

SECTION 33 10 00
WATER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Underground water distribution system complete, ready for operation, including all appurtenant structures, and connections to both new building service lines and to existing water supply.

1.2 RELATED WORK

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, trenching, pipe bedding, backfill, shoring, sheeting, bracing: Section 31 20 00, EARTH MOVING.
- C. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.3 DEFINITIONS

- A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout building areas and other areas of water use, including hydrants, valves, and other appurtenances used to supply water for domestic and fire-fighting/fire protection purposes.
- B. Water Service Line: Pipeline connecting building piping to water distribution lines.

1.4 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be product of one manufacturer.
 - 2. Nameplate: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with all rules and regulations of the Prince William County Service Authority (utility owner), which has jurisdiction over the design, construction, and operation of potable water systems. All new water lines, including fire hydrants and other appurtenances, are subject to inspection by the utility owner
- C. All new water lines, including fire hydrants and other appurtenances, are subject to inspection by the utility owner. Contractor is responsible for coordinating with the utility owner for all required notifications, inspections and approvals.
- D. All material surfaces in contact with potable water shall comply with NSF 61.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit manufacturers' product data sheets for the following products:
 - 1. Pipe (including fittings, joint materials and accessories).
 - 2. Valves.
 - 3. Fire hydrants.
 - 4. Meter.
 - 5. Backflow preventer.
 - 6. Vaults, frames and covers.
 - 7. Tapping sleeves.

- 8. Valve boxes.
- 9. Joint restraint.
- 10. Disinfection products.
- C. Testing Certifications:
 - 1. Certification of Backflow Devices.
 - 2. Hydrostatic Testing.
 - 3. Certification of Disinfection, including free chlorine residuals, and bacteriological examinations.
- D. At project completion, submit record (as-built) drawings showing installed system as specified in this section.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Referenced standards shall be the current version as of the date of advertisement of the project.
- B. American National Standards Institute (ANSI/ASME):
 - B16.18.....Cast Bronze Solder Joint Pressure Fittings
- C. ASTM International (ASTM):
 - A242.....Standard Specification for High Strength Low Alloy Structural Steel
 - A536.....Standard Specification for Ductile Iron Castings
 - B88.....Standard Specification for Seamless Copper Water Tube
- D. American Water Works Association (AWWA):
 - B300.....Hypochlorites
 - B301.....Liquid Chlorine
 - C104.....Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - C105.....Polyethylene Encasement for Ductile-Iron Pipe Systems
 - C110.....Ductile-Iron and Gray-Iron Fittings
 - C111.....Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
 - C115.....Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
 - C151.....Ductile-Iron Pipe, Centrifugally Cast, for Water
 - C153.....Ductile-Iron Compact Fittings FOR Water Service
 - C502.....Dry-Barrel Fire Hydrants
 - C509.....Resilient Seated Gate Valves for Water Supply Service
 - C510.....Double Check Valve Backflow Prevention Assembly
 - C511.....Reduced Pressure Principle Backflow Prevention Assembly
 - C550.....Protective Interior Coatings for Valves and Hydrants
 - C600.....Installation for Ductile-Iron Water Mains and Their Appurtenances
 - C651.....Disinfecting Water Mains
 - C800.....Underground Service Line Valves and Fittings
- E. National Fire Protection Association (NFPA):
 - 24.....Standard for the Installation of Private Fire Service Mains and Their Appurtenances
- F. NSF International:
 - 61.....Drinking Water System Components-Health Effects (Sections 1-9)
- G. American Welding Society (AWS):
 - A5.8.....Brazing Filler Metal
- H. Foundation for Cross-Connection Control and Hydraulic Research-2005
- I. Copper Development Association's Copper Tube Handbook-2005

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe, direct buried:
 - 1. Provide ductile iron pipe conforming to the requirements of AWWA C151 Pressure Class 350 for pipe 4 inches through 12 inches in diameter.
 - 2. Supply pipe in lengths not in excess of a nominal 20 feet, with push-on restrained joints or mechanical joints as indicated on the Drawings and specified in this Section. Provide mechanical and restrained joint pipe with sufficient quantities of accessories as required for each joint.
 - 3. When a polyethylene encasement over pipe, fittings, and valves is a requirement as indicated on the Drawings, the material, installation and workmanship shall conform to applicable sections of AWWA C105. Make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfill following installation without delay to avoid exposure to sunlight.
- B. All Pipe Fittings: Ductile iron conforming to AWWA C110 or AWWA C153, with a minimum working pressure rating of 350 psi.
- C. Unless otherwise indicated, joints for pipe and fittings shall be push-on restrained joint type or mechanical joint conforming to AWWA C111.
- D. Provide cement mortar lining on the inside of the pipe and fittings in accordance with AWWA C104. Interior lining shall be specifically designed for potable water applications for the local service area. Provide standard asphaltic coating on the exterior in accordance with AWWA C151 for ductile iron pipe, and AWWA C110 or AWWA C153 (as applicable) for fittings.
- E. Provide a factory hydrostatic test of not less than 500 psi for all pipe in accordance with AWWA C151.
- F. Provide non-detectable adhesive backed identification tape on top and sides of all buried ductile iron pipe, extended from joint to joint along the length of the pipe and include black lettering identifying the pipe service at no more than 12 inch intervals. According to service, the tape background color shall be as follows: potable water-blue.

2.2 COPPER PIPE AND TUBING

- A. Copper Piping: ASTM B88, Type K, or Type L with flared fittings in accordance with AWWA C800, with sweat cast brass fittings per ANSI B16.18. Use brazing alloy, AWS A5.8, Classification BCuP.

2.3 VALVES AND TAPPING SLEEVES

- A. Asbestos packing is not allowed.
- B. Gate:
 - 1. 2 inches to 12 inches: Valves shall resilient wedge gate valves conforming to the requirements of the utility owner as indicated on the Drawings. Conform to AWWA C509. The interior and exterior shall be coated with thermo-setting or fusion epoxy coating in accordance with AWWA C550.
 - 2. Operator:
 - a. Underground: Except for use with post indicators, furnish valves with 2 inch nut for socket wrench operation.
 - 3. Joints: Ends of valves shall accommodate, or be adapted to, pipe installed with required joint type as indicated on the Drawings.
- C. Tapping sleeves shall be ductile iron mechanical joint tapping sleeves of required size as indicated on the Drawings

2.4 VALVE BOXES

- A. Valve boxes shall be slide style adjustable valve boxes with lid as indicated on the Drawings. Minimum thickness of metal shall be 3/16 inch. Box shall be adapted, without full extension, to depth of cover required over pipe at valve location. Cast the word "WATER" in cover. Provide "T" handle socket wrenches of 5/8 inch round stock long enough to extend 2 feet above top of deepest valve box.

2.5 FIRE HYDRANTS

- A. Fire hydrants shall conform to the requirements of the utility owner, as summarized in the following paragraphs and as indicated on the Drawings.
- B. Size of main valve opening of each hydrant shall be 5 inches, minimum. Hose thread, size of fire apparatus connection, and shape, size and direction of rotation of operating head of hydrant shall be identical with present local fire department and/or water department standards.
- C. Hydrants shall conform to AWWA C502, heavy construction, of proper length to connect pipe without extra fittings, and shall be the traffic type with safety flange on barrel and safety couplings on the valve stem with the following features:
 - 1. Unless otherwise indicated, furnish: one steamer nozzle and two hose nozzles with nozzle caps securely chained to barrel; suitable drainage device; nozzles, stuffing boxes, wedge nuts, seat rings, and other accessories as required. Upper and lower barrels shall be of equal diameters. Upper barrel shall be of sufficient length to permit setting hydrant with barrel flange not more than 3 inches above finished grade. All fire hydrants shall have 6 inch bottom connection.
 - 2. Provide fire hydrants with a finish paint identical to the existing fire hydrants.

2.6 BACKFLOW PREVENTER

- A. Unless otherwise indicated on the Drawings or approved by the COTR, furnish backflow preventer assembly conforming to the following specifications.
- B. Potable Water and Irrigation Water Service: Reduced Pressure Principle Type AWWA C511, except pressure drop at rated flow shall not exceed 15 psi. Gate valves installed on the assembly shall be resilient seated valve conforming to AWWA C509.
- C. Fire Service: Double detector check valve. AWWA C510.
- D. In cold climate areas, backflow assemblies and devices shall be protected from freezing by a method acceptable to the utility owner.
- E. Backflow preventers shall be approved by the Foundation for Cross-Connection Control and Hydraulic Research per current edition of the Manual of Cross-Connection Control.
- F. Backflow preventer shall not be located in any area containing fumes that are toxic, poisonous or corrosive.
- G. Direct connections between potable water piping and sewer connected wastes shall not exist under any condition with or without backflow protection.
- H. Backflow preventer shall be accessed and have clearance for the required testing, maintenance and repair. Access and clearance shall require a minimum of one foot between the lowest portion of the assembly and grade, floor or platform. Installations elevated more than five feet above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

2.7 WATER METER

- A. If applicable, Meter furnished by Water Service Utility and installed by Contractor. Furnish copper pipe, copper meter setter and bypass as required by local code.

2.8 METER BOX

- A. If applicable, Meter box shall conform to the requirements of the utility owner.
- B. Meter box shall be fabricated of concrete, PVC or FRP, dimensions as indicated on the Drawings. Furnish meter box cover and materials for setting box.

2.9 CONCRETE THRUST BLOCKS (BUTTRESSES)

- A. If allowed by the COTR, concrete for thrust blocking (buttresses) shall consist of: Type I or II Portland cement complying with ASTM C150, aggregates complying with ASTM C33, and clean water. Mix shall be proportioned such that the seven-day compressive strength of moist-cured laboratory samples achieves not less than 3,000 psi.

2.10 POTABLE WATER

- A. Water used for filling, flushing, and disinfection of water mains and appurtenances shall conform to Safe Drinking Water Act.

2.11 DISINFECTION CHLORINE

- A. Liquid chlorine shall conform to AWWA B301 and AWWA C651.
- B. Sodium hypochlorite shall conform to AWWA B300 with 5 percent to 15 percent available chlorine.
- C. Calcium hypochlorite shall conform to AWWA B300 supplied in granular form or 5.g tablets, and shall contain 65 percent chlorine by weight.

2.12 WARNING TAPE

- A. Standard, 4-Mil polyethylene 3 inch wide tape, detectable type, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW".

PART 3 - EXECUTION

3.1 BUILDING SERVICE LINES

- A. Install water service lines to point of connection within approximately 5 feet outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed, provide temporary caps.

3.2 PIPE LAYING, GENERAL

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the COTR.
- B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Government. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.
- C. All buried piping shall be installed to the lines and grades as shown on the Drawings. All underground piping shall slope uniformly between joints where elevations are shown.
- D. Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing utilities (including underground water lines and power lines) and all existing structures, unless otherwise indicated to be removed. Remove and reset existing brick

walkways and fence along the alignment for pipeline installation as indicated on the Drawings and as approved by the COTR.

- E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
- G. Hold pipe securely in place while joints are being made.
- H. Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 12 inches over pipe.
- I. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
- J. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. See subsection "PIPE SUPPORTS".
- K. Close pipe openings with caps or plugs during installation. Tightly cover and protect pipe and accessories against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.
- L. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.
- M. Warning tape shall be continuously placed 12 inches above buried water pipes.

3.3 DUCTILE IRON PIPE

- A. Installing Pipe: Lay pipe in accordance with AWWA C600 with polyethylene encasement if required in accordance with AWWA C105. Provide a firm even bearing throughout the length of the pipe by tamping selected material at the sides of the pipe up to the spring line.
- B. All pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plugs or other approved means.
- C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Bevel cut ends of pipe to be used with push-on bell to conform to the manufactured spigot end. Cement lining shall be undamaged.
- D. Jointing Ductile-Iron Pipe:
 - 1. Push-on joints shall be made in strict accordance with the manufacturer's instruction. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe is to be aligned with the bell of the pipe to which it is joined, and pushed home with approved means.
 - 2. Mechanical Joints at Valves, Fittings: Install in strict accordance with AWWA C111. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gaskets with soapy water before tightening the bolts. Bolts shall be tightened to the specified torque.
 - 3. Ball Joints: Install in strict accordance with the manufacturer's instructions. Where ball joint assemblies occur at the face of structures, the socket end shall be at the structure and ball end assembled to the socket.
 - 4. Flanged joints shall be in accordance with AWWA C115. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

3.4 COPPER PIPE

- A. Copper piping shall be installed in accordance with the Copper Development Association's Copper Tube Handbook and manufacturer's recommendations. Copper piping shall be bedded in 6 inches of sand and then backfilled as specified in Section 31 20 00, EARTH MOVING.

3.5 RESTRAINED JOINTS

- A. Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "locked-type" joints and the joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 200 psi. The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.
- B. The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be as shown on the Drawings.
- C. Restrained joint assemblies with ductile iron mechanical joint pipe shall be "Flex-Ring", "Lok-Ring", or mechanical joint coupled as manufactured by American Cast Iron Pipe Company, "Mega-Lug" or approved equal.
- D. Ductile iron pipe bell and spigot joints shall be restrained with EBBA Iron Sales, Inc. Series 800 Coverall or approved equal.
- E. Ductile iron mechanical joint fittings shall be restrained with EBBA Iron Sales, Inc. Series 1200 Restrainer. The restraining device shall be designed to fit standard mechanical joint bells with standard T head bolts conforming to AWWA C111 and AWWA C153. Glands shall be manufactured of ductile iron conforming to ASTM A536. Set screws shall be hardened ductile iron and require the same torque in all sizes. Steel set screws not permitted. These devices shall have the stated pressure rating with a minimum safety factor of 2:1. Glands shall be listed with Underwriters Laboratories and/or approved by Factory Mutual.
- F. Concrete thrust blocks (buttresses) shall be used only if approved by the COTR. If allowed, construct in accordance with the details included on the Drawings.
- G. Where ductile iron pipe manufactured with restrained joints is utilized, all restrained joints shall be fully extended and engaged prior to back filling the trench and pressurizing the pipe.
- H. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained with UNI-Flange Corp. Series 1300 Restrainer, EBBA Iron, Inc, Series 2000PV Mechanical Joint Restrainer Gland, or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.

3.6 PIPE SEPARATION

- A. Horizontal Separation-Water Mains and Sewers:
 1. Water mains shall be located at least 10 feet horizontally from any proposed drain, storm sewer, sanitary or sewer service connection.
 2. Water mains may be located closer than 10 feet to a sewer line when:
 - a. Local conditions prevent a lateral separation of 10 feet; and
 - b. The water main invert is at least 18 inches above the crown of the sewer; and
 - c. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located one side of the sewer.
 3. When it is impossible to meet the requirements of A.1 or A.2 above, both the water main and drain or sewer shall be constructed of mechanical joint ductile iron pipe. Ductile iron pipe shall comply with the requirements listed in this specification section. The drain or sewer shall be pressure tested to the maximum expected surcharge head before back filling.
- B. Vertical Separation-Water Mains and Sewers:

1. A water main shall be separated from a sewer so that its invert is a minimum of 18 inches above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
2. Both the water main and sewer shall be constructed of slip-on or mechanical joint ductile iron pipe or PVC pipe equivalent to water main standards of construction when:
 - a. It is impossible to obtain the proper vertical separations described in B.1 above; or
 - b. The water main passes under a sewer or drain.
3. A vertical separation of 18 inches between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking the water main.
4. Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least 10 feet.

3.7 SETTING OF VALVES AND BOXES

- A. Provide a surface concrete pad 2 feet by 2 feet by 4 inches to protect valve boxes when valves are not located below pavement.
- B. Clean valve interior before installation.
- C. Set valve cover flush with finished grade.
- D. Valves shall be installed plumb and level and in accordance with manufacturer's recommendations.

3.8 SETTING OF FIRE HYDRANTS

- A. Set center of each hydrant not less than 2 feet nor more than 6 feet back of edge of road or face of curb. Fire apparatus connection shall face road with center of nozzle 18 inches above finished grade. Set barrel flange not more than 3 inches above finished grade.
- B. Unless otherwise approved by the COTR, set each hydrant on a slab of stone or concrete not less than 4 inches thick and 15 inches square. The service line to the hydrant, between the tee and the shoe of the hydrant, shall be fully restrained.
- C. Set bases on a solid concrete block and place crushed rock or gravel to the required dimensions as indicated on the Drawings.
- D. Clean interiors of hydrants of all foreign matter before installation.

3.9 FLUSHING AND DISINFECTING

- A. Unless otherwise directed or approved by the COTR and the utility owner, disinfect the new water lines in accordance with the following specifications.
- B. Flush and disinfect new water lines in accordance with AWWA C651.
- C. Initial flushing shall obtain a minimum velocity in the main of 2.5 feet per second at 40 PSI residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line.

Pipe Diameter	Flow Required to Produce 2.5 ft/sec (approx.) Velocity in Main	Number of Hydrant Outlets			
		Size of Tap. in.			
		1	1 1/2	2	2 1/2-in
In	gpm	Number of taps on pipe			
4	100	1	--	--	1
6	200	--	1	--	1
8	400	--	2	1	1
10	600	--	3	2	1
12	900	--	--	3	2
16	1,600	--	--	4	2

The backflow preventers shall not be in place during the flushing.

- D. The Contractor shall be responsible to provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used, and the Contractor shall provide all required temporary pumps, storage facilities required to complete the specified flushing, and disinfection operations.
- E. The Contractor shall be responsible for the disposal of all water used to flush and disinfect the system in accordance with all governing rules and regulations. The discharge water shall not be allowed to create a nuisance for activities occurring on or adjacent to the site.
- F. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the utility owner. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor.
- G. Re-disinfection and bacteriological testing of failed sections of the system shall be the sole responsibility of the Contractor.
- H. Before backflow preventers are installed, all upstream piping shall be thoroughly flushed.

3.10 HYDROSTATIC TESTING

- A. Hydrostatic testing of the system shall occur prior to disinfecting the system.
- B. After new system is installed, except for connections to existing system and building, backfill at least 12 inches above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.
- C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.
- D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.
- E. The Contractor shall install corporation stops in the line as required to purge the air out of the system. At the completion of the test, all corporation stops shall be capped.
- F. The Contractor shall perform pressure and leakage tests for the new system for 2 hours to 200 psi. Leakage shall not exceed the following requirements.
 - 1. Copper Tubing: No leaks.
 - 2. Ductile Iron Pipe: Conform to AWWA C600.

3.11 BACKFLOW PREVENTER TESTING

- A. All backflow preventers shall be tested and certified for proper operation prior to being placed in operation.
- B. Original copies of the certification shall be submitted to the COTR.

3.12 RECORD (AS-BUILT) DRAWINGS

- A. During the progress of the water utilities system installation, record installed locations, elevations, and all changes and deviations from the original design by marking up the Drawings. Mark-ups shall include the following information: surveyed locations and bury depths for piping and appurtenances; pipe diameter; and material type. Show all deviations from the Drawings.

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