SECTION 4 - WATER SPECIFICATIONS

4.1 General

A. Scope of Work

- Supply all labor, equipment, materials and incidentals necessary to install and test all water supply piping and appurtenances as specified.
- Work shall include, but not be limited to all excavation, backfilling, sheeting, slope protection, drainage, concrete work, rip-rap, grading, and all other work necessary to complete the construction, installation, and testing Of the pipe.

B. Qualifications

- The pipe and fittings shall be designed, constructed, and installed in accordance with these Specifications as applicable.

C. Submittals and Testing

- The Contractor shall submit, to the City of Roswell, prior to start of construction, a list of materials to be furnished.
- Submit shop drawings to the City of Roswell.

D. Inspection

- All pipe and fittings to be installed under this contract may be inspected, by the City of Roswell, at the site of manufacturer for compliance with these Specifications.
- Connection to Work by Others or Existing Lines
- For existing lines or lines installed under other Contracts, to which piping of this Contract must connect, the Contractor shall expose buried lines to confirm or determine end connection details, pipe material and diameter and furnish and install appropriate piping and make proper connections.

4.2 Products

A. General

- All materials shall be of standard manufactured design that the manufacturer recommends for the service intended in accordance with AWWA or ASTM Standard Specifications.
- All pipe and appurtenances shall be of the size shown on the Drawings and all equipment of the same type shall be from one manufacturer.
- Pipe materials shall be as follows:
- Mains, 4 inch and larger, ductile iron, Pressure Class 350

- Mains, smaller than 4 inch, may be Polyvinyl chloride (PVC) plastic pipe, Schedule 80, in conformance with ASTM D 1785, ASTM D 2241 and ASTM D 2672. PVC pipe may be used for larger mains with the expressed written approval from the Director of Public Works.

- Service lines, 3/4 - 2 inch, copper

- Ductile Iron Pipe and Fittings Ductile iron pipe shall meet the following requirements, and be as specified hereinafter.

- Ductile iron pipe shall be of the centrifugally cast type, either in metal or cast molds, and shall conform to ANSI/AWWA C150/A21.51. Ductile iron shall have a minimum tensile strength of 60,000 psi with a minimum yield strength of 42,000 psi, pressure rated at a minimum of 350 PSI and have a minimal wall thickness of 0.25" unless field conditions determine that a heavier wall thickness is required. The pressure rating and manufacture date shall be shown on each piece. All pipes shall be furnished complete with all necessary glands, joint material, including rubber gaskets lubricant, bolts and nuts, etc. Pipe furnished shall be as manufactured by U.S. Pipe and Foundry; American Cast Iron Pipe; or equal in industry standard lengths.

- Except as otherwise provided herein or on the construction drawings, interior surfaces of ductile iron pipe, fittings and specials shall be cleaned and lined with a standard thickness cement mortar lining in accordance with AWWA C104, Portland Cement Mortar. Every precaution should be taken to prevent damage to the lining. If the lining is damaged or found to be faulty at the delivery site, the damaged or unsatisfactory portions shall be replaced or repaired with a lining in conformance with recommendations of the manufacturer. All repairs shall be as smooth as practical and may not project into the waterway

- All ductile iron joints, (unless otherwise noted), used in the project shall be push-on joint or as specified and shall meet the requirements of ANSI/AWWA C111/A21.1,as amended

B. Fittings

- All ductile iron pipe fittings shall be ductile iron or cast iron and shall be of a standard design for use with the pipe purchased under these specifications. Fittings shall conform to the following applicable specification.

- Fittings shall conform to the latest revision of either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, as amended. Fittings and accessories shall be furnished with either push-on or mechanical type joints in accordance with ANSI/AWWA C111/A21.11, as amended. The proper number of gaskets, bolts, and all necessary joint materials, plus one extra gasket for every 50 joints or fraction thereof, shall be furnished with the, pipe fittings.

- Pipe and fittings shall have a cement mortar lining and a bituminous seal coat on the inside in accordance with ANS/AWWA C104/A21.4, as amended and be coated on the exterior with a 1.0 mils thick bituminous coat in accordance with ANSI/AWWA C151/ A21.51, as amended. A ceramic coating shall be substituted for the cement mortar lining where shown on the Drawings.

C. Polyethylene Encasement

- Where indicated on the Drawings, the Contractor shall provide a polyethylene encasement over pipe, fittings and valves. The material, installation and workmanship shall conform to applicable sections of ANSI/AWWA C105/A21.5, as amended. Installation shall be employed using flat tube polyethylene.

D. Copper Pipe

- All copper pipe shall conform to Federal Specifications WW-P-377 and ASTM B42 and ASTM B302, as a minimum with plain ends and lengths standardized at 12 feet.

E. Copper Tubing

- All copper tubing shall conform to ASTM Designation B88 for the Type "K" Soft Temper and AWWA 7S-CR Type "K" and may be used in 20-foot straight lengths or 60/100 foot coils.

F. Gate Valves

- All valves three to 16 inches in diameter shall be gate valves conforming to the requirements of AWWA Specification C-500. Sizes smaller than three inches shall meet Federal Specification WW-V-54, Class "A", rated for 200 psi working pressure. Gate valves shall be as manufactured by Dresser, Mueller, Darling, Clow Corporation, Kennedy, Walworth or similar approved equal.

G. Butterfly Valves

- All valves 16 inches and larger shall be butterfly valves of the tight closing, rubber-seat type and shall conform to the requirements of AWWA Specification C-564 for Class 150 B and as further specified herein. The butterfly valves shall be of the rubber-seat type that are securely fastened to the valve body. No metal-to-metal seating surfaces shall be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction, and shall be satisfactory for applications involving throttling service and/or frequent operation and for applications involving valve operation after long periods of inactivity. Butterfly valves shall be as manufactured by BIF Industries, Henry Pratt Company, Dresser, or similar approved equal.

H. Air/Vacuum Release Valves

- The valves shall have a cast iron body, cover, and baffle, stainless steel float, bronze water diffuser and Buna-N seat with threaded fittings. The valves shall be manufactured by GA Industries, APCO Valve and Primer Corporation or equal.

I. Corporation Stops

- Corporation stops shall be all brass or bronze suitable for 200 psi operating pressure and similar to Mueller Co. H-10046 or Hays 5200.

J. Valve Boxes

- Valve boxes shall be cast-iron two or three piece with cast iron covers. The barrel shall be one or two-piece, screw type, having 5-1/4-inch shaft. Covers shall have "WATER" cast into the top.

K. Flexible Couplings

- Flexible couplings shall be Catalog No. 411-160002 as manufactured by Smith-Blair, Style No. 38, as manufactured by Dresser Manufacturing Company, or equal.

L. Fire Hydrants

- Fire hydrants shall conform to AWWA C502-85 for dry-barrel fire hydrants. Hydrants shall be traffic type with safety flange that allows the valve to remain closed when the hydrant is broken or damaged above or near grade level. The design of hydrant shall be of the compression type with main valves and "0" ring seal between the operating nut and the bonnet. Hydrant color shall be silver.

- Hydrant inlet shall be 6-inch, mechanical joint with harnessing lugs. Hydrant main valve opening shall be 5-1/4inch. Valve seats shall be bronze to bronze.

- Operating nut shall be solid Pentagon, 1-1/2 inches measured flat at point (31/32 on side). Operating nut shall rum counter clockwise to open.

- Hydrant shall have two 2-1/2-inch diameter and one 4-1/2-inch diameter nozzle. Nozzles threads shall be the standard adopted by NBFU. Nozzles shall all have gasketed caps fitted with chain.

- The following fire hydrants are approved for installation in the City of Roswell:

Manufacturer	Model
American AVK	Models 2700 and 2780
Mueller	Centurion & Improved
U.S.	M-94
Kennedy	K81-A
M&H	Models 129 and 929
Clow	Medallion
American-Darling	B-62B

- Materials shall conform to AWWA Standard C-502, latest revision.

M. Curb Stops

- Curb stops shall be of bronze construction with tee handle operator. Curb stops shall be Hays 5060 or approved equal.

N. Tapping Sleeves

- Tapping sleeves shall be Class 250 pipe for 200-psi cold water working pressure. Sleeves shall be either M & H Fig. #74-M or Mueller #H-615 or approved equal.

- Tapping Saddles Double Strap Saddles: Saddles shall be either Smith Blair 313 Double Strap or Superior Style 32.

O. Adapters and Unions

- Copper female iron pipe adapters shall be Hays 5600 CF or approved equal in Mueller. Copper by copper unions shall be Hays 5615 CF or approved equal in Mueller. Copper by male iron pipe adapters shall be Hays 5605 or equal in Mueller.

4.3 Execution

- 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 City of Roswell.

- Pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective pipe 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 City of Roswell. 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.

- Unless specifically indicated otherwise, underground piping shall slope uniformly between joints.

- Contractor shall exercise extreme care when constructing piping to protect from damage all existing underground utilities, and all existing structures.

4.3.1 Installation

A. General

- Pipe and fittings shall be installed using bedding, as shown on the drawings, and in accordance with requirements of AWWA Standard Specifications except as otherwise provided herein. A firm, even bearing throughout the length of the pipe shall be constructed by tamping selected material at the sides of the pipe up to the springline. BLOCKING SUPPORTS WILL NOT BE PERMITTED Bell holes shall be hand excavated to insure uniform bearing along the pipe barrel.

- All pipe shall be sound and clean before laying. When laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer.

- 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. Cut ends of pipe to be used with a bell shall be beveled to conform to the manufactured spigot end. Lining shall be undamaged.

- Push-on joints shall be made in strict accordance with the manufacturer's instructions. 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 to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

- Joints at fittings, and where designated on the drawings and/or as specified, shall be in accordance with the "Notes on Method of Installation* under ANSI Specification A21.11 and the instructions of the manufacturer. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before assembly.

- Unless otherwise noted, underground piping shall be push-on.

- All fittings and other appurtenances needed upon the pipe lines shall be set and jointed as indicated on the Drawings or as required by the manufacturer.

- The Contractor shall arrange, if requested, for the pipe manufacturer to furnish information and supervise the installation of at least the first five (5) push-on joints.

- The Contractor shall carefully regulate his equipment and construction operations such that the loading of the pipe does not exceed the loads for which the pipe is designed and manufactured. Any pipe damaged during construction operations shall be replaced at the Contractor's expense.

- All piping shall be properly and adequately supported. Supports shall be provided as indicated on the Drawings. If the method of support is not indicated on the Drawings, piping shall be supported as directed by the City of Roswell.

- The proper number of gaskets and all necessary joint materials, plus one extra gasket for every 50 joints or fraction thereof, shall be furnished with the pipe and fittings.

- Pipe embedment shall conform to manufacturer's recommendations. Bedding and backfill for pipe shall be as shown on the Drawings.

B. Pipe Supports and Thrust Blocks

- All piping shall be properly and adequately supported. Concrete piers and pads shall be provided as indicated on the Drawings. If the method of support is not indicated on the Drawings, exposed piping shall be supported as directed by the City of Roswell.

- Longitudinal thrust along pressurized pipelines at bends, tees, reducers, and raps or plugs shall be counteracted by enough weight of concrete to counterbalance the vertical and horizontal thrust forces.

- Joints shall be protected by felt roofing paper prior to placing concrete thrust block.

- Bearing area of thrust blocks shall be adequate to prevent any movement of the fitting and shall be of the size and dimensions as shown on the Drawings

- Concrete for thrust blocking shall be 3000-psi minimum. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.

- Restrained joints shall be used as shown on the Drawings. Thrust blocks shall be used at all other locations or as directed by the City of Roswell.

C. Pressure and Leakage Tests of Underground Pressure Piping

- Hydrostatic pressure and leakage tests shall conform to Section 4 of AWWA C600 Specification with the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line. The pressure gauge used for testing shall be laboratory calibrated suitable for the test pressure required.

- The pressure required for the field hydrostatic pressure test shall be 150% of the maximum operating pressure of the section, or the pressure class of the pipe, whichever is greater. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure. Corporation

cocks at least 3/4-inches in diameter, pipe riser and angle globe valves shall be provided at each pipe dead-end and high point in order to bleed air from the line. Duration of pressure test shall be at least 2 hours. The cost of these items shall be included as a part of testing.

- The contractor shall contact the City of Roswell prior to conducting any pressure test. A record of successful pressure testing results will be provided by the contractor to the City of Roswell inspector at the time of observing the leakage testing.

- The leakage test shall be a separate test at the maximum operating pressure as determined by the City of Roswell following the pressure test and shall be of not less than 2 hours duration. All exposed pipes, fittings, valves and joints will be carefully examined during the tests and all leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines that fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe lines shall be tested in such sections as may be directed by the City of Roswell by shutting valves or installing temporary plugs as required. The line shall be filled with water and all air removed and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.

- The amount of leakage that will be permitted shall be in accordance with AWWA C600 Standards for all pressure lines. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L=\frac{SD\,(P)^{0.5}}{133200}$$

- In which "L" is the allowable leakage, in gallons per hour; "S" is the length of pipe tested, in feet; "D" is the nominal diameter of the pipe, in inches; and "P" is the average test pressure during the leakage test, in pounds per square inch gauge.

- The Contractor may backfill the trench before he tests the line if he so desires, but he shall open up the trench at his own expense to repair any leaks.

- The Contractor must submit his plan for testing to the City of Roswell for review at least three (3) days before starting the test. The Contractor shall remove and adequately dispose of all temporary blocking material and equipment after completion and acceptance of the field hydrostatic test, unless otherwise directed by the City of Roswell. The Contractor shall repair any damage to the pipe coating. Lines shall be totally free and clean prior to final acceptance.

D. Cleaning Mains

- At the conclusion of the Work, the Contractor shall thoroughly clean the new pipeline by flushing with water or other means to remove all dirt, stones, and pieces of wood or other material that may have entered during the construction period. If, after this cleaning, obstructions remain they shall be removed.

E. Disinfection

- Upon completion of the pressure and leak-age test, the section of pipe to be disinfected shall be initially flushed using potable water. Flushing shall be accomplished at a minimum velocity of 2.5 feet per second and shall continue until the water runs clear.

- Disinfection shall be accomplished by the continuous feed chlorination method in accordance with AWWA, A C60 1. The following steps shall be employed:

- Begin filling main at a constant, measured rate with potable water. As water first flows in, begin adding chlorine at a point no more than ten feet from the beginning of the new main.

- Add chlorine at a rate to attain a 50 mg/l chlorine concentration. The acceptable method is by preparing a 1% solution with sodium hypochlorite or calcium hypochlorite.

- Continue adding chlorine at a rate to attain a minimum concentration of 50 mg/l. Measure the rate at regular intervals as given in AWWA M12 or with a high range test kit. Chlorine application shall continue until the entire main is filled.

- The chlorinated water shall be retained in the water main for a minimum of 24 hours. At the end of the 24-hour period the water in all portions of the main shall have a minimum chlorine residual of 10 mg/l

- The heavily chlorinated water shall be flushed in a manner that is not detrimental to the environment. The method proposed shall be submitted to and approved by the City of Roswell prior to discharge. Final flushing shall continue until the chlorine residual is less than 1 mg/l.

- Contractor shall coordinate sampling with the City of Roswell. No earlier than 16 hours after final flushing, the City of Roswell will obtain bacteriological samples for testing.

- If bacteriological test results are unsatisfactory, the Contractor shall either flush the main with potable water or re-disinfected, as directed by the City of Roswell, prior to obtaining additional samples. Satisfactory bacteriological test results shall be obtained prior to placing the new main in service or prior to a final plat approval on which a new water service has been constructed.

F. Separation of Water and Sewer Lines

- There shall be no physical connection between a drinking water supply line and a sewer or appurtenance.
- Water lines shall be laid at least ten (10) feet horizontally from a sewer or a sewer manhole whenever possible; the distance shall be measures edge-to-edge. When local conditions prevent a horizontal separation of ten (10) feet, the water line may be laid closer to a sewer or sewer manhole provided that:
    a. The bottom (invert) of the water main shall be at least eighteen (18) inches above the top (crown) of the sewer
    b. Where this vertical separation cannot be obtained, the sewer shall be constructed of ductile iron pipe and pressure tested in place without leakage prior to backfilling.
    c. The water line shall be laid in separate trenches or on an undisturbed earth shelf.

- Where possible the water main shall pass over the sewer main with a vertical separation of at least eighteen (18) inches. When local conditions prevent a vertical separation of eighteen (18) inches between the bottom of the water main and the top of the sewer the following construction standards shall be used:
    a. The sewer shall be constructed of ductile iron pipe and pressure tested in place without leakage prior to backfilling.
    b. Adequate structural support for both the water and sewer mains shall be provided to prevent settling and excessive deflection of the joints.

c. That length of sewer main shall be centered at the point of the crossing such that the joints shall be equidistant from the point of crossing.
d. No deflection of the joints is permitted within ten (10) feet of the point of crossing.

G. Repair and Replacement

- Any cracked or broken material, such as pipe, fittings, valves, or hydrants, shall be removed and replaced with sound pieces. Joints that leak shall be carefully remade. Remade joints and replaced material shall be re-tested under the same conditions of operation. If joints or materials are then found to be defective, they shall be remade and replaced until the line passes the required test.

- Upon completion of back-filling and consolidation of the back-fill, all pavements removed for construction of the pipelines and appurtenance shall be replaced also and all pavements adjacent to pipe trenches, which may have been disturbed or damaged as the result of construction operations shall be removed and replaced and a load test conducted to prove proper consolidation of back-fill to sustain a load of 2500 pounds per square foot without undue settlement. Replacement shall be in accordance with the regulations of the State Highway Department and the city of Roswell.

- Pavement, including driveways, shall be replaced to a minimum width of nine inches beyond the top edges of each side of the trench excavation to allow solid bearing and to the depth as follows:

- Concrete pavement shall be replaced with a minimum depth of eight inches of concrete having a minimum compressive strength of 3000 psi in 28 days.

- Asphalt paving shall be replaced with eight inch concrete base with plant mix surface equal to the thickness of the existing, but a minimum of one inch or as specified in Table 400.05D.1 of the GDOT standard construction specifications. Street cuts that exceed 150 feet shall be topped for the full width of the road.

- Driveways and sidewalks shall be replaced with the same as existing material.

4.4 Water mains and fire hydrants on private property and subdivision developments.

- Water mains of at least eight-inch pipe shall be installed; six-inch pipe may be used only where it completes a gridiron and then only up to 600 feet in length between interconnecting mains of approved diameter, unless otherwise approved by the Director of Public Works and the Fire Marshal. All pipe materials shall comply with the standards approved by the City of Roswell.

- No main line smaller than eight inches shall serve more than one fire hydrant and automatic extinguishing system or one fire hydrant on any dead-end main more than 500 feet in length. All water mains shall be sized in accordance with NFPA 24, as adopted by the State of Georgia.

- Fire hydrants shall be spaced not more than 500 feet apart, with additional fire hydrants located as necessary to Comply with the requirements of the International Fire Code and Appendices as adopted by the City of Roswell and approved by the Fire Marshal.

- Water mains shall be of ductile iron or copper or a type listed for this service by a nationally recognized testing laboratory. They shall be installed at least 30 inches below grade and shall be tested hydrostatically at not less than 200-psi pressure for two hours in the presence of a representative of the city.

- Hydrants, fittings, valves and fire department connections shall be approved by the Fire Department. Fire department connections shall be not less than 18 inches or more than 36 inches above the level of the adjoining ground or paving. The thread of such connections shall be uniform with that used by the Fire Department.

- Water mains and fire hydrants shall be installed, under water pressure and ready for fire fighting before any construction with combustible material begins on-site.