

**STANDARD SPECIFICATIONS FOR
CONSTRUCTING WATER DISTRIBUTION FACILITIES**

DIVISION III – CONSTRUCTION SPECIFICATIONS

**SECTION 1
GENERAL SPECIFICATIONS FOR WATER MAINS**

1.01 SCOPE

These general and detailed specifications form a part of the Contract documents and shall govern the handling and installation of water piping, valves, hydrants and accessories described herein, and as shown on the accompanying plans. Existing water distribution facilities are owned and operated by Daphne Utilities, hereinafter referred to as “Owner”. The construction methods employed in the placement of the water main and appurtenances shall be in accordance with current codes, practices and specifications of the Owner.

1.02 WORK INCLUDED

All labor, equipment, and material necessary to complete the work as stipulated herein. The Contractor shall clear and grub as necessary, remove as much of the pavement as may be necessary; excavate the trenches and pits to the required dimensions; excavate the bell holes; sheet, brace and support the adjoining ground or structures where necessary; construct and maintain all bridges required for traffic control; handle all drainage or groundwater; guard the site, unload, haul, distribute, and lay the pipe fittings and accessories; rearrange the branch connections to transmission mains, or rearrange other conduits, ducts or pipes where necessary; connect new mains to existing mains; connect existing services to new mains; replace all damaged drains, mains or other structures; backfill the trench; restore the roadway surface; remove surplus excavated material; clean the site of the work; chlorinate the completed pipeline; have samples checked and approved for bacteriological analysis by the State Board of Health or other approved regulatory agency, perform hydrostatic testing and flushing the completed pipeline; and maintain the street or other surface over the trenches.

1.03 SCHEDULE OF OPERATIONS

The Contractor shall prepare and submit to the Owner/Engineer for approval by the Owner/Engineer, prior to beginning construction, a schedule of his proposed operations outlining his sequence of pipe installation, connections to existing mains and placement of new water mains in service.

1.04 MATERIALS

- A. Ductile Iron Pipe: Ductile iron pipe for water lines shall meet requirements of AWWA Specification C151 with mechanical joint or push-on joint unless specifically shown otherwise on the plans. Working pressure shall be a minimum of 150 psi.

The interior of all pipe shall be cement-mortar lined as specified in AWWA Specification C104 and the exterior shall receive an approved bituminous coating. All gaskets, bolts and lubricants shall be furnished.

Ductile iron pipe shall be centrifugally cast with minimum wall thickness in accordance with AWWA C151, latest revision, except where shown otherwise on the project plans or in the proposal.

Unless otherwise indicated by soil testing, or as directed by the Owner or the Engineer, polyethylene encasement shall be installed on all ductile iron pipe and appurtenances at all locations and shall conform to AWWA C105, latest revision, "Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids." Cost for any soil testing by an independent laboratory to determine soil characteristics shall be paid for by the Contractor. Refer to "Polyethylene Sheath" included herein for additional details.

If it is necessary to cut ductile iron pipe, in no case shall it be cut by burning, but shall be cut by saw, cutter, abrasive wheel or other approved means.

The pressure rating, metal thickness, net weight of pipe without lining, length of pipe, name of manufacturer and letter "DI" shall be clearly marked on each length of pipe. There is a preference for domestic pipe.

1. Flexible Joint Ductile Iron Pipe: Flexible joint pipe shall meet the requirements of AWWA Specification C151 and may be of the bolted or boltless type suitable for 150 psi working pressure. If bolted type pipe is used, all bolts and nuts shall be Corten Steel. The interior shall be cement-mortar lined as specified in AWWA Specification C104. The exterior of all pipe and fittings shall receive an approved bituminous coating, except the ball and machined surfaces, which shall receive a protective coating as recommended by the manufacturer. All ball joint pipe shall be assembled, lubricated and installed in strict conformance with the pipe manufacturer's recommendations.
2. Ductile Iron Fittings: Ductile iron shall be mechanical joint except where noted otherwise on the plans. Fittings shall be suitable for use at 250 psi working pressure and shall conform to AWWA Specification C110. Fittings shall be cement-mortar lined and the exterior coated with an approved bituminous coating, in accordance with AWWA Specification C104. At the Contractor's option, compact ductile iron fittings meeting AWWA C153 may be furnished.
3. Positive Restrained Joint Pipe and Fittings: Positive restrained joint pipe and fittings may be used in lieu of friction restrained fittings. Positive restrained joint pipe and fittings shall be either mechanical joint or push-on joint and shall be manufacturer's standard restrained joint. The joint shall achieve restraint by means of a positive factory made, metal-to-metal contact and shall allow full deflection of the joint when made up.

4. Friction Restrained Fittings: The following type friction restrained fittings may be used in lieu of positive restraint:
 - a. Locked mechanical joint retainer glands of adequate strength to prevent movement may be used to supplement concrete backing. Locked mechanical joint retainer glands shall be ductile iron retainer glands equipped with hardened cupped end set screws of a type, which insure proper actuating of the restrained devices. Set Screw type shall be used on ductile iron pipe.
 - b. Friction mechanical joint restraint may be used in lieu of locked mechanical joint retainer glands. Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imports multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Restraint shall be epoxy coated. Joint restraint shall be provided by an approved Manufacturer listed in the Appendix or Owner approved equal.
 - c. A gasket system utilizing stainless steel locking segments molded into the gasket may be used in lieu of mechanical joint retainer glands to achieve joint restraint for ductile iron push-on pipe in sizes of 4 inches through 12 inches. System shall be provided by an approved Manufacturer listed in the Appendix or Owner approved equal.
5. Polyethylene Sheath: Unless otherwise indicated by soil testing, polyethylene sheath shall be installed on all ductile iron pipe and appurtenances and shall conform to AWWA C105, latest revision, "Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids" and shall be either 4 mil HDCL or 8 mil LLD. The installation shall be method A. Backfill shall be as specified elsewhere in these specifications.

Polyethylene encasement shall not be exposed to sunlight longer than 7 days.

Contractor shall furnish written certification, accompanied by a copy of test results, that the pipe and pipe material has been sampled, tested, and inspected as required. These certifications and test results shall be submitted, in five complete copies, to the Owner/Engineer for review and the pipe manufacturer shall retain duplicate copies of all test results in permanent files to be made available upon request.

Care shall be taken not to damage the polyethylene sheath during the backfill operation. Any polyethylene sheath, which is damaged, shall be replaced or repaired by the Contractor at no additional expense to the Owner.

B. PVC Plastic Pipe for Water Lines:

1. Polyvinyl chloride (PVC) plastic pipe in sizes 4 inch and greater in diameter shall conform to the requirements of AWWA C900, "Standard for Pressure Pipe with Cast Iron Pipe Outside Diameter." Pipe shall be a minimum Class 150 (UL 235) with a Standard Dimension Ratio of 18 or heavier. Pipe joints shall be integral bell and spigot type with rubber ring sealing gasket. Lubricant for making joints shall be non-toxic, and shall be as recommended by the pipe manufacturer. The pipe bell shall be designed to be at least as strong as the pipe wall. Standard lengths shall be 20 feet except that 15 percent of total footage for a particular project may be random lengths of not less than 10 feet each. Each piece of pipe shall be tested by the manufacturer to 600 psi for a minimum of 5 seconds. The bell shall be tested with the pipe. Ductile iron fittings conforming to the requirements of these specifications shall be used with PVC pipe.

Contractor shall furnish written certification, accompanied by a copy of test results, that the pipe and pipe material has been sampled, tested, and inspected as required in AWWA C900. These certifications and test results shall be submitted, in five (5) complete copies, to the Engineer for review and the pipe manufacturer shall retain duplicate copies of all test results in permanent files to be made available upon request.

The tests and certifications shall be of such frequency as to be representative of the entire Project.

2. Polyvinyl chloride (PVC) plastic pipe for diameter sizes less than 4-inch shall conform to the requirements of ASTM D-2241 and shall be minimum SDR 21 Class 200 manufactured from a Type I, Grade I polyvinyl chloride compound with a cell classification of 12454 per ASTM D1784. Pipe joints shall be integral bell and spigot type with rubber ring sealing gasket. Lubricant for making joints shall be non-toxic, and shall be as recommended by the pipe manufacturer. The pipe bell shall be designed to be at least as strong as the pipe wall. Bells shall be manufactured so that o-rings gaskets are square to the barrel of the pipe. Standard lengths shall be 20 feet except that 15 percent of total footage for a particular project may be random lengths of not less than 10 feet each. Ductile iron fittings conforming to the requirements of these specifications shall be used with PVC pipe. Fittings shall be mechanical joint and shall be provided with a transition gasket specifically designed to accommodate the outside diameter of the pipe.

For all PVC pipe, the Contractor shall furnish written certification, accompanied by a copy of test results, that the pipe and pipe material has been sampled, tested and inspected as required in ASTM D 2241. These certifications and test results shall be submitted, in five complete copies, to the Owner/Engineer for review and the pipe manufacturer shall retain duplicate copies of all test results in permanent files to be made available upon request. The tests and certifications shall be of such frequency as to be representative of the entire Project.

3. Markings of PVC Piping: Marking on the pipe shall include the following, spaced at intervals of not more than 5 feet:
 - a. Nominal pipe size and OD bore
 - b. Type of plastic material
 - c. Dimension Ratio
 - d. Pressure Class
 - e. Manufacturer's name or trademark
 - f. National Sanitation Foundation (NSF) seal of approval for drinking water

4. Tracer Wire for PVC Pipe: All PVC pipe shall be marked using a tracer wire buried 6 inches above the top of the pipe. The tracer wire shall be a 12 gauge except in directional drill applications wire shall be 8 gauge insulated copper wire and shall have blue coating. The pipe trench shall be backfilled to approximately 6 inches over the top of the pipe then the tracer wire shall be placed over the top of the pipe. Backfill shall be carefully placed to a depth of 6 inches by hand to assure that the wire is secured in place over the pipe. It is the intent to provide a means to locate PVC pipe using standard pipe locating equipment. The wire shall be carried up through every valve boxes and terminated at least 2 feet above the ground line to permit connecting of locating equipment. Excess wire at valve boxes shall be neatly rolled and stored in the valve box for easy accessibility.

If valve and valve boxes are not located within 500 feet, a valve box shall be installed for the purpose stated herein.

5. Marking Tape for PVC Pipe: All PVC pipe shall be marked using a nonmetallic tape buried at least 15 inches above the top of the pipe. Water mains shall be marked with blue tape. Tape shall be 3 inches wide minimum made of an inert plastic film resistant to alkalis, acids or other destructive chemical components likely to be encountered in soils. After the tracer wire has been placed, the pipe trench shall be backfilled to approximately 15 inches over the top of the pipe then the nonmetallic tape shall be placed flat over the top of pipe. Backfill shall be carefully placed to a depth of six inches by hand to assure that the tape is secured in place over the pipe. It is the intent to provide a visible marker in the event of excavation near a water line.
6. Fittings for PVC Pipe: Fittings for PVC pipe shall be ductile iron fittings as specified for ductile iron pipe.
7. Restrained Joint Fittings: Where restrained joint fittings are required with PVC water pipe mechanical joint restraint fittings made specifically for PVC pipe connecting to ductile iron fittings are acceptable. Where PVC pipe is connecting to a PVC fitting, proper fittings are to be provided. Restraints shall be epoxy coated. Restraints shall be provided by an approved Manufacturer listed in the Appendix or Owner approved equal. If requested, mill test report shall be provided.

8. All water PVC pipe shall be blue in color. White pipe may be substituted provided a stripe, applied by the pipe manufacturer, further defined below is applied to the surface of the pipe 180 degrees from the normal pipe markings. The pipe shall be placed in the trench with the stripe visible from the top of the pipe trench. For pipe sizes four inches in diameter and smaller, a one inch wide continuous blue stripe shall be applied. For pipe diameters greater than four inches, a three-inch wide continuous blue solid stripe shall be applied.

C. High Density Polyethylene (HDPE):

Only when prior approval is granted by the Owner HDPE may be used for potable water installations. The Owner reserves the right, in their sole opinion, to refuse the use of any material within their system. Pipe shall be made from high density polyethylene resin compound which meets ASTM D3350, PE 4710, SDR 11 DIPS OD, unless pipe size is less than three inches than IPS may be utilized. Pipe shall be on the Owner's list of materials and approved manufacturers. Dimensions and workmanship shall conform to ASTM F714.

Fittings for HDPE pipe shall be made of ductile iron conforming to the section above for ductile iron. Adapters or transition coupling shall be utilized to transition between HDPE and DI. The adapter shall be mechanical joint, threaded, or flanged depending on the application and suitable for connection to the DI Fitting.

Polyethylene pipe shall be the nominal pipe size and dimension ratio shown on the plans, or in the proposal. Unless field conditions dictate a heavier wall thickness, SDR 11 shall be used. Installation shall be in accordance with ASTM D2321 or as modified herein. For 4 inches in diameter and larger, pipe shall conform to DIPS. For 2 inches in diameter, pipe shall conform to SDR 7, CTS. Pipe shall be have a manufacturer applied blue stripe or be solid blue for water application. Solid black pipe shall not be permitted.

Shipping lengths of pipe shall be assembled into one continuous length at the job site by thermal butt-fusion. Fusion machine and fusion machine operator shall be approved by pipe manufacturer. The resultant joint shall be as strong as the intervening lengths.

Joining of pipe and installation of outlets shall be in accordance with the pipe manufacturer's written recommendations. The pipe manufacturer shall provide the services of a trained representative to instruct the Contractor's forces in the proper techniques for joining of pipe and the installation of outlets or other items.

Contractors shall provide written certification from the manufacturer that the personnel performing the joint welding has received proper training for the welding of the manufacturer's piping material. Data logger shall be used for all machine welding of pipe and data from logger provided to Owner/Engineer. Hand written data from the logger will shall not be accepted.

Installation of polyethylene pipe in areas where flotation is probable whether on land or a subaqueous location installation shall conform with manufacturer's recommendation.

Polyethylene pipe shall not be crimped in any way during construction.

Fabricated polyethylene bends shall be manufactured by pipe manufacturer. SDR of fabricated polyethylene bends shall be equal to SDR of connecting pipe.

Deflection of polyethylene pipe after installation and backfilling shall not exceed 5 percent.

Tracer wire and marker in accordance with PVC pipe section shall be provided for HDPE pipe.

D. Fusible PVC: Fusible PVC may be submitted for consideration by the Owner in areas of transmission mains for directional drills provided the material meets all standards for C 900 PVC and is constructed in accordance with all manufacturer.

E. Gate Valves:

1. Resilient Seated Gate Valves: All valves shall be non-rising stem for underground directional burial service and shall close when the operating nut is turned in clockwise rotation. Valves shall be in accordance with and meet the requirements of AWWA C515. O-ring seals shall be provided and the valve shall be a compression resilient seated gate valve. Disc shall be SBR coated. Valve body shall be fusion-epoxy bonded inside and out. Valves shall be furnished complete with necessary gaskets, stainless steel bolts and nuts as needed for mechanical joint ends.

Mechanical joints and accessories shall comply with the latest published AWWA C111. Gaskets shall be of best grade quality of a type suitable for potable water service.

a. Valves (12 Inches and Smaller): Each valve shall have mechanical joint bell ends. Valve shall be installed with the operating stem in the vertical position. Valve stem shall be furnished with 2 inch square water works nut.

b. Valves (24 Inches and Larger): Ductile iron resilient seated gate valves produced by manufacturers on the Daphne Utilities approved list, meeting or exceeding all of the requirements and recommendations of AWWA C515, may be used on valves twenty four inches and larger in diameter provided they meet the additional criteria listed in this section.

F. Butterfly Valves:

1. General: Butterfly valves shall only be installed with prior approval by the Owner. These valves are not intended for installation on main distribution lines or service lines. If approved by the Owner, butterfly valves shall be rubber

seated for 150 psi minimum working pressure and line velocities up to 16 fps. The bodies of all valves shall be cast iron construction of ASTM A126, Class B, or ASTM A48, Class 40. Valves shall be on Daphne Utilities' list of materials and approved manufacturers. Underground valves shall be provided with operators with noncorrosion type of construction for input shaft, seals, bushings and bolting. Operators shall be totally enclosed and permanently lubricated for direct burial of the valves and frequent submergence in water up to 20 feet of head. The operators shall open the valves on a counterclockwise rotation of the nut wrench which shall be AWWA 2 inch square cast iron. The valve ends shall be mechanical joint in accordance with AWWA C111, except where indicated otherwise on the plans or in the proposal.

Except as modified herein, the butterfly valves and operators shall meet, or exceed, the applicable requirements of the "Specifications for Rubber Seated Butterfly Valves," AWWA C504, for Class 150B.

2. **Stuffing Boxes:** All butterfly valves shall be provided with O-ring seals, nonadjustable stuffing boxes, and shall be self-sealing or self-adjusting type, which can be replaced without the necessity of removing the valve or the valve shaft from its pipeline location.
 3. **Valve Shafts:** The valve will be installed with the valve shaft in a horizontal position. The shaft shall be of 18-8 stainless steel, Type 304. A machined, one piece, high tensile steel hexagonal shaft fitting on a matching opening through the valve disc, completely sealed from the pipeline contents with Type 304 stainless steel bushings, will be acceptable. Valve disc shall be keyed or pinned securely to the valve shaft. Pins, wedges and accessories shall be 18-8 stainless steel, Type 304 or 316.
 4. **Valve Discs:** The material for valve discs may be ductile iron ASTM A536 or ASTM A48, Class 40, cast iron.
 5. **Valve Seats:** The mating seat surfaces shall be 18-8 stainless steel on natural rubber.
- G. **Tapping Valves and Sleeves:** Tapping valves shall meet the requirements set forth for gate valves as described in these Specifications and shall be on the Daphne Utilities list of materials and approved manufacturers. Tapping sleeves shall be stainless steel with carbon steel flanges. Tapping sleeves being 12" x 12" and smaller shall have a minimum working pressure of 200 psi and larger sleeves shall have a working pressure of 150 psi. All tapping sleeves shall be stainless steel with full wraps. Tapping valves and sleeves are to be used for making connections to existing mains. Daphne Utilities shall be notified forty-eight (48) hours prior to any tapping of an existing water main.
- H. **Fire Hydrants:**
1. All hydrant manufacturers shall be on Daphne Utilities' list of approved materials and manufacturers, or an Owner/Engineer approved equal. All

hydrants shall meet or exceed AWWA C-502, latest revision, shall be the traffic-model design, and shall be rated at 200 psi working pressure, 400 psi hydrostatic test pressure. Size of hydrant valve shall be 5¼ inches minimum and of a compression type that closes with the pressure. Hydrants shall be located at a maximum of every 500 feet. All operating parts, including the drain ring, operating nut, hold-down nut, upper valve plate, seat ring, drain lever, and nozzles shall be made of bronze, in compliance with AWWA C-502, Section 2.2.501.

- a. The bonnet assembly shall provide for an oil or grease reservoir and lubricating system that lubricates all stem threads and bearing surfaces each time the hydrant is operated. The reservoir shall be completely sealed from the waterway and all external contaminants by two (2) O-ring stem seals. Hydrants shall be factory prefilled with a lubricant suitable for a working range of -60 degrees F to +150 degrees F and shall comply with USDA Safety and Health Regulations. Material Safety Data Sheets shall be made available if requested.
- b. Hydrants shall be provided with two (2) 2½ "bronze hose nozzles and one (1) 4½ "bronze pumper nozzle. All nozzle threads shall be National Standard Fire Hose Coupling thread. Nozzle caps shall be cast or ductile iron and provided with gaskets and chains.
- c. Hydrants shall have a 6" mechanical joint inlet, less accessories, with the interior of the hydrant shoe fully fusion bonded epoxy coated with at least 4 mils in accordance with AWWA C-550 and the exterior of the hydrant shoe coated with at least 8 mils of asphaltic coating or epoxy coated to the same specification as the interior.
- d. The exterior of the lower barrel shall be coated with 4 to 8 mils of asphaltic coating in compliance with ANSI/AWWA C110/A21.10. The interior of the lower barrel shall be seal coated in accordance with the requirements of Seal Coating in ANSI/AWWA C104/A21.4 to a thickness of no less than 4 mils.
- e. Flanges of the hydrant lower barrel shall be integral cast with the barrel, screwed on, or of a connection type approved by the Owner.
- f. The shoe of the hydrant shall be made of ductile iron. The lower barrel shall be made of cast iron only. Shoes shall have the letters "DI" or "Ductile" cast, stamped, or stenciled (painted) on them.
- g. Hydrants shall utilize three-quarter inch (¾") bolts meeting ASTM A-307 Grade B, zinc coated by the hot dip process, in accordance with the requirements of Class C of Specification A 153, to secure the lower barrel to the hydrant shoe or Type 316 Stainless Steel bolts must be used if the bolts are less than ¾" in diameter.

- h. Hydrants shall be of the three-way design with the upper barrel capable of full 360-degree rotation by any degree.
- i. Gate valves shall be located a maximum of two (2) feet from hydrants.
- j. Hydrants shall have a 1½ “ pentagon, one piece operating nut and open left. Protection from weather shall be accomplished by one or both of the following methods:
 - i. The weather cap shall be an integral part of the fire hydrant operating nut.
 - ii. An exterior rubber seal to prevent water entry and a redundant interior rubber seal for additional protection. (2 separate seals)
- k. Hydrants shall allow for easy installation of barrels or extensions at the hydrant shoe or groundline without having to shut off the water main.
- l. Design, materials and workmanship shall be similar and equal to the latest stock pattern produced by the manufacturer and that hydrant shall be of the same general type as the hydrants in the existing system.
- m. Hydrants shall be furnished for a bury of 3’ 6” except where otherwise required in the field and/or called for by the plans. Hydrant shall be equipped with traffic break away feature.
- n. The inside diameter of hydrant barrel shall be 6.125 inches or greater. Hydrants with barrels less than 7 inches shall meet AWWA C-502 minimum wall thickness requirements for a 7-inch inside diameter barrel.
- o. Friction losses through the hydrant shall not exceed 7.6 psi at 1500 gpm or 3.0 psi at 1000 gpm through the pumper nozzle, and 1.25 psi at 500 gpm through two (2) hose nozzles when tested simultaneously as outlined by AWWA C-502. Flow test results indicating the friction losses through the hydrant shall not be older than 12 months from the date said results are requested by Daphne Utilities. Flow tests must be conducted by an independent lab. Each manufacturer must provide written certification, if requested, that their hydrants meet all of the Daphne Utilities’ hydrant specifications.
- p. Hydrants shall be painted in accordance with the requirements of AWWA C-502. The outside of the hydrant top section shall receive one coat of shop-applied primer (Federal Specifications TT-P-86-Type IV, TT-P-636, or equal). After hydrant is installed, it shall be cleaned and primer applied to scraped or abraded areas. Hydrants shall receive an intermediate coat and final coat of paint meeting Federal Specifications

TT-E-489 applied at a dry thickness of 2 mils per coat. Hydrant barrel color for hydrants shall be red.

- q. Complete drawings standards and certificate of compliance must be furnished when requested. Should any accepted fire hydrant change design or material of present accepted fire hydrant, Daphne Utilities must be notified in writing prior to the change and the fire hydrant must be resubmitted for approval.
 - r. All hydrants shall have a 10-year warranty, a copy of which is to be made available on demand, identified from the cast date on the upper barrel of the hydrant.
 - s. Hydrants shall be shipped on a trailer or truck that will allow the unloading of the hydrants from both sides of the trailer or truck with a forklift. Any hydrants delivered in an enclosed trailer or truck that does not allow access to the hydrants from both sides with a forklift will be immediately rejected and not unloaded.
 - t. Hydrants will be visually inspected for compliance with these specifications upon arrival. Hydrants that clearly do not meet these specifications upon delivery will not be accepted and will be returned to the shipper.
 - u. If it is discovered that the hydrants accepted by Daphne Utilities do not meet these specifications, the provider of said hydrants will be asked to replace the noncompliant hydrants without additional payment.
- I. Air Release Valves: Air release valves, when required, shall be located at high points in the line and shall be properly sized for the installation. Air release valves shall be combination style with features of both an air release valve and air & vacuum valve. Flanged fittings shall comply with AWWA C110 and have ANSI B16.1, Class 125, flanges. Models shall be stainless steel. Owner will give consideration to outer material provided interior components are stainless steel. Final decision on material will be in the sole opinion of the Owner based on field conditions and maintenance.
- J. Valve Boxes: Cast iron valve boxes with concrete collars shall be provided for all valves installed vertically and shall consist of a base covering the operating nut and head of the valve, a vertical shaft of at least 5¼ inches in diameter, and a top section extending to a point even with the finished ground surface, provided with a cast iron cover marked "Water" and placed concentrically over the operating nut.
- K. Valve Stem Extensions: All valves in which the operating nut is greater than 3 feet below the normal ground or road surface shall be provided with extension stems to bring the operating nut to within 3 feet of the finished grade. The extension stem shall be provided with a 2 inch square operating nut on top and a coupling to connect the extension to the operating nut of the valve. A stem guide shall be provided to keep the valve stem extensions concentric with the valve box. Extension stems shall be of the

same diameter as the valve stem unless otherwise specified and shall be on Daphne Utilities' list of materials and approved manufacturers.

- L. Anchoring Fittings: Ductile iron anchoring fittings shall meet the requirements for ductile iron fittings, and shall be "Plain End" mechanical joint fittings with integral follower gland.
- M. Rustproof Rods for Anchorage: The threaded rods for anchorage shall be mild steel conforming to ASTM A36. The rods shall be brushed clean of all rust and foreign matter and completely coated with "No-Oxide" or approved equal before backfilling.
- N. Formed Concrete: The minimum compressive strength required at 28 days is 3,000 pounds per square inch. Field specimens and laboratory tests shall be made in accordance with the standards of the American Society of Testing Materials. The minimum amount of water shall be used to produce a workable mix and shall not exceed 6 U.S. gallons per sack of cement.
- O. Crushed Slag or Crushed Stone: See section entitled "Erosion Control", paragraph entitled "Crushed Slag or Crushed Stone".
- P. Water Meters (5/8" x 3/4" through 2"): Water meters will meet or exceed the requirements of AWWA Specification C700, latest revision, and an affidavit of compliance and certificate of testing for accuracy will be furnished. Meters 5/8" x 3/4" through 1" will be furnished with coupling nuts and tailpieces meeting the requirements of the above named specification. Meters 1 1/2" and 2" will be furnished with flanged (two bolt) with drop in gaskets ends meeting the requirements of the above named specification. Meters may be either nutating disc or oscillating piston. Frost protection will not be required. Registers shall be touch read with straight reading in U.S. gallons per thousand. Serial number will be imprinted on the case as well as on the register box lid. Materials used for meters shall be as specified in AWWA Specification C700.
 - 1. Copper pipe, Rigid type with compression fittings, shall be used on 1" and 2" meters. Ductile iron pipe with ductile iron mechanical joint fittings shall be used on 3" and 4" meters.
 - 2. Meters that are 1 1/2 Inches and larger in size shall have a bypass. The meter and bypass shall be installed within a below ground concrete or fiberglass vault.
 - 3. Vaults shall have a minimum of three (3) feet of clearance around the meter assembly which shall include the piping, bypass, and necessary fittings. Also, the vault shall not exceed a depth of three (3) feet below grade.
 - 4. All vaults and vault hatches shall be traffic rated and shall be aluminum, stainless steel, or fiberglass with a cast iron reader door. Vaults shall also have a drain if necessary.
- Q. Back Flow Preventors: Backflow preventors shall be double check and in accordance with Daphne Utilities policy.

- R. Meter Boxes: Water meter boxes will be plastic with iron reader lids or concrete with cast iron lids in traffic areas. Boxes will be sufficient to size to house the meter and curb stop. Residential meter boxes for meters less than 1 ½ Inches will be provided by Daphne Utilities. Commercial meter boxes will not be provided by Daphne Utilities. Commercial meter boxes shall either be a lightweight concrete composite or fiberglass.
- S. Service Saddles: Service saddles shall be the double strap stainless steel neoprene gasket to fit PVC pipe and provided by an approved Manufacturer listed in the Appendix or Owner approved equal.
- T. Corporation Stops: Corporation stops where required, shall have standard thread on inlet as specified by AWWA C800, and copper tubing size O.D. outlet suitable for service piping. Corporation stops may be tapped directly into ductile iron water mains. A saddle shall be required for PVC pipe connection. All corporation stops shall be provided by an approved Manufacturer listed in the Appendix or Owner approved equal.
- U. Curb Stops: This section shall be amended to include the following: Curb stops, where required, shall be suitable for service piping and shall be provided by an Approved Manufacturer or Owner approved equal.
- V. Service Tubing: Service tubing shall be continuous from corporation stop to service connection conforming to applicable requirements of ASTM B88, Type K, Annealed. Copper service pipe shall be seamless copper water tube, ASTM B88, Type K. Only compression fittings shall be permitted. No solvent weld fittings or material other than Type K copper shall be permitted.
- W. Pressure Regulating/Sustaining Valves: Shall be provided by an approved Manufacturer listed in the Appendix, or Owner approved equal. Pressure settings shall be as approved by Daphne Utilities. Valve shall include open/close limit switch. Provide reinforced concrete vault with removal top section and cast iron access cover. Valve setting shall include sleeve to facilitate valve removal, 3/8" NPT taps (plugged) each side of pressure regulatory/sustaining valve and isolation valves.
- X. Fire Hydrant Location Markers: At each fire hydrant location, blue reflectors shall be installed in the street to mark the location of the fire hydrant. The reflectors shall be Stimpsonite 2-Way Blue or Owner approved equal. One reflector shall be installed in the middle of the traffic lane closest to the hydrant. The reflector shall be located at a position where a line passing through it and the fire hydrant will be perpendicular to the centerline of the road. If the fire hydrant is located at an intersection, a reflector shall be placed in each of the two streets forming the intersection.

1.05 INSPECTION

- A. Of Material at Factory: All materials are subject to inspection and approval at the plant of the manufacturer.

All material shall meet the requirements specified and suppliers of pipe and fittings shall furnish, in triplicate, to the Owner, an affidavit stating that all pipe and fittings furnished under this Contract conforms to the requirements as set forth in these Specifications.

- B. Of Materials at Delivery Point: During the process of unloading, all pipe and accessories shall be inspected by the Contractor for loss or damage in transit.
- C. Field Inspection: All pipe and accessories shall be laid, jointed, tested, for defects and for leakage with pressure in the manner herein specified and in the presence of the Engineer or his authorized representative.
- D. Disposition of Defective Material: All material found during the progress of the Work to have flaws or other defects will be rejected and the Contractor shall promptly remove from the site of the Work such defective material.

1.06 HANDLING PIPE AND ACCESSORIES

- A. Care: Pipe, fittings, valves, hydrants, and other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at the site of the Project by the Contractor. They shall at all times be handled with care to avoid damage. In loading and unloading, they shall be lifted by hoists or slid, or rolled on skidways in such manner as to avoid shock. Under no circumstances shall they be dropped. Pipe handled on skidways must not be sided or rolled against pipe already on the ground.
- B. At Site of Work: In distributing the material at the site of the Work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
- C. Care of Pipe Coating: Pipe shall be handled in such manner that a minimum amount of damage to the coating will result. Damaged coating shall be repaired in accordance with the pipe manufacturer's recommendations.
- D. Bell Ends, How Faced: Pipe shall be placed on the site of the Work parallel with the trench alignment and with bell ends facing the direction in which the Work will proceed.
- E. Pipe Kept Clean: The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. Each pipe shall have a swab run through it until all foreign matter has been removed.
- F. Frost Protection: Valves and hydrants before installation shall be drained and stored in a manner that will protect them from damage by freezing.

1.07 REMOVING AND REPLACING PAVEMENT

See section entitled "Removing and Replacing Pavement".

1.08 ALIGNMENT AND GRADE

- A. General: All pipe shall be laid and maintained to the required lines and grades with fittings, valves, and hydrants at the required locations, with joints centered and spigots home, and with all valve and hydrant stems plumb.
- B. Protecting Underground and Surface Structures: Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, and other obstructions encountered in the progress of the Work shall be furnished by the Contractor at his own expense.
- C. Deviation with Engineer's Consent: No deviation shall be made from the required line or grade except with the written consent of the Engineer.
- D. Subsurface Explorations: Whenever necessary to determine the location of existing pipes, valves, or other underground structures, the Contractor shall examine all available records and shall make all explorations and excavations for such purpose. This investigation shall be made in advance of any pipe laying.
- E. Depth of Pipe Cover: All pipe shall be laid to the depth shown or described, measured from the proposed or established street grade or the surface of the permanent improvement to the top of the barrels of the pipe.

Pipes 16 inches and larger shall have minimum cover of 48 inches, and pipes smaller than 16 inches shall have minimum cover of 36 inches, except where otherwise noted on the plans. At street intersections or where the new pipelines cross existing or proposed underground lines at the approximate same depth as the new line, the cover shall be increased and the new line laid below the existing or proposed pipelines. Where the new pipeline crosses existing or proposed ditches, the top of the pipe shall be a minimum of 36 inches below the existing or proposed invert of ditch, whichever is lower, except where noted on the plans.

1.09 EXCAVATION AND PREPARATION OF TRENCH

- A. Description: The trench shall be dug to the alignment and depth required and only a minimum distance in advance of pipe laying. The trench shall be so drained that workmen may work therein efficiently. It is essential that the discharge of water pumped from the trench be led to natural drainage channels or storm drains and not discharged to sanitary sewers unless otherwise approved.
- B. Width: The trench width may vary with and depend upon the depth of trench and the nature of the excavated material encountered, but in any case shall be of ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly. The minimum width of unsheeted trench shall be 18 inches. For pipe 8 inches in diameter or larger, the minimum clear width of the trench, sheeted or unsheeted, at the top of the pipe, shall be the pipe outside diameter plus 12 inches. The maximum clear trench width sheet or unsheeted, at the top of the pipe, shall be the outside diameter plus 24 inches.

- C. Pipe Foundation in Good Soil: The trench, unless otherwise specified, shall have a flat bottom, conforming to the grade to which the pipe is to be laid. The pipe shall be laid upon sound soil cut true and even so that the barrel of the pipe will have a bearing for its full length.
- D. Correcting Faulty Grade: Any part of the trench excavated below grade shall be corrected with approved material, thoroughly compacted.
- E. Pipe Foundation in Poor Soil: See Section entitled "Backfilling".
- F. Bracing: In the event that the Contractor or his surety deems it necessary, desirable, or for other reasons to open sheet or close sheet the trenches, the sheeting shall be accomplished in such a manner that the pipe will be protected at all times. Such sheeting shall remain in place until the backfill is carried to a point at least 2 feet above the top of the pipe. The Contractor shall exercise every precaution in removing the sheeting in order to avoid damaging the pipe. Should there be evidence that the removal of sheeting would damage the pipe, the sheeting shall be left in place. The top of sheeting left in place shall be at least 12 inches below the finished ground. There will be no direct payment for this item.
- G. Care of Surface Material for Re-Use: If local condition permit their re-use, all surface material suitable for re-use in restoring the surface shall be kept separate from the general excavation material.
- H. Manner of Piling Excavated Material: All excavated material shall be piled in a manner that will not endanger the Work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clean or other satisfactory provisions made for street drainage. Also, storm drains shall be kept clear.
- I. Bell Holes Required: Bell holes of ample dimensions shall be dug in earth trenches at each joint to permit the jointing to be made properly.
- J. Trenching by Machine or by Hand: The use of trench-digging machinery will be permitted, except in places where operation of same will cause damage to trees, buildings, or existing structures above or below ground, in which case hand methods shall be employed.
- K. Barricades, Guards, and Safety Provisions: To protect persons from injury and to avoid property damage, adequate barricades, construction signs, warning devices, and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the trenched highway. Rules and regulations of the respective safety provisions shall be observed.
- L. Traffic and Utility Controls: Excavations for pipe laying operations shall be conducted in a manner to cause the least interruption to traffic. Where traffic must cross open trenches, the Contractor shall provide suitable bridges at street intersections and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire

or police call boxes, or other utility controls shall be left unobstructed and accessible during the construction period.

- M. Flow of Sewers and Drains Maintained: Adequate provisions shall be made for the flow of sewer, drains and water courses encountered during construction, and the structures which may have been disturbed shall be satisfactorily restored upon completion of the Work.
- N. Property Protection: Trees, fences, poles and all other property shall be protected unless their removal is authorized; and any property damaged shall be satisfactorily restored by the Contractor.
- O. Interruption of Water Service: No valve or other control on the existing system shall be operated for any purpose without approval of Daphne Utilities, and all consumers affected by such operation shall be notified at least 1 hour before the operation and advised of the probable time when the serviced will be restored.
- P. Thrust Restraint for Water Mains: Thrust restraint for water mains at bends shall be provided by concrete thrust blocks and mechanical joint restraint. Thrust blocks of concrete of a mix not leaner than one cement, two fine aggregate and four course aggregate, having a compressive strength of not less than 3,000 psi shall be installed. The blocking shall be poured against undisturbed earth.

Mechanical joint restraints shall be of adequate strength to prevent movement shall be used to supplement concrete blocking where noted. Mechanical joint restraint shall be provided by an approved Manufacturer listed in the Appendix or Owner approved equal. Assembly shall be designed for minimum pressure of 250 psi.

1.10 PIPE LAYING

- A. Manner of Handling Pipe and Accessories Into Trench: Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the Work. All pipe, fittings, valves, and accessories shall be carefully lowered into the trench, piece by piece, by means of derrick, ropes or other suitable tools or equipment, in such manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
- B. Pipe Kept Clean: All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying.
- C. Laying Pipe: After placing a length of pipe in the trench, the joint shall be held around the bottom of the spigot so that it will enter the bell as the pipe is shoved into position. Joint material shall meet regulations of agency having jurisdiction.

The spigot shall be centered in the bell, the pipe shoved into position, and brought into true alignment; it shall be secured there with earth carefully tamped under and on each side of it, except at the bell holes. Care shall be taken to prevent dirt from entering the joint space.

- D. Preventing Trench Water from Entering Pipe: Whenever pipe laying is stopped for the night or for any other cause, the end of the pipe shall be securely closed with a stopper to prevent the entrance of water, mud or other obstructing matter, and shall be secured in such manner as to prevent the end pipe from being dislodged by sliding or other movement of the backing.
- E. Cutting Pipe: Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe.
- F. Bell Ends to Face Direction of Laying: Pipe shall be laid with bell ends facing in the direction of laying. For lines on an appreciable slope, bells shall face upgrade.
- G. Permissible Deflection at Joint: Wherever necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions, to plumb stems, or where long radius curves are permitted, the degree of deflection shall be in accordance with the pipe manufacturer's recommendations.
- H. Railroad and Highway Crossing: When any railroad and/or highway is crossed, all precautionary construction measures required by the railroad and/or highway officials shall be followed.
- I. Unsuitable Conditions for Laying Pipe: No pipe shall be laid in water, or when the trench conditions or weather is unsuitable for such work. The Contractor shall remove any water that may be found or may accumulate in the trenches and shall perform all work necessary to keep them clear of water while the foundations are being laid, the masonry being constructed, or pipe laying is in progress. Such water removal shall be accomplished by means of a well point system or other approved means. Comprehensive plans for dewatering operation, if used, shall be submitted prior to installation. Unless otherwise stated, no extra payment will be made for dewatering.

1.11 JOINTING PIPE

Mechanical, push-on, or other type joints shall be installed in strict accordance with the recommendations of the joint manufacturer.

1.12 SETTING VALVES, VALVE BOXES, FITTINGS AND BLOW-OFFS

- A. General: Gate valves and pipe fittings shall be set and jointed to a new pipe in the manner specified for cleaning, laying and jointing pipe.
- B. Valve Boxes: Cast iron valve boxes shall be firmly supported and maintained, centered and plumb over the wrench nut of the gate valve, with box cover flush with the surface of the finished pavement or at such other level as may be directed.

- C. Back-Siphonage to be Prevented: Drainage branches or blow-offs shall not be connected to any sewer or submerged in any stream or be installed in any other manner that will permit back-siphonage into the distribution system.

1.13 SETTING HYDRANTS

- A. General Location: Hydrants shall be located in a manner to provide complete accessibility, and in such manner that the possibility of damage from vehicles or injury to pedestrians will be minimized in accordance with AWWA Manual M31, latest edition. Unless otherwise directed, the setting of any hydrant shall conform to the following.
 - 1. Location Re-Curb Lines: When placed behind curb, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 18 inches nor more than 30 inches from the gutter face of the curb, or less than 20 feet from the curb line intersection of any street.
 - 2. Location Re-Sidewalk: When set in the lawn space between the curb and the sidewalk, or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within 12 inches of the sidewalk.
- B. Position of Nozzles: All hydrants shall stand plumb, and shall have their nozzles parallel with or at right angles to the curb with the pumper nozzle pointing normal to the curb except that hydrants having hose nozzles at an angle of 45 degrees shall be set normal to the curb. They shall conform to the established grade, with nozzles at least 12 inches above the ground.
- C. Connection to Main: Each hydrant shall be connected to main pipe with a 6 inch ductile iron branch. Each fire hydrant shall be controlled by an independent 6 inch gate valve.
- D. Drainage at Hydrant: Wherever hydrants are set in impervious soil, a drainage pit 2 feet in diameter and 2 feet deep shall be excavated below each hydrant and filled completely with coarse gravel or broken stone mixed with coarse sand, under and around the bowl of the hydrant and to a level 6 inches above the waste opening. No hydrant drainage pit shall be connected to a sanitary sewer.
- E. Anchorage for Hydrant: The bowl of each hydrant shall be well braced against unexcavated earth at the end of the trench with stone slabs or concrete backing, or it shall be tied to the pipe with locked mechanical joint retainer glands or restrained joint pipe. In no case shall the waste opening be obstructed from free drainage.
- F. Cleaning: Hydrants shall be thoroughly cleaned of dirt or foreign matter before setting.
- G. Determination of Fire Hydrant Locations: Exact locations of fire hydrants shall be determined by the Engineer to best suit field conditions and fire code requirements. It is the intent to locate fire hydrants at property lines between lots, if practical and possible.

1.14 PLUGGING DEAD ENDS

Standard plugs shall be inserted into the bells of all dead ends of pipes, tees or crosses, and spigot ends shall be capped. Plugs or caps shall be jointed to the pipe or fittings in the appropriate manner.

1.15 ANCHORAGE OF BENDS, TEES AND PLUGS

- A. Limiting Pipe Diameter and Degree of Bend: Reaction or thrust backing shall be applied on all pipelines 4 inches in diameter or larger at all tees, plugs, caps and at bends deflecting 22 ½ degrees or more or as shown on Plans or movement shall be prevented by attaching mechanical joint retainer glands, rust proof tie rods, or other approved anchorage as indicated on the Plans. Tie rods shall be coated with No-Oxide grease after installation.
- B. Material for Reaction Backing: Reaction or thrust backing shall be of concrete of a mix not leaner than 1 cement, 2 ½ sand, 5 stone, having compressive strength of not less than 2,000 psi. Backing shall be placed between solid undisturbed ground and the fitting to be anchored. The minimum area of bearing on pipe and on ground shall be as shown on the plans. The backing shall be so placed that the pipe and fitting joint will be accessible for repairs.

1.16 HYDROSTATIC TESTING

- A. General: After the pipe has been laid and backfilled as specified, all newly laid pipe, or any valved section of it shall, unless otherwise specified, be subject to hydrostatic testing, which shall include pressure testing and leakage testing. Hydrostatic testing shall conform to all requirements of the agency having jurisdiction. Hydrostatic testing shall also conform to the requirements of AWWA C600, unless otherwise specified herein. In general, the requirements of AWWA C600 will apply whether ductile iron or PVC pipe is used. If desired, air testing can be presented to the Owner for consideration.
- B. Test Pressure: The test pressure shall be at least 150 psi and shall not exceed pipe, valve, or thrust restraint design pressures. The pressure shall not vary by more than ± 5 psi for the duration of the test.
- C. Pressurization: Each section of pipe shall be slowly filled with water and the specified test pressure, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, and all necessary apparatus shall be furnished by the Contractor.
- D. Air Removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants, If permanent air release valves are not located at all high points, the Contractor, at his expense, shall install corporation stops at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation stops shall be closed and the test pressure applied. After pressure testing, the corporation stops shall be removed and plugged.

- E. Duration of Pressure Test: The duration of each pressure test shall be until the line has been completely inspected for visible leaks, but in no case shall the pressure test duration be less than 6 hours.
- F. Recording Pressure Gauge: A recording pressure gauge shall be used during the pressure test. Charts shall be turned over to the Owner/Engineer prior approval by the Owner.
- G. Examination: Any exposed pipe, fittings, valves, hydrants, and joints shall be examined by the Contractor carefully during the test. Any damage or defective pipe, fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the Owner.
- H. Leakage Testing: Suitable means shall be provided by the Contractor for determining the quantity of water lost by leakage. No pipe installation will be accepted until or unless this leakage (evaluated on a pressure basis of 150 psi) is less than allowable leakage in the following formula:

$$L = \frac{SD(P)^{1/2}}{133200}$$

- L = allowable leakage in gallons per hour
- S = length of pipe tested, in feet
- P = average test pressure during the leakage test, in pounds per square inch gauge
- D = nominal diameter of the pipe in inches

- I. Leakage Defined: Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section of it, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled, for the duration of the leakage testing.
- J. Acceptance of Installation: No pipe installation will be accepted unless leakage is within the limits specified herein. If any test of pipe laid discloses leakage greater than that specified, the Contractor shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowance.
- K. Visible Leaks: The Contractor shall repair, at his own expense, all visible leaks regardless of the amount of leakage.
- L. Scheduling of Testing: The Contractor shall notify the Owner/Engineer prior to each testing. Pipe may be subjected to pressure testing and leakage testing at any convenient time after partial completion of backfill. Segments of water line to be connected to existing water lines shall be chlorinated, flushed and checked for absence of bacteria before the new section of line is pressure tested. The Contractor may at his option pressure test the line before chlorination, provided the new line is not connected

to the existing line during the pressure test. This procedure is set forth to prevent contaminated water or water with high chlorine content from being forced into a line in service through a faulty valve or other device during pressure tests.

1.17 CHLORINATION OF COMPLETED PIPELINE

- A. Before placing into service and approval of the Owner, all new water distribution systems, or extensions to existing systems, or any valved section of such extension or any replacement in the existing water distribution system shall be disinfected in accordance with AWWA C651, Latest Edition.
- B. Preliminary Flushing: Prior to chlorination, all dirt and foreign matter shall be removed by a thorough flushing through the hydrants, or by other approved means. Each valved section of newly laid pipe shall be flushed independently.
- C. Liquid Chlorine: A chlorine gas-water mixture shall be applied by means of a solution-fed chlorinating device, or, if approved by the Engineer, the gas shall be fed directly from the chlorine cylinder equipped with proper devices for regulating the rate of flow and the effective diffusion of gas within the pipe. (Chlorination with the gas-water mixture is preferred to direct feed.)
- D. Point of Application: The preferable point of application of the chlorinating agent shall be at the beginning of the pipelines extension, or any valved section of it, and through a corporation stop inserted in the horizontal axis of the newly laid pipe. The water injector for delivering the gas-water mixture into the pipe shall be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. If a supply of water is not available, the Contractor shall haul the water by tank truck or other means. No additional payment will be made to the Contractor for hauling water. All water used for testing or chlorinating shall be approved by the Owner/Engineer and shall be at the expense of the Contractor.
- E. Rate of Application: Water from the existing distribution system or other source of supply shall be controlled to flow very slowly into the newly laid pipeline during the application of chlorine. The rate of chlorine gas-water mixture flow shall be in such proportions to the rate of water entering the pipe that the chlorine dose applied to the water entering the newly laid pipe shall be at least 40 to 50 ppm.
- F. Back Pressure Prevented: Back pressure, causing a reversal of flow in the pipe being treated, shall be prevented.
- G. Retention Period: Treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. This period shall be at least 24 hours and preferably longer as may be directed. After the chlorine treated water has been retained for the required time, the chlorine residual at pipe extremities and at other representative point shall be at least 25 ppm.

- H. Chlorinating Valves and Hydrants: In the process of chlorinating newly laid water pipe, all valves and other appurtenances shall be operated while the pipe is filled with the chlorinating agent.
- I. Final Flushing: Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipeline. Discharge of chlorinated water shall conform to all local, state and federal regulations. Dechlorination shall be performed as required by regulatory agencies. Dechlorination shall be performed at the Contractor's expense.
- J. Bacteriological Tests: Samples shall be taken of water that has stood in the main for at least 16 hours after final flushing has been completed and shall be tested by a state certified laboratory for bacteriological quality in accordance with "Standard Methods for the Examination of Water and Wastewater". The samples shall show the absence of coliform organisms.
- Samples shall be taken at locations selected by the Owner/Engineer but not less than 1 samples shall be collected for every 7,000 feet of pipe or 1 sample from each dead end line, whichever is greater. No hose or fire hydrant shall be used in collection of samples. A corporation stop shall be installed in the main with a copper tube gooseneck assembly for samples.
- If the initial disinfection fails to produce satisfactory bacteriological samples, the main shall be reflashed and shall be resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated until tests show the absence of coliform organisms. There will be no additional cost to the Owner for subsequent chlorination and retesting. Copies of all bacteriological tests shall be furnished to the Owner/Engineer.
- K. Calcium Hypochlorite or Chlorinated Lime in Water: On approval of the Owner/Engineer, a mixture of either calcium hypochlorite or chlorinated lime of known chlorine content and water may be substituted as an alternative for liquid chlorine.
1. Calcium hypochlorite (comparable to commercial products known as "HTH", "Perchloron", and "Maxochlor"); or
 2. Chlorinated lime (frequently called chloride of lime and known to industry as bleaching powder), may be used.
- L. Proportions of Calcium Hypochlorite or Chlorinated Lime and Water Mixtures: A 5 percent solution shall be prepared, consisting of 5 percent of either powder to 95 percent of water by weight.
- M. Application: The calcium hypochlorite or chlorinated lime and water mixture, first made into a paste and then thinned to a slurry, shall be injected or pumped into the newly laid pipe under conditions heretofore specified for liquid chlorine application, after preliminary flushing.
- N. Approval: Provisions for final flushing, testing, and approval under this alternative shall be the same as those described previously.

- O. Procedure When Cutting into Existing Pipelines: Cuts made in existing pipelines for the insertion of valves, fittings, repairs, or for any other purpose shall be chlorinated by shaking a predetermined quantity of the powder into the pipe on each side of the cut-in. After slowly filling the section and reversing the flow, the chlorinated water shall be retained for several hours, then flushed until no odor of chlorine can be detected in the wastewater, or preferably until a check has been made for residual chlorine as provided for herein.
- P. Resumption of Service: After satisfactory chlorination by any of these alternative procedures, the consumer may be served from the newly laid pipeline or the service may be resumed on existing pipelines after authorization is received from the health agency having jurisdiction.

1.18 CONCRETE

The minimum compressive strength required at 28 days is 3,000 pounds per square inch. Field specimens and laboratory tests shall be made in accordance with the standards of the American society of Testing Materials. The minimum amount of water shall be used to produce a workable mix and shall not exceed 6 U.S. gallons per sack of cement. Slump shall range between 2 and 5 inches.

1.19 BACKFILLING

See section entitled "Backfilling".

1.20 EROSION CONTROL

See section entitled "Erosion Control".

1.21 MAINTENANCE OF SURFACES

Following the certification of completion by a registered professional engineer, the Contractor shall maintain the surface of the unpaved trenches, adjacent curb, sidewalks, gutters, shrubbery, fences, sod and other surfaces disturbed for a period of 3 months thereafter; and shall maintain the repaved areas (if paved by Contractor) and adjacent curbs, gutters, and sidewalks for two (2) years after said certification. All material and labor required for the maintenance of the trenches and adjacent structures shall be supplied by the Contractor and the work shall be done in a manner satisfactory to the Owner.

1.22 CLEAN-UP

The project area shall be kept clean at all times. Loose dirt shall not be allowed to clog ditches or cover sidewalks. Soft clay or other undesirable material removed from the trenches shall be removed from the streets, sidewalks or ditches.

1.23 PRESSURE TESTS AND CHLORINATION ADJACENT TO EXISTING WATER LINES

Sections of water lines adjacent to existing water lines that are in service shall be chlorinated, flushed and checked for absence of bacteria before the new section of line can be pressure tested. The Contractor may at his option pressure test the line prior to chlorination, provided the new line is not connected to the existing line during the pressure test. This procedure is set forth to prevent contaminated water or water with high chlorine content from being forced into a line in service through a faulty valve or other defect during pressure tests.

1.24 EXISTING WATER SYSTEM

The Contractor shall protect, maintain, and keep in service all existing water lines and service connections during construction operations on the new water lines. Any existing lines cut or damaged shall be repaired immediately and the service restored on the existing lines.

1.25 DUST CONTROL

The Contractor shall at all times provide for the control of dust within residential areas and such other areas where dust is a nuisance to the public by sprinkling with water or by other approved dust control measures. Water provided by Daphne Utilities will only be available after prior agreement and rental of a meter from Daphne Utilities.

1.26 PUBLIC SAFETY

All water line materials unloaded on the job sites shall be placed in areas well away from the traveling public in order to avoid hazardous conditions.

1.27 TAPPING OF WATER MAINS

Tapping of existing water mains shall be performed by the Contractor where such taps are indicated on the plans or required for connection of new lines to existing lines. The Owner shall be notified a minimum of 48 hours prior to the tap being made. The Contractor shall furnish tapping valves and tapping sleeves required for the tap. The Contractor shall perform all excavations, backfill, removing and replacing pavement and incidentals necessary for the tap. Valve stem extensions, when required as hereinafter specified, and valve boxes shall be furnished by the Contractor. Tapping valves and sleeves shall be provided by an approved Manufacturer listed in the Appendix or Owner approved equal.

Corporation stop outlets required for testing and chlorination of new water mains will be furnished and installed by the Contractor at his expense. The Contractor shall perform all excavation, backfill, removing and replacing pavement and incidentals necessary for installations of corporation stop outlets.

1.28 EXTRA DEPTH FOR WATER LINES

Water lines shall be laid below existing drainage pipes, existing water lines, gas lines, and other utility lines, by deflecting pipe downward, unless otherwise shown on the plans. There will be no extra payment made for extra depth of waterline required to go under the existing drainage pipes and utilities.

1.29 USE OF CHEMICALS

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with manufacturer's instructions.

1.30 PERMITS, CERTIFICATES, LAWS AND ORDINANCES

The Contractor shall, at his own expense, procure all permits, certificates and licenses required of him by law for the execution of his work. He shall comply with all Federal, State, or Local laws, ordinances, or rules and regulations relating to the performance of the work.

1.31 UNDERGROUND UTILITIES

The plans show certain features of topography, and certain underground utilities, but they do not purport to show in complete detail all such lines or obstructions. Such topography and notes on the plans were inserted from records available and are for the Contractor's convenience only, and shall not be used as the basis for claims of extra compensation. Whenever necessary to determine the location of existing pipes, valves, or other underground structures, the Contractor shall examine all available records and shall make all explorations and excavations for such purpose. Any damage to existing facilities resulting from the Contractor's operations shall be immediately repaired by the Contractor at no cost to the Owner.

1.32 SHOP DRAWINGS AND RECORD DRAWINGS

The Contractor shall submit to the Engineer for review and approval prior to ordering materials six (6) sets of shop drawings for valves, fittings, special connection fittings, and piping at connections to existing pipes. No separate compensation will be allowed the Contractor for Shop Drawings. Review and approval of Shop Drawings by the Engineer shall in no way relieve the Contractor of his responsibilities for materials and workmanship in construction of the project. Upon project completion, two (2) sets record drawings shall be submitted to the building inspector showing final construction conditions noting installed materials and locations.

Refer to Design Criteria section certification by manufacturers and suppliers for equipment and products.

1.33 ABANDONED WATER MAINS AND APPURTENANCES

The Owner shall retain ownership of all salvageable material removed from the project. The Contractor shall neatly store these materials at locations designated by the Engineer. The cost of removing and storing these materials as directed will be borne by the Contractor with no direct payment. Any material deemed unsalvageable by the Engineer or that is not wanted by the Owner shall become the property of the Contractor and removed from the work site for no additional compensation.

1.34 PROJECT DOCUMENTATION

- A. General: Prior to start of construction, work on private property or within easements shall be documented by the use of photographs or video. Pictures or videos (photo or video), in color, shall be taken at a minimum of 50 feet on centers and shall be taken along the centerline of the Project looking up station. At least one station marker shall be visible for identification purposes and station markers shall be set by the Contractor. During the course of the documentation, any features or items of interest or importance which may be encountered shall be photographed or videotaped. Photos and videos shall be delivered to the Engineer within one week after they are made.
- B. Photographs: Clear, legible photographs shall be taken by a skilled technician using a digital camera with a resolution capacity equal to current equipment standards. Each photograph shall clearly identify the date, time, and location the photograph was taken. Two copies of the photographs shall be provided on a CD, DVD, or hard drive using a standard digital format such as JPEG, GIF, or BMP which can be viewed on a standard PC.
- C. DVD: The purpose of the video recordings shall be a supply of continuous visual and audio record of problem areas, items, and features found within any particular area. This video record may be supplemented with photographs to exactly identify and locate specific bad features or items.

The video camera shall be capable of recording and reproducing a picture having not less than 500 lines of resolution. The video camera shall be one on which both sound and video information can be recorded using a standard digital format such as WMA or MPEG. The replay of the video information, when reviewed on a monitor/receiver, shall be free of electrical interference and shall produce clear, stable images. To determine whether the equipment to be used in this Work meets the stated minimum requirements, a video of a suitable test pattern will be required prior to initiation of Work.

The audio portion of the video shall be sufficiently free of electrical interference and background noise to provide an oral report that is clear and completely and easily discernible.

The audio portion of the video report shall be recorded by the operating technician as the video is being recorded and shall include the location or identification of the section being viewed, the station-to-station direction of travel, the distance traveled on the specific run, and any problems encountered.

Two (2) copies of the video shall be provided to the Engineer on CD, DVD, or hard drive each within a sleeve or plastic container which shall clearly indicate the date the tape was taken and the designated section(s) of the Project contained on the video.

END OF SECTION