



DIVISION 6

Standards for Trenchless Installation

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6-1.000 TRENCHLESS INSTALLATION

6-1.010 General

The District may allow the use of trenchless methods to complete portions of water and/or sewer projects and extensions.

The use of trenchless methods will require special approval of the District. Trenchless methods shall only be considered when other standard methods of construction cannot be completed in a reasonable or economical fashion. Any use of trenchless methods shall be at the Contractor's complete risk as to the ability to satisfactorily complete the utility installation in compliance with District standards.

Methods the District is willing to consider and evaluate include:

- Horizontal Directional Drilling (HDD)
- Microtunneling
- Pipe Jacking
- Pipe Bursting
- Auger Boring
- Pipe Ramming
- Cured in Place Pipe (CIPP) for rehabilitation
- Sliplining for rehabilitation

Each of these methods may be suitable for different site conditions, soil types, water table levels and utility size and type. Consideration shall be given to those issues when the Contractor is proposing a method to the District.

6-1.020 Qualifications

The Contractor shall demonstrate to the satisfaction of the District that the Contractor is qualified to perform the work. The District reserves the right to contact references and investigate past performance and qualifications of the Contractor. The District may contact references for other projects, including District projects, even though the Contractor did not identify those projects and /or references. Poor references may be justification to determine that the Contractor is not acceptable for the proposed method. The Contractor shall provide references and, at a minimum, the information required by each item set forth below.

A. Trenchless Contractor:

- Specializes in trenchless installations for a minimum of the last five years.
- Has completed at least three trenchless installations in the last two years using the type of trenchless system proposed in the approved plans.
- The three installations noted in the above must have been constructed in conditions of a similar nature and geology to those indicated in the approved plans, including work in granular soils, dealing with frac-out situations, and cleanup and disposing of bentonite.

B. Trenchless Superintendent:

- Has experience on at least three trenchless Installations in the past two years using the type of trenchless system proposed in the approved plans.
- Experience must include projects that have been constructed in conditions of a similar

nature and geology to those indicated in the approved plans.

- The superintendent's responsibilities on each project must be documented.

C. Trenchless Operator:

- Experience as a trenchless machine operator on at least three trenchless installations in the past two years using the type of trenchless system proposed in the approved plans. Experience must include projects that have been constructed in lengths and conditions of a similar nature and geology to those indicated in the approved plans.
- The trenchless operator's responsibilities on each project must be documented.

D. Trenchless Designer:

- Registered professional engineer licensed in the State of Washington with a minimum of three years experience in trenchless design and construction of installations for the proposed trenchless method. Previous installations shall be similar in diameters, lengths and conditions of a similar nature and geology to those for the proposed installation location..

E. Additional Qualifications:

- The District may request additional information depending on trenchless method approved for installation, to demonstrate that the Contractor is qualified to perform the Work. The information may include:
 - a) Drilling Fluids Engineer:
 - Minimum of two years experience with slurry design used in trenchless installations in granular and abrasive soils. Minimum of two years experience with slurry separation systems and additives to be used for effective soil separation for all soil types and quantities indicated in the Drawings.
 - b) Biological Monitor:
 - Fisheries biologist with a minimum of 10 years experience in local sensitive species identification and surveys, experience with fish life status, salmon habitat requirements, and water quality issues.
 - c) Surveyor:
 - Surveyor shall be a professional land surveyor who is licensed in the State of Washington.

6-1.030 Trenchless Submittals

Contractor shall provide the District with a trenchless submittal **applicable to the trenchless method approved** that may include the following as appropriate:

- A. Trenchless system plan for each drive. Resubmit for all modifications to that previously accepted. Certifications that pits are constructed as required and certified for trenchless operations.
- B. When CIPP or Sliplining is approved for rehabilitation of existing mains, submittal must address maintaining and re-connecting customer services, side sewer laterals and or water service connections.

- C. Reports and records:
 - 1. Alignment surveys and checks: prior, during, and at completion of pipe installation.
 - 2. Daily trenchless operation records and measurements, and welding records including an electronic copy of the trenchless system electronic digital drive record.
 - 3. Well decommissioning reports and permits.
 - 4. Start up test results. (Microtunneling)
 - 5. Status of dewatering prior to pit wall penetration.
 - 6. Field testing results.
 - 7. Material catalog cut sheets.
- D. Pipe repair procedures.
- E. Pipe repair certifications.
- F. CCTV documentation of casings and pipes.
- G. Tunnel Safety Plan. (Microtunneling)
- H. Frac-Out Mitigation and Contingency Plan.
- I. Pre-tunneling meeting minutes. (Microtunneling)
- J. Obstruction removal records and testing results.
- K. Annular filling plan
- L. Bypass pumping plan if existing sewage flow is affected. See Division 3 for basics.

6-1.040 Construction Standards

All materials, installation and workmanship shall be in accordance with the latest District standards and the latest edition of the State of Washington Standard Specifications for Road, Bridge and Municipal Construction.

All applicable standards for water and/or sewer installations, Divisions 2, 3 and 7, shall also apply.

6-2.000 MATERIALS

6-2.010 General

The Contractor shall furnish all material as noted herein and as indicated on the approved plans and as required to complete all work. All materials shall be manufactured with premium material and comply with all referenced standards.

6-2.020 Casing Pipe

Casing pipe is typically used in microtunneling, pipe jacking, auger boring and pipe ramming applications. Calculations shall be provided for the proposed casing pipe material demonstrating sufficient capacity to accommodate highway loading during the life of the project and loading during installation. Casing pipe shall conform to all industry standards. Casing pipe that may be considered for District review includes steel or approved equal by the District.

6-2.030 Casing Spacers

Casing spacers shall be used to support the carrier pipe inside the casing pipe. Casing spacers shall be equally spaced within the casing and shall be sized to center the carrier pipe within the casing pipe or as necessary to achieve desired slope. Casing spacers shall be as manufactured by Advanced Products and Systems Stainless Steel Band Casing Spacers, Model SSI, or Cascade Waterworks Manufacturing Company Stainless Steel Casing Spacer or approved equal. See Standard Detail TI-1.

6-2.035 Annular Filler

The annular space between the carrier pipe and casing pipe shall be filled with sand that conforms with Section 9-03.1 (2)B of the WSDOT Std. Specs for Class 2 Fine Aggregated gradations. Other materials shall be approved by the District prior to installation.

Method of installation of the annular filler shall take into consideration the impacts to the adjacent surroundings. An annular fill plan shall be included with the product information for District review.

6-2.040 Carrier Pipe

For Horizontal Directional Drilling(HDD) applications the carrier pipe is typically installed without a casing pipe. For HDD installations the carrier pipe shall be high density polyethylene pipe (HDPE). For CIPP, the CIPP shall extend from end-to-end of the section being lined in a continuous jointures, seamless, tight fitting pipe-within-a-pipe with a Thermosetting Resin Impregnated Pipe or Tube. For Sliplining, the existing pipe becomes the casing for the HDPE carrier pipe.

- A. Water & Sewer Force mains: HDPE pipe shall be extra high molecular weight HDPE pipe conforming to all applicable AWWA and NSF standards and shall be equal to DriscoPlex 4000/4100 Series as manufactured by Performance Pipe, Chevron Phillips Chemical Company.
- B. Gravity Sewer: High density polyethylene pipe shall be extra high molecular weight HDPE PE3408 for gravity sanitary sewer main applications with cell classification 345434C conforming to ASTM D3350 and shall be equal to DriscoPlex 4200/4300 Series as manufactured by Performance Pipe, Chevron Phillips Chemical Company.

For microtunneling, pipe jacking, auger boring and pipe ramming applications, the carrier pipe is installed inside the casing pipe. Carrier pipes that will be considered by the District include:

- A. Ductile Iron - Ductile iron (DI) pipe shall meet all requirements of Division 2, Water Installation or Division 3, Sewer Installation as applicable. In addition all DI pipe shall be restrained joint. Rubber gasket restraining systems such as Field-Lock gaskets are not acceptable as restrained joint piping in boring, casing, or carrier pipe installations.
- B. Concrete polymer reinforced pipe.
- C. HDPE as specified above.
- D. Cured in Place Pipe (CIPP) shall adhere to these referenced standards
 - ASTM F1216: Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin- Impregnated Tube.
 - ASTM D5813: Cured-in-Place Thermosetting Resin Sewer Pipe. Inversion Lining.
 - ASTM D790: Test Methods for Flexural Properties of Non-Reinforced Plastics.
 - ASTM F1743: Cured in Place Thermosetting Resin Sewer Pipe. Pull In and Inflate.

6-2.050 Fittings

Fittings and adapters shall match the pipe material being used.

- A. For HDPE pipe all fittings and adapters shall be molded and fabricated HDPE compatible with the specified pipe, referenced standards and manufacturer requirements. All joints shall be butt-fused joints in accordance with referenced standards, and manufacturer requirements and using equipment specifically developed for joint fusions.
- B. For DI pipe, all fittings and adapters shall meet all requirements of Division 2 Water or Division 3 Sewer as applicable. In addition, all DI pipe joints and adapters shall be restrained joint and Field-Lock gaskets are not acceptable as restrained joint.

6-2.060 Drilling Fluid

Drilling fluid, if used, shall be a slurry mix specifically used for horizontal directional drilling or Microtunneling and shall be biodegradable and non-toxic.

6-2.070 Tracer Wire and Box

Tracer wire shall be installed with installations of non-metallic carrier pipe, including open cut installations.

- A. Tracer wire shall be installed with the carrier pipe during HDD installations. The tracer wire shall extend from end-to-end of the section being installed in one continuous length without splices. Wires shall be terminated in a traffic rated magnetized tracer box on each end.
- B. Tracer wire for HDD installation shall be a 10 AWG solid conductor. Conductor shall be hard-drawn, 21% IACS, copper clad steel, utilizing a AISI 1065 high carbon steel core, with rated break load of 1,940 lbs (238,000 psi). Conductor

shall be extruded with a 45 mil, high density, high molecular weight polyethylene (HMW-HDPE) pursuant to ASTM D1248 standard. Tracer wire shall be PRO-TRACE HDD-CCS PE45 as manufactured by Pro-Line Safety Products or approved equal.

- C. Tracer box shall be traffic rated with blue coated locking cast iron cover with direct connect terminal and encapsulated magnet system for amplification. Tracer box shall be SnakePit model RB14*TP as manufactured by Copperhead Industries, LLC, or approved equal. Installation of the tracer box shall be performed per Cast Iron Valve Box detail WD-13.

6-3.000 INSTALLATION

6-3.010 General

When approved by the District trenchless methods may be considered an option for the Contractor.

When approved by the District, use of HDD shall generally comply with the Horizontal Directional Drilling Manual as published by the North American Society for Trenchless Technology (NASTT) and standard industry requirements.

When approved by the District, the use of microtunneling shall generally comply with the Standard Construction Guidelines for Microtunneling as published by the American Society of Civil Engineers (ASCE) and standard industry requirements.

When the approved trenchless method includes a casing and carrier pipe, the external void space between the casing and native material shall be filled with grout as specified on the approved plans. The annular void between the carrier pipe and casing shall be filled and the ends sealed off in accordance with District Standard Drawing TI-1.

6-3.020 Trenchless Installation

Pipe shall be installed to the lines and grades as shown on the plans and profiles. Because of the minimum pipe slopes and easement width, installation of the pipe shall be closely monitored to maintain the proper alignment.

Easements allowed for construction shall be as shown on the plans. All debris caused by construction shall be removed from the premises and legally disposed of. Contractor is liable for damages caused to construction areas from heavy equipment and trucks. Contractor is responsible for restoring area when construction is complete.

The equipment used during the drilling operation shall be determined by the Contractor for the approved trenchless method and meeting the requirements of the plans or specifications of this project.

The Contractor's drilling equipment shall be equipped with an electrical strike by sensing both current and voltage. The strike system shall be equipped with warning strobes on both the drill frame and the power unit. Contractor shall supply grounding mats for the operator.

Water required for the drilling operation may be obtained from the District if available. If available and the Contractor elects to use, Contractor shall apply to the District for a water use permit and shall furnish backflow prevention equipment according to District Standards. Water use shall follow the latest guidelines in accordance with District policy. Water for drilling operations shall not be used directly from a fire hydrant. The Contractor shall provide a tanker truck for use as a water reservoir for the drilling operation.

Contractor shall provide portable fluid (mud) tanks at both entry and exit points to contain all drilling fluids resulting from the drilling operation and is responsible for proper disposal of all drilling fluids and waste tailings offsite unless a suitable location is approved by the District.

For HDD installations, the pullback method shall be used to install the water/sewer lines. Once the pullback has begun, it shall be continuous until full completion. Contractor shall make preparations for extended hours of operation during pullback of piping.

Contractor shall maintain a minimum horizontal separation of ten (10) feet between all sewer and water lines except when placed in the same casing. When water main pipe and sewer main pipe need to be installed in the same casing, the installation shall meet the Washington State Department of Health (DOH) separation requirements and may require separation by an additional casing around either the water or sewer within the joint casing. DOH approval is required whenever water and wastewater pipes are proposed to be placed in the same casing.

Acceptable horizontal and vertical tolerances vary depending on the trenchless method being used. In general and unless identified in the approved plans: horizontal variances are plus or minus one (1) foot from the plan alignment and vertical variances are plus or minus one-half foot from the elevation centerline or tighter. For gravity sewer carrier lines, pipe shall meet the minimum allowable slope or greater, per Division 3, continuously in the direction of flow. Contractor shall continuously record all measuring and gauging equipment used at all times during operation and pullback of the piping and the District shall have access to these records. Drilling fluids shall be recycled during the drilling operation whenever possible.

Contractor shall use every available means to install the pipeline in accordance with the approved plans. This includes sealing and re-drilling all or any part of the pilot hole if the completed or partially completed pilot is not in compliance with the plans. In the event the pipeline becomes lodged and cannot be pulled out of the drilled hole during installation, the Contractor shall seal the pipeline and existing hole and re-drill a pilot hole and pullback the pipeline again.

Drilling operations shall minimize impact on the environment. Contractor shall restore jobsite to original condition upon completion of all work activities.

The entire length of the trenchless installation shall have a recorded profile upon completion. Information shall be continually recorded throughout the drilling operation by a surface computing system placed behind the bit. Contractor shall furnish this information to the District upon completion of the trenchless method operation.

All HDPE pipe shall have butt-fused joints completed in accordance with the manufacturer's recommendations as to equipment and technique by workers who have a demonstrated ability and experience in the fusion process. HDPE pipe shall be butt-fused into the maximum available lengths prior to pulling the pipe into the directional drill hole. Following the joint fusion

process of the HDPE, all interior butt welds shall be reamed to provide the full unobstructed inside diameter of the HDPE pipe for sewer installations.

Following installation of the HDPE pipe by the directional boring technique, the pipe shall be allowed to return to its equilibrium length and temperature. No connections, pipe cutting or other work will be allowed on the HDPE pipe for 48 hours following installation.

6-3.030 CIPP Liner Installation- Rehabilitation

The CIPP liner shall be installed and cured in the host pipe per the manufacturer's instructions, following the methods indicated in the materials submitted. CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, except as modified herein.

Resin Impregnation - The quantity of resin used for tube impregnation shall be sufficient to fill the volume of all voids in the tube material with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. The amount of resin used shall exceed the calculated value by ten percent (10%) to fill the voids in the annular between the CIPP and the existing pipe due to the structural deterioration of the existing pipe. The person in charge of the Contractor's wetout process shall submit a signed wetout sheet that shows the quantity of resin that was placed into the fabric tube, and certifies that the information is accurate and the resin was distributed uniformly throughout the fabric tube. A vacuum impregnation process shall be used. To ensure thorough resin saturation throughout the length of the felt tube the level of the vacuum and the speed of the resin advance shall be coordinated so that white spots (dry areas) at the inside surface of the flexible membrane shall be small, shallow, less than 10% of the fabric tube wall thickness or 3-mm, whichever is less, and be less than 1% of the volume of the resin per unit length.

A roller system shall be used to uniformly distribute the resin throughout the tube. The roller gap dimension shall be calculated by a method that determines the correct volume of resin/felt per unit length (foot, yard or meter), contained within the confining perimeter of the flexible membrane. A gap dimension calculation based on the parameters as diameter, cut size, nominal felt void percentage, nominal resin polymerization shrinkage, the design thickness, and whether the flexible membrane will end up as the ID of the CIPP as with inversion, or the OD as with a pull-in method shall be submitted to the District for approval. If the Contractor uses an alternate method of resin impregnation and resin distribution, the method must produce the same results. The District must approve any alternate resin impregnation method.

The wetout tube shall be positioned in the pipeline using either inversion or a pull-in method. If pulled into place, a power winch shall be utilized and care should be exercised not to damage the tube as a result of friction during pull. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.

Prior to installation, remote temperature gauges (typically thermocouple probes) shall be placed inside the host pipe at the invert level of each end to monitor the temperatures during the cure cycle. Liner and host pipe interface temperature shall be monitored and logged during cure and cool-down.

Curing shall be accomplished by utilizing hot water under hydrostatic pressure in accordance

with the manufacturer's recommended cure schedule. The heat source in and output temperatures shall be monitored and logged during the cure and cool-down cycles. The manufacturer's recommended cure schedule shall be submitted for each line segment installed, and the liner wall thickness and the existing ground conditions with regard to temperature, moisture level, and thermal conductivity of soil, per ASTM F1216, 7.6.1.2 or ASTM F1743, 6.6.1.2 as applicable, shall be taken into account and shown how those factors influence the cure schedule.

If a pulling method is used, a cable shall be strung through the existing pipe to be rehabilitated and attached to the liner through an existing manhole or access point. The liner shall be pulled through the existing manhole and through the existing pipe by this cable. Care shall be taken not to damage the existing sewer lines or manholes during the installation. Appropriate sleeves and rollers shall be used to protect the liner.

6-3.040 Cool Down

The Contractor shall cool the CIPP in accordance with the approved manufacturer recommendations. Cooling shall be done without pressure interruption and with either water or air. When the exterior "skin" (interface) temperature on both ends reaches 100° F and held for the appropriate period of time, the processing shall be finished. The equipment may then be disconnected.

Temperatures shall be monitored and recorded throughout the installation process to ensure that each phase of the process is achieved at the approved manufacturer's recommended temperature.

6-3.050 Finish

The finished lining shall be continuous over the entire length of an installation run and be free from visual defects such as foreign inclusions, dry spots, pinholes, and de-lamination. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to inside the lined pipe.

Any defect, which will or could affect the structural integrity or strength of the linings, shall be repaired at the Contractor's expense, in a manner approved by the District.

The beginning and end of the CIPP shall be sealed to the rehabilitated pipeline. The sealing material shall be compatible with the pipe end and shall provide a watertight seal.

6-3.055 Sliplining Installation- Rehabilitation

Sliplining is an acceptable rehabilitation method for sewer and water mains whereas the existing main becomes a casing for a smaller carrier pipe. The District may allow for Sliplining under certain circumstances and only when proposed lines can accommodate final build out flows or demand utilizing a smaller diameter carrier pipe.

6-3.060 Testing and Acceptance

Trenchless methods shall be subject to all conditions and requirements of the applicable portions of Division 2-Water and/or Division 3-Sewer.