

SECTION 02550

WATER LINE CONSTRUCTION

PART 1 - GENERAL

1.1 Description

A. Description of the Work

The work to be performed in accordance with this section includes all work associated with waterline construction including valves, tapping sleeves, service connections, fire lines, fire hydrants and other appurtenances.

The work shall include the furnishing of all labor, tools, equipment, materials and installation of tracer wire, as well as performing all operations required to provide a complete item in accordance with the project plans and these specifications. All materials incorporated into the work shall be new unless otherwise indicated on the project drawings and the Contract Documents.

B. Related Work Specified Elsewhere

Trench Excavation and Backfill.....Section 2300

1.2 Quality Assurance

A. Reference Test Standards and Specifications

ASTM A48, Specification for Gray-Iron Castings

ASTM A307, Specification for Carbon Steel Bolts and Studs

ASTM B88, Specification for Seamless Copper Water Tube

ASTM B766, Specification for Electro-Deposited Coatings of Cadmium

ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

ASTM D2466, Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D1785, Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 & 120

ASTM D2241, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D2467, Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AWWA C104, American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C105, American National Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids

AWWA C110, American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In., for Water and Other Liquids

AWWA C111, American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

AWWA C115, American National Standard for Flanged Ductile-Iron Pipe with Threaded Flanges

AWWA C151, American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

AWWA C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C213, Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipeline

AWWA C303, Standard for Reinforced Concrete Pressure Pipe, Steel Cylinder Type, Pre-tensioned, for Water and Other Liquids

AWWA C500, Standard for Gate Valves, for Water and Sewerage Systems
AWWA 502, Standard for Dry-Barrel Fire Hydrants

AWWA C504, Standard for Rubber-Seated Butterfly Valves

AWWA C509, Standard for Resilient-Seated Gate Valves, for Water and Sewerage Systems

AWWA C550, Standard for Protective Epoxy Interior Coatings for Valves and Hydrants

AWWA C600, Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C605, Standard for Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

AWWA C651, Standard for Disinfecting Water Mains (Includes addendum C651)

AWWA C800, Standard for Underground Serviced Line Valves and Fittings

AWWA C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in. for Water Transmission and Distribution

AWWA C901, Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch through 3 inches for Water

AWWA C907, Standard for Polyvinyl Chloride (PVC) Pressure Fittings for Water – 4 in. Through 12 In.

PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

ANSI/NSF Standard 60 – Drinking Water Chemicals

ANSI/NSF Standard 61 – Drinking Water System Components

ADEQ Bulletin #8, Disinfection of Water Systems

Other miscellaneous AWWA and ASTM Standards

B. Hydrostatic Tests

All testing shall be in accordance with AWWA Standards. Perform pressure and leakage tests on all pipe or any valved section of it or both as required. Furnish all necessary assistance, equipment, and material and make all taps in the pipe as required. Utilize a saddle and corporation stop on all taps. All tests shall be witnessed by the **OWNER**.

For short segments of mainline pipe repair or replacement, 100 feet in length or less, where it is imperative that water service be restored immediately, the **OWNER** will waive pressure test requirements. When so approved, the joints, valves and fittings will remain exposed for pressurization to allow visual inspection for leaks. Upon satisfactorily passing visual inspection, backfill remaining trench in accordance with these specifications.

Furnish the following equipment and materials for the tests:

1 - 55 gallon drum.

1 - 5 gallon graduated container.

2 - Pressure gauges, liquid filled, 1% accuracy, 2-1/2 inch dial min. complete with surge and vibration dampeners.

1 - Hydraulic pump with air chamber, suitable hose and suction pipe as required suitable check valves and shut-off valves.

Conduct tests after the trench has been backfilled or partially backfilled with the joints left exposed for inspection. Where any section of pipe is provided with concrete reaction blocking, the pressure test shall not be made until at least five (5) days after the concrete reaction blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be cut to two (2) days instead of the five (5) previously specified.

Conduct the pressure test in the following manner: After the pipe has been backfilled or partially backfilled as specified, fill the pipe with water.

1. Test Pressure

Test pressure is in accordance with AWWA C605 and shall be one hundred eighty-eight (188) psig unless otherwise indicated on the plans or in the Contract Documents and measured at the lowest elevation on the test section.

2. Duration

A minimum of two (2) hours.

3. Expelling Air

Before applying the specified test pressure, expel all air from the pipe.

4. Procedure

Slowly fill each valved section of pipe with potable water to fill the pipe and expel all air in accordance with AWWA C605. Connect the test pump to the pipe in a satisfactory manner and operate the pump until the specified test pressure is achieved.

Valve off the pump and hold the pressure in the line for the test period. The pressure shall not vary more than five (5) percent from the specified test pressure during the test period. In the event that the pressure falls below the test pressure, the pump shall be operated to raise the pressure back to the specified test pressure. At the end of the specified time period, operate the pump to raise the pressure back to the specified test pressure. Measure all water necessary to restore the test pressure during and after the testing time period and include as leakage. The pump suction shall be placed in a graduated container so that the amount of water required to restore the test pressure can be measured accurately. Test equipment which drips or leaks is not acceptable for pressure testing and will be rejected.

5. Mainline Hydrostatic Test

Make-up is defined as the total quantity of water necessary to maintain and restore the specified test pressure during and at the end of the test period, Water lines will not be accepted for payment until the makeup water is less than the number of gallons per hour as determined by the following formula:

$$L = \frac{SD (P)^{1/2}}{148,000}$$

in which:

L = Allowable makeup water in gallons per hour

D = Nominal diameter of pipe in inches

P = Average test pressuring during the mainline hydrostatic test in pounds per square inch

S = Length of pipe tested in feet

Water lines which do not comply with the specified makeup water requirements will be rejected, and the **CONTRACTOR** shall, at his own expense, locate and repair the defective joints or pipe sections until the makeup water is within the specified allowance. ALL VISIBLE LEAKS SHALL BE REPAIRED REGARDLESS OF INITIAL TEST RESULTS AND SHALL BE RETESTED AFTER REPAIRS ARE MADE.

C. Sampling and Testing

The acceptance testing for all water mainline installation will include sampling and testing. Upon completion of the pressure test on the new mainline, the CONTRACTOR will notify the ENGINEER that the mainline is ready for sampling and testing as noted below. The ENGINEER will notify the City Water Department and they will schedule the necessary acceptance testing for high and low chlorine and bacteriological testing. The City Water Department will perform all acceptance sampling and testing. All work by the City Water Department will be scheduled in a timely manner as to not delay the Contractor.

1. Residual Chlorine

Samples for bacteriological testing shall not be taken until the residual chlorine content is less than 10ppm or comparable to the water in the existing system.

2. Sampling

Obtain samples and perform tests for two consecutive days. The number of samples and sample locations are as follows:

LENGTH OF WATERLINE	NUMBER OF SAMPLES	LOCATIONS
<150 feet	1	Extreme end
150 to 300 feet	2	One at each end
301 to 3000 feet	3	One at each end and one near the middle
>3000 feet	1 per 1000 feet	One every 1000 feet Coordinate with OWNER

3. Bacteriological Tests

Obtain above required number of samples. Test each sample for residual chlorine and bacteriological quality. Perform sampling and testing in accordance with Standard Methods for the Examination of Water and Wastewater. All bacteriological tests shall show the absence of coliform organisms at a chlorine residual no greater than previously specified.

4. Qualified Testing

All sampling and testing shall be performed in a laboratory and by a laboratory technician certified by the State of Arizona to perform such work. The **OWNER** will be responsible for all initial testing. All retesting shall be paid by the **CONTRACTOR**.

5. Final Acceptance

Final acceptance will not be made until the **OWNER** receives a laboratory report for each sample which indicates the test samples comply with the specified requirements.

1.3 Submittals

A. Certificate of Compliance and Descriptions

- 1.** Pipe
- 2.** Valves
- 3.** Fittings
- 4.** Hydrants
- 5.** Valve Boxes
- 6.** Miscellaneous appurtenances

1.4 Product Delivery, Storage and Handling

Take all necessary precautions whether unloading, storing, and placing all equipment and components so as not to damage the product. All products with visible damage are subject to rejection.

PART 2 - MATERIALS

2.0 General

All materials utilized in the construction of water facilities, whether it is the replacement or relocation of existing facilities or the construction of new facilities, shall be new, previously unused, and in excellent condition. No existing materials shall be incorporated into the work, either by relocation or replacement of existing facilities, unless specifically stated on plans and indicated in the Contract Documents as directing the Contractor to reuse existing materials.

2.1 Pipe and Fittings

A. PVC Pipe

AWWA C900, with the pressure class indicated on the drawings or as recommended by the pipe manufacturer, but not less than Pressure Class 305 DR-14 for push-on or mechanical joint pipe.

1. Pipe joints shall be gasket, push-on type. Gaskets shall be part of a complete pipe section and purchased as such. Lubricant shall be as recommended by the pipe or fitting manufacturer and shall not adversely affect the potable qualities of the water to be transported. The gasketed joint shall meet the laboratory performance requirements specified in ASTM D3139. (This is a qualification test to verify a leak-free design of the specified joint.)

B. Ductile Iron Pipe

AWWA C151, with the pressure class indicated on the drawings or as recommended by the pipe manufacturer, but not less than the requirements of Pressure Class 350 for push-on or mechanical joint pipe. Cement mortar lined and seal coated for potable water, AWWA C104.

1. Push-on and Mechanical Joints, AWWA C111.
2. Pipe used for fire hydrant assemblies shall be flanged or Mechanical Joint.
3. Threaded Flanges, Ductile Iron, AWWA C115. DIP requiring threads for flanges shall not be less than that required by thickness Class 53.
4. Flange Bolts and Gaskets, AWWA C115, Appendix A.

C. Concrete Cylinder Pipe

Concrete cylinder pipe shall be manufactured and tested in accordance with AWWA C303. The average circumferential stress in the steel cylinder and bar or wire reinforcement of the pipe at design pressure shall not exceed 16,500 psi nor 50 percent of the minimum yield strength of the steel used in the cylinder.

D. Ductile Iron Fittings

AWWA C110. Cement mortar lined and seal coated for potable water, AWWA C104.

E. Service Lines

AWWA C800

1. Polyethylene (PE) Pipe and Fittings

AWWA C901, PC200

2. Copper Pipe and Fittings

ASTM B88, Type K

3. Service Line Fittings

AWWA C800

2.2 Couplings and Adapters

A. Flanged Coupling Adapter

Adapter shall be ductile iron or steel with flange template compatible with adjacent fitting or valve. Minimum working pressure rating shall not be less than the adjacent valve, fitting or piping. Factory furnished with fusion bonded epoxy coating per AWWA C213. FCA shall be manufactured by Rockwell, Dresser or approved equal.

B. Flexible Couplings

One cylindrical steel middle ring, two steel follower rings, two resilient gaskets and high grade, high strength nuts and bolts. Factory furnished with fusion bonded epoxy coating per AWWA C213. Coupling shall be as manufactured by Rockwell, Dresser or approved equal.

2.3 Valves

A. Valves, 12 Inch and Larger

1. Butterfly Valve

AWWA C504, minimum 150 psig working pressure, NRS, 2 inch square operating nut, left hand opening, counter clockwise, EPDM seat, stainless steel valve shaft, ductile iron disk with stainless steel disk edge. Install with valve shaft in horizontal position. Factory applied minimum 6 mil dry film thickness epoxy coating on all interior and exterior ferrous surfaces. Epoxy coating per AWWA C550.

B. Gate Valves, 3 Inch to 10 Inch

AWWA C509, minimum 150 psig working pressure, resilient seated wedge, non-rising stem, O-ring packing, 2 inch square operator nut for buried service. Left hand opening, counter clockwise.

Factory applied minimum 6 mils dry film thickness, epoxy coating on all interior and exterior ferrous surfaces. Epoxy coating per AWWA C550.

C. Gate Valves, 2 Inches and Smaller

AWWA C800, minimum 150 psig working pressure. Threaded, all bronze, double disk, non-rising stem.

2.4 Valve Box and Riser

Valve boxes shall be Tyler Pipe/Union Foundry for 6850/60 series or an approved equal.

A. Operating Nut Less Than 3 Feet Below Surface

Valve boxes shall be two (2) piece or three (3) piece, depending on the manufacturer's recommendations. Valve boxes shall be the screw-type with a minimum 5-1/4 inch diameter shaft utilizing a standard drop lid. Valve boxes including upper part, lower part, extensions and lids shall be cast iron. The valve box shall be specifically designed for the type of valve for which it is used. The valve box shall be of proper length for the depth of cover. The word "WATER" shall be cast into the top of the Lid.

B. Operating Nut Greater Than 3 Feet below Surface

Riser pipe shall be minimum six (6) inch diameter Ductile Iron, Class 51 or an approved equal. Frame and cover, per ASTM A48, Class 30 painted or dipped with asphalt paint. Provide extension stem per detail. The word "WATER" shall be cast into the top of the lid.

2.5 Water Service Boxes

Boxes for meters shall be a #1419 (for one-inch) meter box and lid as manufactured by Brooks or an approved equal.

2.6 Fire Hydrants

- A.** Hydrants shall be designed, manufactured, and tested in compliance with the last edition of A.W.W.A. C-502 "Standard for Dry-Barrel Fire Hydrants" as published by the American Waterworks Association.
- B.** Hydrants shall be "Traffic" type with a replaceable "breakable" unit immediately above the ground line for minimizing repairs due to traffic damage.
- C.** Hydrants shall be of the compression type and constructed such that the main valve closes with the water pressure to assure no loss of water in the event of damage to the upper portion of the fire hydrant.
- D.** The lead from the service main to the fire hydrant will be ductile iron cement mortar-lined Class 50, no less than 6 inches in diameter and a maximum of 50-foot in length.
- E.** Main valve opening shall have a minimum diameter of 5-1/4" to assure optimum flow.
- F.** Hydrant shall be of the dry top design with O-ring seals to ensure that the operating threads will be protected from water entry. Dry top design to include factory lubricated operating mechanism which allows supplemental lubricant to be added in the field without removal of the top section. Standard lubricant shall be either oil or grease, suitable for a temperature range of -40 degrees to +150 degrees F.
- G.** All hydrants shall have a weather shield at the operating nut to protect the clearance area between the top casting and the operating nut.
- H.** The operating nut shall be a one-piece bronze casting, both the operating nut and nozzle cap nuts to be National Standard Pentagon in shape and measure 1-1/2" from point to flat at the base of the nut and measurement at the top height of nut shall be not less than 1". Caps must be provided with rubber gaskets.
- I.** Hydrants shall have two (2) 2-1/2" nozzles and one (1) 4-1/2" pumper nozzle with National Standard type threads.
- J.** Hydrant nozzle section shall be capable of rotation through 360 degrees with respect to the standpipe.

- K.** Minimum distance allowable between the centerline of the lowest nozzle and ground line is 16 inches.
- L.** Hydrant shall have identification mark indicating direction of opening left (counter-clockwise).
- M.** Hydrants shall have permanent markings identifying the manufacturer name, size of main valve opening, and year of manufacturer.
- N.** Hydrants shall have an automatic drain that is operated by the main valve rod. Drain valve is to open as the main valve is closed and close as the main valve is opened. Port and seat of drain valve to be bronze.
- O.** The outside of the hydrant top section shall be painted a minimum of one coat of primer and one finished coat of enamel caterpillar yellow in color.
- P.** The shoe of the hydrant shall be provided with a flange or mechanical joint type of inlet, 6 inches in size. The internal surfaces of the shoe shall be coated with a factory applied two part thermosetting epoxy coating with a minimum thickness of 4 mils.
- Q.** The bronze valve seat shall be threaded into a bronze drain ring or shoe bushing to prevent electrolysis between these components.
- R.** Hydrants shall be designed to permit the use of extension sections and allow all parts to be removable from ground level without requiring excavation of the hydrant.
- S.** Installation shall be in accordance with the details shown on the Plans and testing shall be in accordance with A.W.W.A. Standards C-600 and A.W.W.A. Manual M-17.
- T.** Hydrants shall be Mueller Centurion, Waterous Pacer, Clow Medallion, East Jordan 5CD250, AVK Series 2700 or approved equal.

2.7 Tapping Sleeves and Valves

A. Valves

Meet the requirements of Section 2.3, Flanged on one end to match sleeve with sufficiently large inside diameter to allow tapping.

B. Tapping Sleeves

Tapping sleeves and valves are used when service connections larger than 2 inches (50 mm) must be made. Tapping sleeves may be used for making large taps under pressure. When tapping sleeves are ordered from the manufacturer, the outside diameter of the pipe being tapped, the size of the outlet desired, and the working pressure should be specified to insure that the sleeve furnished will be satisfactory in all regards, including outside-diameter tolerance and minimum sleeve length. Lead-joint sleeves should not be used. Tapping sleeves should be assembled in accordance with the manufacturer's directions. Drilling equipment can be purchased or rented from sleeve manufacturers who also furnish instructions and/or instructors trained in making such taps. (Contractors who specialize in this type of work are also available in some areas.) Tapping sleeves should be supported independently from the pipe. The use of fabricated steel tapping sleeves will reduce the weight. Support used should be left in place after tapping. Thrust blocks or joint restraint should be used as with any other fitting or appurtenance.

All tapping sleeves for use on ductile iron or existing asbestos cement or C-900 PVC water mains shall be designed for an operating pressure of 150 psi and shall be fabricated using Type 304 (18-8) Stainless Steel. Sleeve shall be furnished with gridded virgin SBR compounded gasket for water service that provides full 360 degree pipe coverage ("full gasket"). Gasket shall be shop glued to the body section of the sleeve and the gasket shall provide adequate seal for the design pressure. Sleeve flange shall be Type 304 (18-8) Stainless Steel having the flange face machined and recessed to receive standard tapping valve in accordance with MSS Standard SP-60 for sizes 4" through 12". Flange shall conform to AWWA C207 Class D ANSI 150 lb. drilling. Bolts shall be Type 304 (18-8) Stainless Steel per ASTM A193 and A194. Fasteners shall be coated to prevent galling. Mueller H-304SS, Ford Style FTSS, JCM 432, Romac SST III and Powerseal Model 3490 or 3490MJ or equivalent are allowed. Size on size wet taps are allowed up to 12" diameter. Tapping sleeves for wet taps on steel water mains shall be weld on tapping outlets equivalent to JCM 416 Type 1 Weld on Outlet or JCM Type 2 Three Piece Weld On Saddle. Weld on outlets shall be fusion bonded epoxy coated. The use of two (2) tapping saddles, when side by side or back to back, as a substitute for a cross, will not be allowed. Edge of tapping saddle must be a minimum of 24" away from all joints or other appurtenances as measured along the water main spring line.

2.8 Service Saddle Clamp and Corporation Stops

A. Service Saddle Clamp

Service connections vary in size from small services supplying individual homes to large outlets for industrial users. Service connections to PVC water mains are accomplished in the field using the following methods:

- Tapping through service clamps or saddles.
- Tapping with large service connections through tapping sleeves and valves.

Service connections may be made using a service clamp or saddle. Maximum outlet size recommended with service clamps or saddles is 2 inches (50 mm). Most service saddles are only designed for 150 lb/in² operating pressure, therefore insure saddle is designed to accommodate line pressure. When making this type of connection, equipment is used which attaches to the corporation stop permitting a cutting tool to be fed through the corporation stop to cut a hole in the pipe. No threading of the pipe wall is required since the corporation stop is threaded into the service clamp. Service clamps or saddles used for attaching service connections to PVC water pipe should:

- Provide full support around the circumference of the pipe.
 - Be designed for use with PVC pipe.
 - Be sized properly.
 - Provide a bearing area of sufficient width along the axis of the pipe, insuring that the pipe will not be distorted when saddle is properly tightened.
 - For taps up to 1 in (25 mm), a minimum of 2 in (50 mm) total width along the axis of the pipe is recommended. Taps 1.25 in (32 mm) through 2 in (50 mm) should have a minimum 3 in (75 mm) total bandwidth with full circumferential support.
- Service clamps should not:
- Have a U-bolt type of strap that does not provide sufficient bearing area.
 - Have a clamping arrangement that is not fully contoured to the outside diameter of the pipe.

A number of tapping machines are available which will drill through a corporation stop. The cutting tool should be of a shell-type design, have a minimum of two slots, shall retain the cut coupon after penetrating the PVC pipe wall, and shall be designed to accommodate AWWA C900 wall thicknesses. It is recommended that the tapping machine have an

operator-controlled feed rate. In no case should a hand-held drill be used. Service clamps and saddles should be installed in accordance with manufacturer's recommendations and should conform to the outside diameter of the PVC pipe being tapped.

Service saddle clamp shall be a brass saddle with double strap as manufactured by Ford or an approved equal. Provide CC Type for services of one (1) inch or smaller and provide IPT Type for services larger than one (1) inch. Provide clamp gasket suitable for use with potable water. Minimum working pressure is 150 psig.

B. Corporation Stops

Bronze alloy body with threaded and/or compression type connections suitable for service intended (Ball-Type). Minimum working pressure is 150 psig.

2.9 Combination Air Release Valves

Single body units built for 150 psi service. Design to vent large quantities of air during filling, opening to atmosphere during draining, and venting small amounts of air when pipeline is under pressure. Combination air release valve shall be the size and style indicated on Drawings similar to APCO 143C and 145C, Crispin, or approved equal.

2.10 Bolts and Nuts

A. Pipe Larger than 12-inches

ASTM A307, Grade B, carbon steel or ASTM A276, stainless steel.

B. Pipe 12 inches and smaller

ASTM A276, stainless steel or ASTM A307, Grade B, cadmium plated carbon steel per ASTM B766, minimum plating thickness of 0.0002 inches Class 2A threads, Class 2B threaded nuts or AWWA C111 cast iron tee head bolts with hexagon nuts.

2.11 Below Ground Corrosion Protection

A. Ferrous flanges, bolts, nuts, anchor bolts, rods, etc.

AWWA C203, hot coal tar epoxy minimum thickness 1/16 inch, with pan or cocoon method, complete coverage. The coal tar epoxy coating will not be required on stainless steel components.

B. Ferrous Pipe Polyethylene Protective Wrap

AWWA C105 plastic tube, 8 mils minimum, virgin polyethylene, black. Secured with 2 inch wide pressure sensitive plastic tape, 10 mils minimum.

2.12 Concrete

Per Specification Section 3300, Concrete Structures, compressive strength as indicated on the plans but not less than 2500 psi.

2.13 PVC Conduits for Water Service Lines

ASTM D2241, SDR 32.5 (125 psi pressure rating).

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify all preliminary work has been performed in accordance with these Specifications prior to performing water line construction.

3.2 Minimum Cover

Measure minimum cover from existing or proposed finish grade of pavement or natural ground, whichever is deeper. Place to depth as shown on the plan. If not shown, minimum cover from finish grade shall be as follows:

A. Pipe less than 12 inches, minimum cover of 36 inches.

B. Pipe 12 inches or larger, minimum cover of 48 inches.

3.3 Trench Excavation and Backfill

Per Specification Section 2300.

3.4 Installation

A. PVC Pipe - AWWA C605

B. General

1. Alignment and Grade

Lay pipes to the line and grade indicated on the plans. Place fittings, valves, and hydrants at the required locations. Plumb and level all equipment, fittings, hydrants, valve stems, etc. Maximum deviation from alignment and grade shall not exceed 0.1 feet - horizontally or vertically. Where a deviation from the alignment or grade occurs, the pipeline will be gradually realigned to the proper location. Maintain positive or negative slopes as indicated on plans. Avoid making high spots in the pipeline. If a high spot cannot be avoided, an air release assembly must be installed at the high point.

2. Pipe Installation

Examine piping and appurtenances prior to placement. Replace defective materials. Prevent foreign materials from entering the pipe while it is being placed. No debris, tools, clothing or other materials shall be placed in the pipe at any time. As each joint of pipe is placed in the trench, assemble that joint and adjust the pipe to the proper line and grade.

For metal-detection equipment to assist in locating the water line after installation, a tracer wire (Tapped/Attached to Pipe) or coated metal strip should be placed immediately above the initial backfill material and directly over the pipe. The tracer wire shall be insulated for protection from corrosion and be 12 or 14 gauge. Alternatively, plastic-coated metal strips that have been specifically designed for this purpose shall be used.

3. Joint Assembly

Thoroughly clean bell and spigot ends, paying particular attention to the gasket and gasket recess. Use lubricant as recommended by the manufacturer which meets the requirements of AWWA C605. Torque mechanical and flange joint bolts to specified torque. Do not exceed specified joint deflection.

C. Service Lines

Service lines shall be bedded in sand per Section 2300. Service lines under pavement shall be placed in PVC conduit as indicated on the Plans, and the PVC conduit shall be bedded in sand per Section 2300.

3.5 Valves and Valve Boxes

AWWA C605. Inspect valve and appurtenances. Check valve for direction of opening, freedom of operation, cleanliness and seating surfaces. Replace defective materials. Install valve on concrete slabs as detailed. Wrap valve and valve joints with polyethylene encasement per AWWA C105.

Place and plumb valve riser pipe as indicated, clean all rocks and debris from around operating nut. Set box frame to provide a minimum of 2 inches of travel between the box and the riser.

At the end of every day, valve boxes that are not clearly visible shall be marked with a stake indicating the location and depth in which to find the valve.

3.6 Adjust Existing Valve Boxes and Meter Boxes to Finished Grade

Inspect existing water valve boxes and water meter boxes for damage. Replace existing boxes with new boxes at the direction of the **OWNER**. Adjust boxes to finished grade. Provide a concrete collar for all valve boxes and protect from traffic for a minimum of 48 hours.

3.7 Fire Hydrants

AWWA C605. Inspect hydrant for direction of opening, nozzle threading, operating nut dimensions, tightness, cleanliness, shipping damage and cracks. Replace defective materials. Install new fire hydrant assemblies (complete). Install hydrants plumb. Direct the smaller nozzles at right angles to the curb, with the larger nozzle facing the curb.

Set hydrant to the established grade with the centerline of the nozzles at least 18 inches above the ground, and the base flange not more than 6 or less than 2 inches above grade. Construct gravel drainage and thrust restraint as indicated.

3.8 Removal of Existing Fire Hydrant Assemblies

Excavate and remove the existing fire hydrant assemblies at the locations shown on the plan. Completely remove the hydrant and spool and install a blind flange on the existing valve.

All salvageable materials shall be safely stored onsite for delivery to the City. Delivery of the materials shall be coordinated with city personnel.

3.9 Relocating Fire Hydrants

Relocating fire hydrants will be done in accordance with Section 2550. All 4 inch fire hydrants will be upgraded to 6 inch hydrants and 6 inch assemblies including a 6 inch stainless steel tapping sleeve to the main line. Included in the relocation shall be the installation of a new 6 inch fire hydrant assembly.

3.10 Replacing Fire Hydrants

Replacing fire hydrants shall consist of the installation of new fire hydrant assemblies in the locations indicated on the project drawings and Contract Documents. All installation shall be in accordance with these specifications, the project drawings and Lake Havasu City Standard Details.

3.11 Connection to Existing Mains

Any connection to an existing main shall include a new valve. Expose existing pipe to be connected and verify location, size and type prior to constructing new mainline. The locations, sizes and depths of existing mains indicated on the plans are approximate only. Provide new waterline as indicated on the plans prior to making connection to the existing waterline. Coordinate connection to existing main with **OWNER** at least 48 hours in advance. The **OWNER** will operate existing valves but will not guarantee a complete shut down.

When shutdown of an existing water main is necessary in order to connect to the new lines, make application and pay the required charges to the **OWNER**. The **CONTRACTOR'S** representative, the project inspector, and Water Distribution personnel shall meet to establish the time and procedures to ensure that the shutdown will be for the shortest possible time.

It may be necessary to schedule the shutdown before or after normal working hours in order to minimize the inconvenience to some customers. The water supply to some customers, such as hospitals, cannot be shut off at any time. Provisions to furnish a continuous supply of water to such establishments will be required. After the procedures and the time for a shutdown are agreed upon, it shall be the **CONTRACTOR'S** responsibility to notify all customers that the water will be turned off. When possible, notify customers 24 hours in advance and in no case, except in emergency, shall notification be less than 30 minutes. Notification shall be in writing, giving the reason for the shutdown and the time and duration the water service will be shut off.

3.12 Mainline Pipe Replacement, 100 Feet in Length or Less

Gate valves shall be provided at the locations indicated on the plans prior to performing any work on the main line pipe. The maximum time allowed to install gate valves shall be two hours unless separate arrangements have been made by the **CONTRACTOR** to supply water to the affected properties. After the gate valves have been accepted by the **OWNER**, City forces will close the valves and replacement of the main line pipe by the **CONTRACTOR** may proceed. Remove and replace piping per plans and these specifications. Disinfect new piping per paragraph 3.12, Disinfection Procedures When Cutting into or Repairing Existing Mains. Place thrust blocking, temporary blocking, tie rods and backfill as required, to hold the line in place for pressurization. Leave all joints, valves and fittings exposed for visual leakage inspection during pressurization. Upon approval of visual leakage inspection, complete placement and backfill per these specifications.

3.13 Anchor and Thrust Blocking

Place anchor and thrust blocking to MAG Specifications and Details 301, 380, and 381 for all tees, plugs, caps, and bends and other locations where unbalanced forces exist. Place blocking against undisturbed ground surfaces. Do not place blocking until polyethylene wrap is secured in place. Place blocking neatly with straight sides and so joint bolts are accessible for future repairs.

3.14 Disinfecting Water Lines

AWWA C651 and ADEQ specifications

A. Pipe Placement

Keep the interior of the pipe and fittings free from dirt, trench water and foreign materials at all times. At the end of each work day, plug or cap open pipe end to prevent entry of dirt or trench water. Clean and swab interior surfaces that become contaminated, with 0.005 to 0.01 percent chlorine solution.

B. Joint Lubricant

Do not use material capable of supporting prolific growth of microorganisms for sealing joints. Lubricant shall be suitable for use with potable water. Handle lubricant in a manner that will avoid contamination.

C. Preliminary Flushing

Flush all mains 12 inches and smaller prior to chlorination and after the pressure test, except when using the tablet method of chlorination. Install service saddle clamps and corporation stops at high points and disinfection points. Leave service saddles and corporation stops exposed until testing is complete. Leave saddle clamps and corporation stops on the main line upon completion. Check operation of all valves after flushing. Replace damaged or defective material.

D. Methods of Chlorination

AWWA C651. Use any of the following methods:

- 1.** Tablet Method
- 2.** Continuous Feed Method
- 3.** Slug Method

E. Retention Period

Retain chlorinated water in the pipe long enough to destroy all non spore-forming bacteria, but not less than 24 hours. Minimum chlorine residual at the extreme end of the line shall be no less than 10 ppm at the end of the retention period. Initial chlorinated water should have a residual of 50ppm to 100ppm.

F. Chlorinating Valves and Hydrants

Operate all valves, hydrants and appurtenances while chlorinating to ensure complete disinfection.

G. Final Flushing

Following chlorination, flush chlorinated water from the line at its extremities until the water through its length is comparable in quality to the water served to the public by the existing system. Following final flushing the chlorine residual shall be no less than 10 ppm.

H. Disposal of Heavily Chlorinated Water

Inspect the environment to which the chlorinated water is to be discharged. Apply a reducing agent to chlorinated water if required. Contact Federal, state and local regulatory agencies to determine special provisions for chlorinated water disposal.

3.15 Disinfection Procedures When Cutting into or Repairing Existing Mains

AWWA C651. The following procedures apply to mainline replacements or repairs 100 feet in length or less. After the appropriate procedures have been completed, the main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water.

A. Trench Treatment

When an old main is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Apply liberal quantities of hypochlorite in granular or liquid form to open trench areas to lessen the danger from such pollution.

B. Swabbing with Hypochlorite Solution

The interiors of all pipe and fittings (particularly couplings and sleeves) used in making the repair shall be swabbed or sprayed with a 1-percent hypochlorite solution before they are installed.

C. Flushing

If valve and hydrant locations permit, flush toward the work location from both directions. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

D. Sampling

Bacteriological samples shall be taken after repairs are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is unknown, samples shall be taken on each side of the main break. If positive bacteriological samples are recorded, the situation shall be evaluated by the **OWNER** to determine corrective action, and daily sampling shall be continued until two consecutive negative samples are recorded.

3.16 A. Water Line Crossing

When constructing water lines near sewer pipe, construction shall be in accordance with Arizona Administrative Code R18-4-502 Minimum Design Criteria:

1. A water main shall not be placed:

- a.** Within six feet, horizontal distance, and below two feet, vertical distance, above the top of a sewer main unless extra protection is provided. Extra Protection shall consist of constructing the sewer main with mechanical joint ductile iron pipe or with slip-joint ductile iron pipe if joint restraint is provided.
- b.** Alternate extra protection shall consist of encasing both the water and sewer mains in at least six inches of concrete for at least ten feet beyond the area covered by this subject.
- c.** Water main shall not be placed within two feet horizontally and two feet below the sewer main.

2. Minimum Separation

No water pipe shall pass through or come into contact with any part of the sewer manhole. The minimum horizontal separation between water mains and manholes shall be six feet measured from the center of the manhole.

3.17 Fire Line Assemblies

Installation of fire line assemblies shall be in accordance with Lake Havasu City Standard Details, and shall utilize pipe, valves, fittings and appurtenances conforming to these specifications. Assemblies shall be of the size indicated on the project drawings and the Contract Documents.

All fire line assemblies shall be tapped to the existing main and extended to the right-of-way line as indicated on the plans, and all fire line assemblies shall have at least one resilient seat gate valve with riser and valve box installed in the line.

3.18 Water Service Assembly

Installation of water service assemblies shall be in accordance with Lake Havasu City Standard Details, and shall utilize pipe, valves, fittings, meter boxes and appurtenances conforming to these specifications. Assemblies shall be of the size indicated on the project drawings and the Contract Documents. All water service assemblies shall be tapped to the existing or new main and extended to the right-of-way line as indicated on the plans, with the meter box installed as close as possible to the right-of-way line. All water service assemblies shall have a shut-off valve installed at the connection to the main, as well as the other shut-off valves, fittings and appurtenances indicated in the Standard Details.

3.19 Combination Water Service Assemblies

Installation of combination water service assemblies shall be in accordance with Lake Havasu City Standard Details, and shall utilize pipe, valves, fittings, meter boxes and appurtenances conforming to these specifications. Assemblies shall be of the size indicated on the project drawings and the Contract Documents. All combination water service assemblies shall be tapped to the existing or new main and extended to the right-of-way line as indicated on the plans, with the meter box(s) installed as close as possible to the right-of-way line. All combination water service assemblies shall have a shut-off valve installed at the connection to the main, as well as the other shut-off valves, fittings and appurtenances indicated in the Standard Details.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

A. Water Line

Water line will be measured by the number of linear feet along centerline of pipe from the center of the fittings or to the end of the pipe.

B. Assemblies

Water service assemblies, fire line assemblies, combination water service assemblies and fire hydrant assemblies will be measured per each new assembly provided or existing service relocated.

C. Adjust Valve Boxes

Valve boxes adjusted to finished grade will be measured per each.

4.2 Payment

A. Water Line

Payment for water line will be based on the unit price per linear foot for each size and class of pipe and shall be considered as full payment for the pipe in place including any fittings, connections to existing water lines, flexible couplings, anchor and thrust blocks, hydrostatic testing, disinfection, plastic pipe wrap, trench excavation, bedding and backfill. No payment will be made until the hydrostatic testing and disinfection is satisfactorily completed.

B. Assemblies

Payment for various water system assemblies will be based on the contract unit price for each type and size of new water system assemblies and shall be considered as full payment for furnishing and installing the item complete.

1. Fire Hydrant Assembly (New, Replacement & Relocation)

Payment for each fire hydrant assembly shall be considered as full payment for furnishing and installing the fire hydrant, the gate valve and box, the six (6) inch pipe, the tee and connection to the water line, plastic pipe wrap, disinfection, thrust blocks, excavation, bedding and backfill complete in place. The CONTRACTOR is responsible for tapping all assemblies.

2. Removal of Existing Fire Hydrant Assembly

Payment for each Removal of existing fire hydrant assembly shall be considered as full payment for excavating and removing the existing fire hydrant, pipe, valve and mainline fitting and repairing the pipe section, backfilling and surface repair as required at the location indicated on the plan. Unless otherwise indicated in the bid schedule and these contract documents, the price for all removal of existing fire hydrant assemblies shall be included in the price to install, relocate or replace fire hydrant assemblies.

3. Mainline Gate Valves, and Butterfly Valves

Payment for each gate valve and each butterfly valve shall be considered full payment for furnishing and installing the valve, thrust block, valve box and appurtenances complete in place.

4. Combination Air Release Valve

Payment for each combination release air valve assembly shall be considered full payment for furnishing and installing the air release valve saddle clamp, corporation stop, appurtenant piping, fittings and valves, concrete valve box complete in place. The CONTRACTOR is responsible for tapping all assemblies.

5. New Water Service (Mainline Tap with Valve)

Payment for each water service shall be considered full payment for furnishing and installing all materials including pipe, fittings, service saddle, corporation stop, curb stop, isolation valve and meter box complete in place. This item also includes any required PVC conduit and adjustment of the meter box to grade. The CONTRACTOR is responsible for tapping all services.

6. Combination Water Service Assemblies

Payment for each combination water service assembly shall be considered full payment for furnishing and installing all materials including pipe, fittings, service saddle, corporation stop, curb stop, tapping valves, shutoff valves, valve boxes, meter boxes and service boxes complete in place. This item also includes any required PVC conduit and adjustment of the meter box(s) to grade. The CONTRACTOR is responsible for tapping all combination water service assemblies.

7. Relocate Existing Water Service or Combination Water Service Assembly

Payment for each existing service relocation shall be considered full payment for excavating, furnishing and installing pipe and fittings, moving existing box(s) and meter(s), replacing existing box(s) with new box(s) if broken or damaged, adjusting box(s) to grade, backfilling and surface repair as required at the location indicated on the plan. The CONTRACTOR is responsible for tapping all services.

8. Fire Lines

Payment for each fire line assembly shall be considered full payment for furnishing and installing all materials including pipe, fittings, tapping valves, shutoff valves, valve boxes, and service boxes complete in place. This item also includes any required PVC conduit. The CONTRACTOR is responsible for tapping all fire line assemblies.

C. Adjust Valve Boxes

Payment for adjusting water valve boxes to finished grade will be made at the unit price per each for each type of box and shall be considered as full payment for setting the box to finished grade, providing a concrete collar for all valve boxes and providing a new box when required.

See Section 00310 Bid Schedule for Bid Items.

**** END OF SECTION 02550 ****