

# **TECHNICAL SPECIFICATIONS**

## **WATER MAINS and MATERIALS**

### **Scope of Work**

Work to be performed under this contract shall consist of furnishing and installing, complete and ready for service, the water (storm mains where applicable) mains with various appurtenances as shown on the contract plans and as specified.

The Contractor for this project must understand that this type of work deals with many unforeseen situations. The Town of Green Level will assist the Contractor in the control of the water system where work is to be performed. However, the Town of Green Level hereby notifies the Contractor that completing this contract may include working with uncontrollable water flows; total control of the water system may not be possible.

### **WATER MAINS**

#### **I. MATERIALS**

A. **Ductile Iron Pipe** - All ductile iron pipe furnished for diameters four inches (4") through twenty-four inches (24") shall be as manufactured in accordance with ANSI Specifications A 21.51-1976, tentative, (AWWA C151-76, tentative), or latest specifications, in eighteen-foot (18') lengths with single rubber gasket joints in accordance with ANSI Specifications A 21.11-1972 (AWWA C111-72) or latest specifications. Four inch (4") diameter pipe shall be Class 51 wall thickness, and six inch (6") through twenty-four inch (24") diameter pipe shall be Class 50 wall thickness in accordance with ANSI Specification A 21.50-1976, tentative, (AWWA C150-76, tentative), or latest specification, unless otherwise specified or shown on the plans. All ductile iron pipe shall be cement lined in accordance with ANSI Specifications A 21.4-1971 (AWWA C104-71) or latest specifications.

B. **High Density Polyethylene (HDPE) Pipe:**

Materials used for the manufacture of polyethylene pipe and fittings shall be PE 3408 high density polyethylene meeting ASTM D 3350 cell classifications 345464C (black) or 345464E (non-black & color) and shall be listed in the name of the pipe and fitting manufacturer in PPI TR-4 with a standard grade HDB rating of 1600 pounds per square inch at 73 °F. In potable water applications the material shall be listed and approved in accordance with NSF Standard 61.

Polyethylene pipe shall be manufactured in accordance with AWWA C901-96 for sizes 1.25-inch through three-inch IPS diameters and to the requirements of ASTM D3035. Pipe 4-inch IPS and DIPS sizes 4-inch and above shall be manufactured to the requirements of ASTM F714 and AWWA C906-99 (IPS).

Pipe diameter shall be as indicated on the Contract Drawings, and shall be a minimum of DR 9 unless otherwise indicated on the Contract Drawings.

Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked. Fittings shall also be tested in accordance with AWWA C906.

Joining:

1. Joints between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle fusion. The butt fusion and saddle fusion procedures used shall be procedures that are recommended by the pipe and fitting Manufacturer. The contractor shall ensure that persons making heat fusion joints have received training in the Manufacturer's recommended procedure.
2. External and internal beads shall not be removed.
3. Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple or by mechanical means or electrofusion.
4. Polyethylene pipe and fittings may be joined together or to other materials by means of flanged connections, mechanical couplings, mechanical joint adapters, or electrofusion.
5. Branch connections to the main shall be made with saddle fittings or tees.

- C. SDR 21 PVC: Pipes shall comply with ASTM Standard D1784 and shall be made of virgin PVC compound with a cell classification of 12454-B. Physical dimensions shall comply with the ASTM Standard D2241.

Push on joints shall conform to the applicable requirements of ANSI A21.11 and AWWA C111. Gaskets and lubricants for pipe fittings shall conform to the applicable requirements of ASTM D3139 and F477.

- D. PVC (Polyvinyl Chloride) Six Inch or Larger: Pipe shall be John Manville “Blue Brute” or Robintech “White Knight” Class 150 minimum or approved equal conforming to all requirements of American Water Works Association Standard AWWA C900-75. No PVC fittings shall be used under any circumstances. Pipe shall be joined by means of a rubber ring bell joint which shall be integral and homogeneous part of pipe barrel.

A magnetic locator tape (ductile At-2100) shall be installed over any PVC water main in the same trench one foot above the pipe. Tape shall not be measured separately, but included in the pipe cost.

- E. Fittings - All fittings shall be manufactured in accordance with ASA Specification A 21.10-1964 and AWWA C0110 or latest revision. Fittings shall be mechanical joint, ASA Specification A 21.10-1964, latest revision, unless otherwise noted, and shall have interior cement mortar lining in accordance with ASA Specification A 21.4-1964, latest revision.

All fittings shall have a pressure rating of 250 psi. Fittings four inches (4”) through 12 inches (12”) shall be ductile iron with a minimum strength of 25,000 psi. Fittings fourteen inches (14”) and greater shall be ductile iron.

- F. Gate Valves - All gate valves shall conform in all respects to latest AWWA Specifications and shall be American Darling or Mueller “O” - ring or M&H.

Gate valves shall be vertical open-left of the non-rising stem type with mechanical joint ends and 2” square operating nut. Gate valves shall be iron body, double disc, parallel seat or resilient wedge, fully bronze mounted.

Gate valves shall be designed for the following pressures:

<u>Valve Size</u>	<u>Working Pressure</u>	<u>Hydrostatic Test Pressure</u>
Up to 12”	200	400

Butterfly Valves - Butterfly valves shall be class 150-B, meeting or exceeding AWWA Specification C-054-70.

Valve bodies shall be of close grain cast iron conforming to ASTM designation A-126, Class B. Valve disc shall be cast bronze or cast iron with bronze or stainless steel sealing surfaces. The disc shall have adjustable stops preset by the factory. The seats shall be natural rubber warranted for five (5) years from the date of acceptance by the Owner. Butterfly valves shall be manually operated, with the operator assembly meeting all requirements of Section 12, AWWA C-504-70. Operating torque shall comply with Table 1 of C-504-70 for Class 150-B valves.

They shall be open left and provided with 2" operating nut. The operator assembly shall be suitable for trench bury.

Butterfly valves shall have mechanical ends. Each valve shall have a serial number permanently indented into the body. The number shall be kept on file by the manufacturer for future reference. Certified copies of the tests shall be forwarded to the Owner for record purposes.

Butterfly valves shall be American Darling, Henry Pratt "Ground Hot" or approved equal.

Butterfly valves shall not be used unless specifically approved by the Town Engineer.

- G. Valve Boxes - Adjustable valve boxes shall be subject to the approval of the Engineer and shall be of equal quality and workmanship to Tyler 562S or equal and AWWA approved. Valve boxes shall be of close-grained gray cast iron in two pieces, consisting of a lower base piece which shall be flanged at the bottom to fit around the stuffing box gland and rest on tamped backfill and not touch the valve assembly, and an upper part which shall be manufactured on the lower end such that it will screw connect over the lower part and the upper end being constructed in the form of a socket to receive the cover. The cover shall have cast on the upper surface, in raised letters, the word "WATER." Valve boxes shall be painted prior to shipment with a coat of protective asphaltum paint.

- H. Hydrants - Fire hydrants shall be of the compression type and shall be Mueller Centurion new and improved #A-421, American Darling 73, Dresser M & H #129, and AWWA C-502, or approved equal, designed for a minimum working pressure of 150 psi and a hydrostatic test pressure of 300 psi with the valve in both the open and closed position.

The hydrant valve opening shall be a minimum of 4½". Hydrants shall be equipped with two (2) 2½" hose nozzles and one (1) 4½" pumper nozzle. All 2½" nozzles shall have threads which are 3.112" x 8 threads per inch measured on the outside of the male diameter. The suction hose (4½") will be National Standard. All 4½" pumper nozzles shall have National Standard threads. Nozzles shall be bronze with cast iron caps secured thereto with suitable steel chain. All hydrants shall have bronze seating. The hydrant shall meet all other requirements under TSW-A-Section 8.

The upper hydrant operating stem within the bonnet shall be sealed and lubricated by means of an oil or grease bath. The operating nut shall be National Standard pentagon-type measuring 1½" from point to flat. Hydrants shall be open left.

The hydrant shoe shall be 6" in size, of the mechanic joint type.

Hydrants shall be of the “safety” type so that if the upper barrel is broken off, the hydrant valve will remain closed and reasonably tight. All fire hydrants shall be painted red with all hydrant bonnets painted with reflective white paint.

All hydrants shall be furnished with barrel and stem extensions as required for the final field location. Nominal minimum bury will be 3½’. Payment will be allowed for these extensions based on the unit price stated in the proposal.

- I. Connections - All connections shall have either a reduced pressured backflow prevention device, double check valve, or other protection devices approved by the Town Engineer and the Department of Human Resources, Division of Health Services.

## II. CONSTRUCTION METHODS

- A. General - Water mains shall be installed in strict accordance with plans and these specifications. Work shall be planned and arranged so that the existing service shall be interrupted to the least possible degree. Access to property along the route of proposed construction shall be maintained at all times. The Contractor will give the property owners a 24-hour notice before cutting water off.

### B. General Construction Safety

1. The Contractor and any subcontractors shall be responsible for the total compliance to all federal, state, and local ordinances, laws and regulations as it relates to safe construction practices and to protecting the employees and the public’s general health to include providing by name(s) someone designated to be the “Competent Person” on the Job site.
2. The Contractor shall ensure that all Occupational and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
3. The Town of Green Level shall not be responsible for making the Contractor adhere to these OSHA regulations and standards. However, the Town may report known violations or unsafe practices to the appropriate enforcement agency.

- C. Trench Excavation - Excavation shall be made to the lines and grades as directed by the Engineer or as shown on the plans. The width of the trench shall not be more than is necessary for proper installation of the pipe. Depth of the trench shall, generally, be such as to provide a minimum depth of cover over the pipe of 3' below the finished grade of the street or ground.

Bell holes shall be hand dug at each joint to permit thorough making up of the joint. Bottom of the trench shall be shaped to support the pipe throughout its entire length. It shall be the responsibility of the Contractor to provide adequate bearing for all pipe lines laid in uncertain soil conditions or if the trench bottom should be softened by rain, flooding, or other causes, the unsuitable material shall be removed and replaced with suitable material properly shaped and tamped to grade. The Contractor shall, however, make efforts to prevent surface water from flowing into the trench. The Contractor shall, at his expense, remove any water which may accumulate in the trench by pumping or other approved means. The Contractor shall make every effort to prevent water and other materials from entering the pipe during construction. At the end of the day the line shall be plugged or capped and the trench filled in to protect the line. The use of timber or other material to support the pipe shall not be used. If rock is encountered, the excavation shall be carried to such depth below the established grade as to provide clear space of not less than 6" between the rocks at any point along the line. This space shall be filled with suitable material or stabilizing material and shall be included in the unit price for pipe as stated in the proposal. All excavation is unclassified. Cost of any rock excavation shall be included in the unit price bid per linear foot for pipe, complete in place.

- D. Pipe Laying - Shall be accomplished in accordance with the pipe manufacturer's published instructions. All pipe shall be installed by experienced, skilled workmen. Pipe shall be laid with straight and smooth lines and to the grades indicated on the plans, with all joints perfectly fitted. Changes in alignment or grade without fittings shall be made uniformly with several joints, with deflection at joint not to exceed the recommendations of the pipe manufacturer.

- E. Backfilling - After the pipe has been satisfactorily installed, the trench shall be backfilled with approved material free from large stones or clods in 6" layers, loose measurement and shall be thoroughly tamped and compacted with a rapid hitting mechanical tamper capable of exerting at least 185 lbs. /square foot of tamping area per blow. Other mechanical equipment may be used if approved by the Engineer. The backfill material shall be moistened when necessary, in the opinion of the Engineer, to obtain maximum compaction. Water settling or puddling shall not be permitted. The backfilling shall be done on each side of the pipe

simultaneously to prevent possible displacement of the pipe. Any material not suitable for use in backfilling in the opinion of the Engineer shall be removed and suitable material hauled in at the expense of the Contractor. After backfilling has been completed, the Contractor shall thoroughly clean the street of all dust and dirt by brooming and/or washing with water. Backfill within State Highway rights-of-way shall conform to NCDOT specifications. In trenches within highway right-of-way, backfill shall be mechanically tamped and compacted in 6" layers for full depth of trench.

- F. Water Main Crossing Sewer - Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least eighteen inches (18") above the top of the sewer. If local conditions prevent an 18" vertical separation, then both the water main and sewer main shall be constructed of ductile iron pipe materials and with joints that are equivalent to water main standards for a distance of ten feet (10') on each side of the crossing. Both the water main and the sewer line shall be pressure tested to assure water tightness prior to backfilling.

Whenever it is necessary for a water main to cross under a sewer, both shall be constructed of ductile iron pipe materials and with joints equivalent to water main standards for a distance of ten feet (10') on each side of the crossing. A section of water main pipe shall be centered at the crossing. Both the water main and sewer line shall be pressure tested to assure water tightness prior to backfilling.

- G. Installation of Hydrants and Valves - Hydrants shall be set plumb as indicated on the plan with the pumper connection 18" above grade. Hydrants shall be set on a slab of concrete 15" square x 4" thick. The back of the hydrant, opposite the pipe connection, shall be firmly blocked against the vertical face of the trench with poured-in-place concrete to prevent the hydrant from blowing of the line and, in addition, bridle rods and rod collars shall be used (see details "Typical Pipe Tie Rods). Bridle rods and collars shall not be less than 5/8" diameter stock and shall be protected by a coat of bituminous paint. A minimum of 7 cubic feet of stone shall be placed around the hydrant base to insure drainage. The backfill around hydrants shall be thoroughly compacted to grade line. Hydrants and valves shall have the interior cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the hydrant or valve shall be inspected in both the open and closed position to see that all parts are in working condition. Normal hydrant installations shall be within and as near as possible to the right-of-way. Normal valve installation for hydrants will be no greater than three feet (3') from the main line.

H. Valve Box Installation - Valve boxes shall be installed on each valve. The bell of the valve box shall completely enclose the valve operating nut and shall be seated on tamped backfill and shall not touch the valve assembly. When valve boxes are located in pavement, the box shall be adjusted to finished street grade by a method approved by the Engineer. When valves are located out of pavement, the boxes shall be adjusted to finish grade by a method approved by the Engineer, and a concrete block two feet (2') square and six inches (6") thick shall be poured around the box one-half inch ( $\frac{1}{2}$ ") from the top. Normal valve box installations shall be one inch (1") below edge of pavement.

I. Service Taps - All service taps will be done according to Town of Green Level specifications as detailed in the attachment to this section. Any old services being reconnected will be brought up to the Towns specifications which includes, but is not limited to, the replacement of the service saddle, service line with K copper tubing, corporation stop, meter stop, yoke, dual check valve, expansion wheel, meter box, or gate valve with riser (for lines larger than 1").

Service taps will have to be made by boring from main line to the existing meter. Any disturbed pavement, curbs, sidewalks, etc., will be restored by the Contractor. Open cuts will only be allowed on an individual basis upon approval of Town Engineer.

J. Hydrostatic Pressure Testing of Water Mains - Upon completion of water mains, the Contractor shall hydrostatically test between each main line valve. The Contractor shall furnish a suitable test pump, measuring device, materials, labor, equipment, etc., to perform the test to the satisfaction of the Engineer.

The line shall be filled slowly, with care being taken to insure complete removal of air from the line. The contractor shall install, at his expense, any corporation stops which may be required for this purpose. After the line has been filled, each portion between valves shall be hydrostatically tested to 150 psi and maintained for a period of three (3) hours. Do not test against closed valves at pressures higher than the allowable seating pressures for individual valves. Leakage shall not exceed three (3) gallons per inch of diameter per mile of pipe. Any visible leakage shall be repaired to a water-tight condition. Defective materials disclosed by the test shall be replaced and the test repeated. The cost of all testing shall be included in the unit price per foot of the pipe. Care will be taken to maintain the pipe in a reasonable sanitary condition during installation.



- K. Disinfecting of Water Main - Before being chlorinated, the entire line shall be thoroughly flushed at a rate to produce a minimum flow of 2½' per second in all parts of the pipe, to remove mud and other foreign materials. The flushing shall be done after the pressure tests on the line are made. If necessary, the contractor shall furnish, at his expense, any tap necessary to produce the proper flow for flushing.

The line shall be chlorinated in accordance with AWWA standard C 601-54, except as may be specified otherwise. Chlorine may be applied by the following methods: Liquid Chlorine Gas-Water Mixture, Direct Chlorine Gas Feed, or Calcium Hypochlorite and Water Mixture.

The chlorinating agent shall be applied at the beginning of the section adjacent to the feeder connection and shall be injected through a corporation cock, hydrant or other connection insuring treatment of the entire line.

Water shall be fed slowly into the new line with chlorine applied in amounts to produce a dosage of 50 PPM. Mains previously filled shall be treated to a concentrated dosage at intervals along the line and retained for a period of twenty-four (24) hours or more. A residual of not less than 10 PPM shall be produced in all parts of the line.

During the chlorinating process all valves and accessories shall be operated by the Contractor. After chlorination the water shall be flushed from the line at it's extremities until the replacement water test are equal chemically and bacteriologically to those of the permanent sources of supply. It shall be the responsibility of the Contractor to collect the samples and to have the test conducted by the approved laboratory, and to provide a certificate of same.

### III. METHOD OF MEASUREMENT

- A. D.I. Pipe - Pipe will be measured from the bell or connection at the end of the line, such measurements to be made through all intermediate valves and fittings. Where changes in size or direction occur, measurement shall be to the center of the connecting fitting. In the case of hydrant branches, measurement shall be from the center of the main to the center of the hydrant barrel. Such measurement shall include the total linear feet of pipe installed, complete, in place, and accepted, including the furnishing of labor, tools, materials, and equipment necessary for benching, laying pipe, jointing, testing, sterilization, backfilling, and all other necessary incidentals.

- B. Valves - Valves shall be counted by unit, complete in place and accepted, including tapping valve and boxes.
  - 1. Ductile Iron Fittings - The total number of installed fittings twelve inches (12") and smaller will be counted by unit, complete in place and accepted;
- C. Hydrants - Hydrants shall be counted by unit, when complete in place and accepted.
- D. Service Taps - Taps will be counted by unit, complete in place and accepted, including connection of old services and new installations, and restoration of grass, pavement, curb and gutter and sidewalk, etc.

#### IV. BASIS OF PAYMENT

Payment will be made for all items based on the unit and lump sum prices stated in the proposal and measured as previously described. The prices stated in the proposal shall cover all work required to properly install the water mains complete with all necessary appurtenances in accordance with the plans and specifications.

EFFECTIVE DATE OF SPECIFICATION: September 1, 2014