HAMPTON ROADS
PLANNING DISTRICT COMMISSION

REGIONAL CONSTRUCTION STANDARDS

FIFTH EDITION

Publication Update #4

Full Committee Approved Proposed Revision #9
as Publication Update #4.

Insertions include: fPVC pipe specifications in Section 200 for Sanitary Force Main Systems (5.10.E), Water Distribution Systems (5.18.E) and, replacement of entire Horizontal Directional Drilling Section (806)

April 19, 2013

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strength of the pipe. Socket-fusion, extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications. Flanges, unions, grooved-couplers, transition fittings, and some mechanical couplers may be used to mechanically connect HDPE pipe without butt-fusion, if specified on the Drawings and approved by the manufacturer.

E. Fusible Polyvinylchloride (fPVC) Pipe

1. Pipe Supplier shall furnish fPVC pipe conforming to all standards and procedures, and meeting all testing and material properties as described in this specification. Pipe, 4 to 12 inches in diameter, shall conform to AWWA C900 – Class 150 (DR 18), unless otherwise indicated on the Drawings. Pipe greater than 12 inch shall conform to AWWA C905 – Class 235 (DR 18) or Class 150 (DR25), as specified on the Drawings.

2. fPVC pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in AWWA C900 or C905, as appropriate. Rework material shall be allowed per AWWA C900 and AWWA C905 standards. All piping shall be made from a PVC compound conforming to cell classification 12454 per ASTM D1784.

3. fPVC pipe shall be extruded with plain ends and shall normally be supplied in standard 40 foot lengths. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe. fPVC pipe shall be blue in color for potable water use or green for wastewater.

4. Acceptable fittings for use with fPVC pipe shall include standard ductile iron fittings conforming to AWWA/ANSI C110/A21.10 and AWWA/ANSI C153/A21.53.

5. Connections to fPVC pipe may be made using a restrained or non-restrained retainer gland product for PVC pipe, as well as for MJ or flanged fittings.

6. Bends, tees and other ductile iron fittings shall be restrained as indicated in the Contract Documents.

7. Ductile iron fittings and glands must be installed per the manufacturer's guidelines.

8. Pipe generally shall be marked per AWWA C900 or AWWA C905, and shall include as a minimum:

- **a. Nominal pipe size**
- **b. PVC**
- **c. Dimension Ratio, Standard Dimension Ratio or Schedule**
- **d. AWWA pressure class and Standard number**
- **e. Extrusion production-record code**
- **f. Trademark or trade name**

g. Cell Classification 12454 and/or PVC material code 1120 may also be included.

h. NSF-61 mark if for potable water service.

~~E.~~ **F**. Valves

1. Gate Valves

a. Gate valves shall be manufactured by Kennedy Valve Company, Mueller Company, or approved equal, or as specified in the Special Provisions.

b. Resilient-seated gate valves shall be used on pipelines from 3-inches in diameter up to and including 16-inches in diameter. Valves under 16-inches shall operate in a vertical position (valves 16-inches and larger shall operate in a horizontal position). Gearing shall be provided on 16-inch and larger valves. Resilient-seated gate valves shall be in accordance with AWWA C509 or AWWA C515 and shall be supplied with an interior epoxy coating in accordance with AWWA C550. Resilient-seated gate valves shall be iron body, non-rising bronze or stainless steel stem, rubber encapsulated disc valve seat, o-ring seals, and suitable for buried service. Valve ends shall be flanged, mechanical joint, or mechanical joint by flange to suit the pipe or fittings as indicated on the Drawings. All gate valves for force main installations shall open counter clockwise.

c. Gate valves smaller than 3-inches in diameter shall be cast bronze, solid-wedge disc, screwed bonnet, inside screw, non-rising stem valves with threaded connections. Valves shall conform to Standard SP-80, Type 2, Class 150, Manufacturer's Standardization Society of the Valve and Fitting Industry, Inc.

b. Coatings

All interior ferrous surfaces of all valves shall be coated in accordance with ANSI/AWWA C550 and shall not contain lead, coal tar resins, lampblack, carbon black or bituminous materials. The exterior surfaces shall receive a factory applied fusion bonded epoxy coating.

c. Valve Operators

Buried valves shall have a 2-inch square operating nut conforming to AWWA C509, and shall open counter-clockwise, unless otherwise noted. A valve key wrench of adequate length and of each type required shall be provided for each Project. Valves in vaults shall have a hand wheel of cast iron conforming to ASTM A 126, Class B.

d. Valve Stem Extensions

Valve stem extensions, when allowed by the locality, shall be furnished when

4. PVCO pipe shall be made from standard PVC plastic pipe stock having a Hydrostatic Design Basis (HDB) of 4,000 psi. The finished PVCO pipe shall have a HDB of 7,100 psi.

5. PVCO pipe shall be manufactured with Ductile Iron outside diameters for all sizes. The pipe shall be joined by means of bell joint, which are integral and homogeneous part of the pipe barrel and conform to ASTM D3139. Spigot ends shall be chamfered.

D. High Density Polyethylene (HDPE) Pipe (Directional Drill Applications)

1. HDPE pipe shall only be used for potable water systems where a carrier pipe is required for directional drill applications.

2. HDPE pipe shall meet the requirements for potable water and have ANSI/NSF No. 61 certification.

3. HDPE pipe 3-inches or less in diameter shall comply with AWWA C901 and shall have a nominal DIPS (Ductile Iron Pipe Size) outside diameter unless otherwise specified. The nominal size and SDR of the pipe shall be as specified on the Drawings.

4. HDPE pipe greater than 3-inches in diameter shall be in accordance with AWWA C906 and shall have a nominal DIPS (Ductile Iron Pipe Size) outside diameter unless otherwise specified. The nominal size and SDR of the pipe shall be as specified on the Drawings.

5. All HDPE fittings shall be molded from PE3408 polyethylene resins in accordance with the requirements of ASTM D3035 and manufactured to comply with ASTM F714 specifications. Butt fusion fittings shall comply with ASTM D3261 requirements.

6. Pipe sections shall be joined on the job site above ground into continuous lengths by the butt-fusion method, which shall be performed in strict accordance with the manufacturer's recommendations. The butt-fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 °F, alignment, and 75 psi interfacial fusion pressure. Butt-fusion joining shall be 100% efficient and shall provide a joint weld strength equal to or greater than the tensile strength of the pipe. Socket-fusion, extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications. Flanges, unions, grooved-couplers, transition fittings, and some mechanical couplers may be used to mechanically connect HDPE pipe without butt-fusion, if specified on the Drawings and approved by the manufacturer.

E. **Fusible Polyvinylchloride (fPVC) Pipe**

1. **Pipe Supplier shall furnish fPVC pipe conforming to all standards and procedures, and meeting all testing and material properties as described in this specification.**

Pipe, 4 to 12 inches in diameter, shall conform to AWWA C900 – Class 150 (DR 18), unless otherwise indicated on the Drawings. Pipe greater than 12 inch shall conform to AWWA C905 – Class 235 (DR 18) or Class 150 (DR25), as specified on the Drawings.

2. **fPVC pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in AWWA C900 or C905, as appropriate. Rework material shall be allowed per AWWA C900 and AWWA C905 standards. All piping shall be made from a PVC compound conforming to cell classification 12454 per ASTM D1784.**

3. **fPVC pipe shall be extruded with plain ends and shall normally be supplied in standard 40 foot lengths. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe. fPVC pipe shall be blue in color for potable water use or green for wastewater.**

4. **Acceptable fittings for use with fPVC pipe shall include standard ductile iron fittings conforming to AWWA/ANSI C110/A21.10 and AWWA/ANSI C153/A21.53.**

5. **Connections to fPVC pipe may be made using a restrained or non-restrained retainer gland product for PVC pipe, as well as for MJ or flanged fittings.**

6. **Bends, tees and other ductile iron fittings shall be restrained as indicated in the Contract Documents.**

7. **Ductile iron fittings and glands must be installed per the manufacturer's guidelines.**

8. **Pipe generally shall be marked per AWWA C900 or AWWA C905, and shall include as a minimum:**

   a. Nominal pipe size
   b. PVC
   c. Dimension Ratio, Standard Dimension Ratio or Schedule
   d. AWWA pressure class and Standard number
   e. Extrusion production-record code
   f. Trademark or trade name
   g. Cell Classification 12454 and/or PVC material code 1120 may also be included.
   h. NSF-61 mark if for potable water service.

~~E.~~ F. Copper Water Pipe

Pipe shall be seamless copper tubing conforming to ASTM B 88, Type K, Temper 060, and shall be of the coiled type. Fittings shall be wrought copper solder-joint pressure fittings

SECTION 806

HORIZONTAL DIRECTIONAL DRILLING

I. GENERAL

1.1. DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, material, and equipment necessary to perform a complete horizontal directionally drilled (HDD) pipeline installation at the location(s) shown on the Drawings. In the HDD process, the casing pipe typically serves as the carrier pipe and is referenced as such herein. When so indicated on the Drawings, the Contractor may be required to install a carrier pipe inside the casing pipe.

B. Carrier pipe shall be HDPE or fPVC in conformance with Section 200.

C. Directional drilling and pipe installation shall be performed only by an experienced Contractor specializing in directional drilling and whose key personnel have at least 5 years experience in this Work, in particular, pilot hole steering and position monitoring.

D. The Work shall be constructed in accordance with the Contract Documents and the applicable laws, rules, ordinances, and permits of regulatory agencies including the Virginia Department of Environmental Quality, the US Army Corps of Engineers, and other local, state and federal agencies having jurisdiction.

1.2. EQUIPMENT

A. Equipment shall include, but not be limited to carrier pipe, HDD Equipment, solids removal and water clean-up equipment, pipeline installation equipment, earth moving equipment, survey equipment, trailer cleaning pigs, caliper pigs, and temporary pig launchers and receivers.

B. The equipment used in HDD shall be of adequate commercial size and satisfactory working condition for safe operation, and may be subject to approval by the Owner. Such approval, however, shall not relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein.

C. The HDD equipment shall be steerable by means of an electronic tool directional system and shall provide a layer of clay (bentonite) to completely seal around the installed carrier pipe. The HDD equipment shall have sufficient strength to drill the pilot hole, ream the hole to adequate diameter, and pull the carrier pipe through the hole for the length and pipe diameter indicated.

D. Drill pipe shall be API steel drill pipe, Range 2, Premium Class or higher, Grade S-135 in a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the Work. Only drill pipe inspected under API's Recommended Practice Specification API RP 7G within 30 Days prior to start and certified as double white band or better shall be used.

E. Each fusion joint shall be recorded and logged by an electronic monitoring device (data

logger) affixed to the fusion machine. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following properties, including the following elements:

1. Heat Plate - Heat plates shall be in good condition with no deep gouges or scratches and shall be clean and free of any debris or contamination.

2. Carriage – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused.

3. Data Logging Device - The current version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

F. Other equipment specifically required for the fusion process shall include the following:

1. Pipe rollers shall be used for support of pipe to either side of the machine

2. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement and /or windy weather.

3. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

4. Facing blades specifically designed for cutting fPVC or HDPE pipe shall be used.

1.3. SUBMITTALS

A. Shop Drawings shall be submitted by the Contractor in accordance with the procedures set forth in Section 105 and as described below:

1. Pipe manufacturer's installation manual, which includes guidelines for handling, joining, installing, and testing HDPE or fPVC.

2. Butt fusion equipment manufacturer's literature. Equipment shall contain mechanisms to prevent excessive pressure during the fusion process.

3. Documentation of temperature and pressure from data logger for each butt fusion joint.

B. The Contractor shall prepare a plan, sealed by a Professional Engineer of the Commonwealth of Virginia, for Owner approval. The plan shall:

1. Describe the pilot hole drilling procedure, the reaming operation, the pullback procedure, ballasting, gauging, hydrostatic testing, and dewatering procedures;

2. Illustrate the plan and profile of the bore plotted at a scale appropriate for the crossing and acceptable to the Owner. **(**The Contractor may make changes to the proposed vertical and horizontal alignment of the installation and the location of the entry and exit points, provided these changes are first submitted in writing and agreed to by the Owner.);

3. Provide the horizontal drilling machine manufacturer's literature;

4. Identify the location for the pipe string (and rollers, if required);

5. Include a Drilling Fluid Plan, which details types of drilling fluids to be used, cleaning and recycling equipment, estimated flow rates, procedures for minimizing drilling fluid escape, and the method/location for final disposal of waste drilling fluids;

6. Identify the size of backreamer;

7. Identify the maximum allowable pulling load and minimum bend radius on the HDPE or fPVC pipe string to avoid overstressing the pipe.

8. Provide a listing of major equipment to be used; and,

9. Provide resumes of supervisory personnel to be used.

C. Detailed schedule of Work including:

1. Pipe delivery

2. Pipe string fusion

3. Drill mobilization and set-up

4. Pilot hole drilling

5. Pipe pulling

6. Testing

7. Demobilization

8. Restoration

D. Record Drawings

1. Record Drawings shall be developed in accordance with Section 105.

2. The Contractor shall provide ten copies of the Record Drawings with as-built x-y-z coordinates within 30 Days of construction completion of the HDD Crossing.

3. Record Drawings must be approved by the Owner prior to payment.

1.4. ENVIRONMENTAL CONSIDERATIONS

A. The Contractor shall be fully responsible for the directional drilling operation.

B. The Contractor shall take all measures necessary to protect surrounding public and private property, structures, buildings, roads, utilities, driveways, sidewalks, and appurtenances from damage due to the directional drilling Work. Responsibility and payment for correction of such damage shall be the sole responsibility of the Contractor.

C. The HDD operation is to be performed in a manner to eliminate the discharge of water, drilling mud and cuttings to nearby waterways. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. The Contractor shall line all excavated pits used in the drilling operation with heavy-duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water. If inadvertent returns of drilling fluids near a structure or into a waterway occur, the Contractor shall immediately provide environmental controls and clean up to the satisfaction of, and at no additional expense, to the Owner.

D. When working adjacent to waterways, the general work area on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.

E. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desilter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered and dried by the Contractor to the extent necessary for legal disposal in off-site landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of locally or hauled off-site for legal disposal. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas may be checked by the Owner for signs of unplanned leaks or seeps.

F. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at the site for use in the event of inadvertent leaks, seeps or spills.

G. Unless otherwise indicated in the Special Provisions, the Contractor shall provide water for the HDD process and pipeline testing.

1.5. BENTONITE

Bentonite shall be provided as specified in *API Specifications 13A, Specification for Oil Well Drilling Fluids Material for fresh water drilling fluids.* Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included in Contractor's drilling plan presented to the Owner. The Owner retains the right to sample and monitor the waste drilling mud, cuttings and water.

1.6 FUSION TECHNICIAN QUALIFICATIONS

A. Fusion Technician shall be certified and/or licensed by the pipe supplier to fuse fPVC pipe of the type(s) and size(s) being used.

B. Fusion Technician shall be trained and certified by the pipe supplier or the fusion equipment manufacturer to fuse HDPE pipe of the type(s) and size(s) being used.

C. Qualifications shall be current as of the actual date of fusion performance on the project.

II. EXECUTION

2.1. GENERAL

A. Directional drilling is a two-stage process consisting of drilling a pilot hole through the ground and pulling back a cable or pipe while the drilling pipe is removed.

B. A lubrication system mixes and pumps bentonite through a hollow stem drill rod to lubricate the hole, assists in the cutting of the earth and rock, and stabilizes the borehole.

C. When the drill rod exits at the correct location, a back reamer is installed to the drill rod to enlarge the hole. The carrier pipe is attached to the reamer with a swivel installed between the two to ensure that the rotating action of the reamer is not transmitted to the pipe or cable being pulled back.

D. During the pull back, drilling fluid is pumped through the hollow stem drill rod and is injected at the reamer to assist in the cutting and lubrication of the hole, the reduction of friction on the outside of the pipe, and the stabilization of the bore hole.

E. The Contractor shall erect temporary fencing around the entry and exit construction areas.

F. The Contractor shall be responsible for locating existing utilities along the projected pipeline route.

2.2. LAYOUT OF ENTRY, EXIT, AND STAGING AREAS

A. The pipe shall be laid out as shown in the Drawings, and assembled in a manner that does not obstruct adjacent roads or activities adjacent to the layout areas except as otherwise shown. The Contractor shall confine construction activities and disturbances within the areas shown on the Drawings. If the Contractor is specifically permitted to use portions right-of-way for staging, pipe layout and joining, the Contractor shall coordinate his operations so as not to interfere with VDOT (or the City as applicable) or with the traveling public.

B. Where the butt fused pipe string is laid-out within the roadway right-of-way, the Contractor shall maintain access to public and private entrances and driveways at all times. Unless otherwise indicated, access may be maintained either by trenching and installing temporary culvert pipe for slip lining of the pipe, or by supporting the pipe aerially. Where aerial crossings are used, provide a minimum of 12 feet of clearance between the bottom of the pipe and the driveway. If commercial entrances or truck traffic are to be spanned, the Contractor shall allow adequate vertical clearance. The minimum bending radius for laying out and pulling the pipe shall be 60 times the pipe outside diameter for HDPE pipe and 250 times the pipe outside diameter for fPVC pipe.

C. The Contractor shall provide copies of written and signed agreements with adjacent property owners for any arrangements made by the Contractor for use of property outside of the rights-of-way and public property shown on the Drawings.

D. Prior to the start of any Work under this section, the Contractor shall photograph or video tape the entire work areas, including the entry and exit points. One copy shall be provided to the Owner.

2.3. TOLERANCES

The pilot hole shall be drilled along the path shown on the construction drawings, or the Contractor's plan and profile approved by the Owner, to the following tolerances:

A. Elevation – Plus zero feet, minus five (5) feet. The vertical path shall not exceed high points shown on the Drawings.

B. Alignment – Plus two (2) feet, minus two (2) feet.

C. Entry Point Location – The pilot hole shall initially penetrate the ground surface at the exact location intended. The angle of entry shall not exceed 75% of the allowable bending radius of the carrier pipe.

D. Exit Point Location – The pilot hole shall finally penetrate the ground surface within:

1. +/- 10 feet overall length tolerance and +/- 5 feet left/right alignment tolerance for directional drills of 1,000 linear feet, and

2. +/- 40 feet of overall length and +/- 5 feet left/right alignment tolerance for directional drills greater than 1,000 linear feet.

E. For gravity sewer installations, sags in the pipeline shall not exceed 25% of the nominal pipe diameter. Sags will only be allowed where the entering and exit grades are adequate to provide velocities through the sag area sufficient for moving the solids. No more than one sag area shall occur between two manholes.

2.4. PILOT HOLE

A. The Contractor will provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure at all times. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 25 feet. This "as-built" plan and profile shall be up-dated as the pilot bore is advanced. Significant deviations between the Owner-approved "design" position and the actual position shall immediately be brought to the attention of the Owner for discussion and/or approval. At no point in the drilled profile shall the radius of curvature of the bore be less than that indicated on the Drawings. The Contractor shall maintain and provide to the Owner upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.

B. The Contractor shall provide and use a separate, electronic, monitoring system employing a ground survey grid system, such as **"**TRU-TRACKER" or equal wherever possible.

C. The alignment of the pilot bore must be approved by the Owner before reaming and pullback may commence. If the pilot bore fails to conform to the above tolerances, the Owner may, at

his option, require a new pilot boring to be made.

D. The Contractor shall notify the Owner when forward motion of operation is stopped by and obstruction. Unless directed otherwise, the pilot hole shall then be abandoned in place with the drilling fluid. With the Owner's approval, another attempt to drill the pilot hole may be made or excavation at the obstruction to alleviate the blockage may be acceptable. Withdrawal, abandonment, and restarts shall be performed at no additional cost to the Owner.

E. The Contractor shall maintain close observations to detect settlement or displacement of surface and adjacent facilities. If settlement or displacement is detected, the Contractor is to immediately notify the Owner and act to maintain safe conditions and prevent damage.

2.5. REAM AND PULL BACK

A. Upon approval of the pilot hole location by the Owner, the hole opening or enlarging phase of the installation shall begin. The borehole diameter shall be increased incrementally to accommodate the pullback operation of the carrier pipe. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The final hole opening diameter shall be a minimum of 40 percent larger than the outside diameter of the carrier pipe to be installed.

B. Once pullback operations have commenced, the Contractor shall continue without interruption until the pipe is completely pulled into the bore hole.

C. During the pullback operation, the Contractor shall monitor roller operation and side booms, if required, to assist the movement of the carrier pipe. Surface damage shall be repaired by the Contractor before pulling operations resume.

D. The maximum pull (axial Tension force) exerted on the carrier pipe shall be measured continuously and limited to the maximum allowed by the pipe manufacturer to prevent the pipe and/or joints from becoming overstressed. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the HDPE carrier pipe. fPVC shall not exceed published minimum bending radii and pipe stresses shall be limited to the maximum allowed by the pipe Manufacturer. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense.

E. A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.

F. The pipelines shall be adequately supported during installation to prevent overstressing or buckling. The Contractor shall provide adequate support/rollers along the stringing area to support the required length of the pipe. Such support/rollers shall be spaced at a maximum of 60 feet on centers, or as recommended by the pipe supplier. The rollers shall be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback.

G. The end of the pipe shall be closed during the pull back operation.

H. The Contractor shall pull detection wire, without splices, on top and along with the pipe.

I. After the HDPE carrier pipe is completely pulled through the bore hole, a sufficient relaxation period as recommended by the specified pipe manufacturer shall be provided prior to the final pipe tie-in. fPVC may be connected without delay.

J. If ballast water is required, means shall be provided to meter the water, in accordance with locality requirements, so that the pipe within the borehole is filled but the pipe above grade is empty.

K. Connections from fPVC and HDPE to direct buried pipe shall be per details/notes indicated in the Contract Documents.

2.6. HANDLING DRILLING FLUIDS AND CUTTINGS

A. To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.

B. During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site.

C. The Contractor shall conduct his directional drilling operation in such as manner that drilling fluids do not compromise nearby structures or are introduced into nearby waterways.

D. During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.

E. Waste drilling mud and cuttings shall be dewatered dried and stocked piled such that it can be loaded, transferred to a truck, and hauled off-site to a suitable legal disposal site.

F. All drilling mud shall be removed from the entry and exit area soils such that water will percolate and replacement sod will grow to restore original conditions.

G. Pits constructed at the entry or exit point area shall be constructed to completely contain the drill fluid and prevent its escape to waterways.

H. The Contractor shall utilize drilling tools and procedures that minimize the discharge of any drilling fluids. Contractor will comply with all mitigation measures listed in the permits and elsewhere in the Contract Documents.

I. The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the return fluids to be reused.

2.7. BUTT FUSION JOINTS

The pipe manufacturer's fusion processes shall be followed at all times as well as the

recommendations of the fusion machine manufacturer.

A. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.

B. Prior to heating of the joint each pipe section to be butt fused will require the ends to be planed in the fusion machine to assure the ends will mate at the fusion point. The pipe ends shall be pushed together in the fusion machine to make a visual check of the compatibility and alignment of the two ends.

C. The Contractor shall adhere to the manufacturer's procedures and recommended heating time for the pipe ends based upon pipe diameter and ambient temperature. A visual inspection shall be made immediately upon removal of the heating element to verify blistering of the pipe has not occurred.

D. Upon completion of the fusion process for each joint, the pipe shall not be removed from the fusion machine until the pipe has cooled in accordance with the pipe manufacturer's published installation guidelines.

2.8. CLEANING AND SIZING PIGS

After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form or buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dents, buckles, gouges, and internal obstructions) greater than 2-percent of the nominal pipe diameter, or excessive ovality greater than 5-percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of five feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of five feet.

2.9. TESTING

A. Just prior to installation, pipe shall be air tested to 5 psi for a minimum of 5 minutes, or for such duration as approved by the Owner, to assure the joints are leak free and there are no holes or gouges in the pipe. The pipe shall again be tested after installation. Acceptance hydrostatic test pressure shall be 150 psi at the entrance pit in accordance with 2.9.D below. The pipe ends shall be sealed with blind flanges or plugs. The Contractor shall furnish all equipment needed to test the pipelines.

B. Test methods shall conform to pipe manufacturer's recommended practices.

C. The acceptance test method will be modified to account for diametric expansion of HDPE.

1. After filling, the pipe will be subjected to a hydrostatic test pressure and allowed to stand without makeup pressure for 2 to 3 hours.

2. After the above equilibrium period, the test pressure will be attained and held for 1 hour with no leakage.

3. Allowances for expansion during final test will be made for conformance with generally accepted procedures furnished by the pipe supplier.

D. Final pressure and leakage testing shall conform to Sections 801, 802, or 803 as appropriate.

E. All air must be vented from the pipeline prior to pressurization. This may be accomplished with the use of tapped air relief valves or vent piping in the testing hardware or end caps, or any other method which adequately allows air to escape the pipeline at the ends. Venting may also be accomplished by 'flushing' the pipeline in accordance with the parameters and procedures as described in AWWA C605.

F. The pipeline must be fully restrained prior to pressurization. This includes complete installation of all mechanical restraints per the restraint manufacturer's guidelines, whether permanent or temporary to the final installation.

2.10. SHEETING AND SHORING

A. The Contractor shall install, maintain, and leave in place any sheeting, underpinning, cribbing, and other related items (other than that required for the boring and receiving pits) to support any structure or facility affected by the boring operations. The Owner, depending upon existing conditions, may require that additional sheeting for the excavation be left in place. If such a requirement is made, no additional compensation will be made for the sheeting left in place.

B. At the completion of the directional drilling operations, the Contractor will be required to leave all wooden sheeting in place. If steel sheeting is used, it may be removed after installation of the carrier pipe in the bore hole, but prior to installation of the joining carrier pipe; however, should damage to the roadway pipeline or any other adjacent structure occur, the Contractor shall leave all remaining sheeting in place and redrive and leave in place any sheeting which is required to stabilize the site and prevent additional damage from occurring. The top of all sheeting left in place shall be cut off 36-inches below finished grade.

2.11. DISINFECTION

See Section 801 for disinfection and bacteriological testing requirements for water mains.

2.12. SITE RESTORATION

After completion of the directional drilling Work, the entry and exit pit locations shall be restored to original conditions, unless otherwise specified. The Contractor shall clean up and restore to pre-construction conditions any public or private property disturbed, or damaged during construction. Restoration shall include paved and unpaved surfaces, shrubbery, landscaping, trees, structures, and all else encountered.

III. MEASUREMENT FOR PAYMENT

A. The project will be considered complete following the successful:

1. Installation of the directionally-drilled pipeline, including all incidental items, equipment and Work required to successfully execute and fully complete the crossing for the intended function.

2. Restoration of the entry and exit sites, including grading, topsoil, mulching and seeding.

3. Testing, disinfection and bacteriological testing (if required).

4. In the event of failure to install the directionally-drilled pipeline, the Contractor shall retain possession of any Contractor supplied pipe and remove it from the site. The bore holes shall be completely filled with grout or flowable fill to prevent future problems. If the pipe cannot be removed from the bore it shall be cut off 5 feet below ground and the pipe and space shall be grouted.

B. A single, lump sum payment shall be made following the successful completion as described above.

C. No partial payments will be made.

D. No payment will be made for the failure of the Contractor to successfully install the pipeline.

End of Section