual shall be not less than 10 PPM (mg/l) at any point in the pipe or structure at the end of the 24-hour retention period.
   i. When making repairs to, or when specified, structures and portions of pipelines shall be chlorinated by a concentrated chlorine solution containing not less than 200 PPM (mg/l) of free chlorine. The solution shall be applied with a brush or sprayed on the entire inner surface of the empty pipes or structures. The structures

disinfected shall remain in contact with the strong chlorine solution for at least 30 minutes.

j. After the required retention of chlorinated water in the pipe or structures, they shall be thoroughly flushed until the replacement water shall, upon test, both chemically and bacteriological, be proven equal to water quality served by the public from the existing water supply system.

k. The disposal of chlorinated water from any pipe or structure shall be such that it will not cause damage to any vegetation, fish, or animal life.

l. The Contractor shall make all arrangements for the testing of water quality by an approved independent laboratory. Two acceptable bacteriological test, taken at least 24 hours apart, shall be collected from the new watermain. At least 1 set of samples must be collected from every 1,000 LF of the new watermain, plus one set from the end of the line and at least one set from each branch. The results for all test shall be forwarded to the Design Engineer and the public health authority having jurisdiction.

m. All water quality requirements shall be fulfilled prior to the passage of any water through the new system to a public supply or the use of the new system.

B. Prepare reports for purging and disinfecting activities.

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END OF SECTION

SECTION 33 21 00 - WATER SUPPLY WELLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The project well has been drilled and tested by others prior to the start of this contract.

B. This Section includes the following:

1. Fit up of the well and connection to the building mechanical room.
2. Submersible-type pumps for water supply wells.
3. Associated specialties.

C. Related Sections include other Division 33 Sections.

1.03 DEFINITIONS

A. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PA: Polyamide (nylon) plastic.
3. PE: Polyethylene plastic.
4. PP: Polypropylene plastic.
5. PVC: Polyvinyl chloride plastic.

1.04 PERFORMANCE REQUIREMENTS

A. Minimum Tested Water Supply Well Performance Capacity: 5 gallons per minute.

1.05 SUBMITTALS

A. Product Data: Submit certified performance curves and rated capacities of selected well pumps and furnished specialties for each type and size of well pump indicated.

B. Shop Drawings: Show layout and connections for well pumps.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Setting Drawings: Include templates and directions for installing foundation bolts, anchor bolts, and other anchorages.

C. Operation and Maintenance Data: For each well pump to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Well Installer Qualifications: An experienced water supply well installer licensed in the jurisdiction where Project is located.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.07 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two days in advance of proposed utility interruptions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.02 WELL APPURTENANCES

A. Pitless Unit: Factory-assembled equipment, as manufactured by Monitor, a division of Baker, or approved equal.

B. Well Seals: Casing cap, with holes for piping and cables, that fits into top of casing and is removable, waterproof, and vermin proof.

2.03 SUBMERSIBLE-TYPE WELL PUMPS

A. Available Manufacturers (or approved equal):

1. Grundfos.
2. ITT Industries; Goulds Pumps.

B. Description: Submersible-type, centrifugal well pump complying with HI 2.1-2.5 or AWWA E101, with the following features:

1. Impeller Material: Stainless steel.
2. Motor: Capable of continuous operation under water, with protected submersible power cable.
3. Column Pipe: ASTM A 53, Schedule 40, galvanized steel pipe with threaded ends and cast-iron or steel threaded couplings.
4. Discharge Piping: ASTM D 2239, SIDR 9 PE pipe; made with PE compound number required to give pressure rating not less than 200 psig. Include NSF listing mark "NSF pw."

    a. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.

C. Capacity and Characteristics:

1. Each Pump: (1 pump required):

    a. Capacity: TBD GPM
    b. Total Dynamic Head: TBD FEET
    c. Motor Horsepower: TBD HP

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install submersible-type well pumps according to HI 2.1-2.5 and provide access for periodic maintenance.

1. Before lowering permanent pump into well, lower a dummy pump that is slightly longer and wider than permanent pump to determine that permanent pump can be installed. Correct alignment problems.
2. Before lowering permanent pump into well, start pump to verify correct rotation.
3. Securely tighten discharge piping joints.
4. Locate line-shaft-type well pump near well bottom; locate motor above grade. Install driver plate to correctly align motor and pump.
5. Connect motor to submersible pump and locate near well bottom.

    a. Connect power cable while connection points are dry and undamaged.
    b. Do not damage power cable during installation; use cable clamps that do not have sharp edges.
    c. Install water-sealed surface plate that will support pump and piping.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 33 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Connect piping between well pump and pitless unit.
2. Connect well line in trench to well pipe at pitless unit and run well line to building mechanical room.

B. Electrical wiring, connections, run from well to building mechanical room.

C. Ground equipment according to applicable electrical requirements.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

A. Start well pump and adjust controls and pressure setting. Replace damaged and malfunctioning controls and equipment.

3.04 CLEANING

A. Disinfect water supply wells according to AWWA A100 and AWWA C654 before testing well pumps. The chlorine solution used for disinfecting the well shall be of such volume and strength and shall be so applied that a concentration of at least 50 mg/L of available chlorine shall be obtained for the entire water depth of the well, and this solution shall remain in the well for a period of at least 24 hours.

3.05 PROTECTION

A. Water Quality Protection: Prevent well contamination, including undesirable physical and chemical characteristics.

B. Protect water supply wells to prevent tampering and introducing foreign matter. Retain temporary well cap until installation is complete.

3.06 PURGING/WATER QUALITY TESTING

A. After well pump has been installed and well disinfected, pump well by running well pump at a minimum flow rate of 12 gpm and a maximum flow rate of 15 gpm for 24-hours.

B. After the well pump has been run for 24-hours have water samples collected by a lab approved by the Engineer and test the water for the following parameters.

1. Bacteria

C. Test results will be used to determine if any additional water treatment or filtering is required.

END OF SECTION 332100

SECTION 33 41 00 - STORM UTILITY DRAIN PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes storm drainage as shown on the project drawings.

B. Related Sections include other Division 31 Sections.

1.03 DEFINITIONS

A. HDPE: High-Density Polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

1.04 SUBMITTALS

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

1. Precast concrete inlets, catch basins, and other structures, including frames, covers, and grates.

2. Drainage Piping.

1.05 DELIVERY, STORAGE, AND HANDLING

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

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

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

1.06 PROJECT CONDITIONS

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

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

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

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

2.02 PIPES AND FITTINGS

A. Corrugated PE Drainage Tubing and Fittings: AASHTO M 252, Type S, with smooth waterway for coupling joints.

1. Soiltight Couplings: AASHTO M 252, corrugated, matching tube and fittings to form soiltight joints.

B. Corrugated PE Pipe and Fittings: AASHTO M 294, Type S, with smooth waterway for coupling joints.

1. Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings to form soiltight joints.

2.03 STORMWATER INLETS

A. Yard Drain Inlets: Made with horizontal gutter opening, of materials and dimensions according to the project drawings. Include heavy-duty frames and grates.

B. Catch Basins: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to project drawings. Include heavy-duty frames and grates.

C. Drain Inlets: Made with horizontal gutter opening, of materials and dimensions according to the project drawings. Include heavy-duty frames and grates.

D. Frames and Grates: Dimensions, opening pattern, free area, and other attributes as indicated on the project drawings.

1. Material: ASTM A 536, Grade 60-40-18 minimum, ductile-iron casting.

2.04 CONCRETE

A. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed steel.

PART 3 - EXECUTION

3.01 EARTHWORK

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

3.02 PIPING APPLICATIONS

A. General: Include watertight, silttight, or soiltight joints.

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

C. Gravity-Flow Piping: Use the following:

1. NPS 4 and NPS 6 (DN100 and DN150): Corrugated PE drainage tubing and fittings, silttight couplings, and coupled joints.
2. NPS 8 to NPS 15 (DN200 to DN375): Corrugated PE drainage tubing and fittings, soiltight couplings, and coupled joints in NPS 8 and NPS 10 (DN200 and DN250). Use corrugated PE pipe and fittings, soiltight couplings, and coupled joints in NPS 12 and NPS 15 (DN300 and DN375).

3.03 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

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

1. Use the following pipe couplings for nonpressure applications:

a. Sleeve type to join piping, of same size, or with small difference in OD.
b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.

3.04 INSTALLATION, GENERAL

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

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

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

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

E. Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

F. PE Pipe and Fittings: As follows:
   1. Join Pipe, tubing, and fittings with couplings for soiltight joints according to manufacturer’s written instructions.
   2. Install according to ASTM D 2321 and manufacturer’s written instructions.
   3. Install corrugated piping according to the Corrugated Polyethylene Pipe Association’s “Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings”.

G. System Piping Joints: Make joints using system manufacturer’s couplings, unless otherwise indicated.

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

3.05 STORMWATER INLET INSTALLATION

A. Construct inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.06 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as work progresses.

1. Place plug in end of incomplete piping at end of day and when work stops.
2. Flush piping between inlets and other structures to remove collected debris, if required by authorities having jurisdiction.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

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

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate reports for each test.

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END OF SECTION