**USP00407 (01-01-21)**

### Section 00407 – Horizontal Directional Drilling

Section 00407, which is not a Standard Specification, is included in this Project by Unique Special Provision.

**Description**

00407.00 **Scope**  - This work consists of furnishing and installing pipe using horizontal directional drilling (HDD) methods. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration.

**00407.01 Definitions** :

**Drilling Fluids –** A mixture of water and additives, such as bentonite, environmentally safe polymers, surfactants, and soda ash, designed to block the pore space on a bore wall, enhance bore hole stability, reduce friction in the bore, and to suspend and carry cuttings to the surface.

**Frac Out** - A condition where the drilling fluid’s pressure in the bore exceeds the in situ vertical confining stress of the surrounding soils, thereby fracturing the soil and allowing the drilling fluids to migrate to the surface at an unplanned location. Also referred to as an Inadvertent Return of drilling fluid.

00407.05 **Required Submittals**  - Submit the following in one package for approval 10 days before beginning the HDD operation.

1. **General** – A construction plan showing details of the proposed methods of construction and the sequence of operations to be performed.
2. **HDD Contractor** **Experience** - Names and contact information of Contractor or subcontractor performing the Work along with qualifications for performing the Work including references and experience on similar projects in the last three years. Include experience and training for Superintendent, Foreman and Operator of HDD crew.
3. **Work Plan** - Shop drawings, schedule, and written description identifying details of the proposed sequence of work and construction operations to be performed, including the following: Show site constraints, equipment and materials staging, proposed crossing configuration, entry and exit angles, location and dimensions of proposed insertion, retrieval, and drilling fluid containment pits dewatering and methods of removing spoils material, method of fusion pipe segment,, type of cutting head, pipe layout prior to pull-back, traffic control plan (if applicable), and contingency plan for possible problems.
4. **HDD Drilling Equipment** - Detailed drawings and cut sheets of drilling equipment including manufacturer, capacity, arrangement of equipment and maximum pullback and push torque.
5. **Pipe Stress Calculations –** Calculations showing the anticipated pullback forces, the equivalent stresses on the pipe, the allowable stresses of the pipe to be installed and calculates safety factors.
6. **Drilling Fluid System** – Details and description of the proposed drilling fluid system that shows the manufacturer and capacity of the drilling fluid mixing and delivery system. Include composition, viscosity, and density of fluid. Include material safety data sheet and special precautions required.
7. **Delivery System** - The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and conveyed to the drilling fluid recycling system. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and recycling facilities.
8. **Spill Contingency Plan** - Details and requirements for the frac-out and Surface Spill Contingency. Include information on how the Contractor will control operational pressures, drilling fluid weights, drilling speeds, and any other operational factors required to avoid hydrofracture fluid losses and control drilling fluid spillage.
9. **Maintaining Line and Grade** - Details and description of proposed guidance equipment, method of line and grade control, and proposed frequency of line and grade checking. In case of deviation, include proposed method of bringing drill head onto specified line and grade.
10. **Drill Logs** – After construction of the HDD sewer mainline is complete, submit drill logs giving the horizontal and vertical position of the sewer mainline to confirm its conformance to specified depth and line and grade, as well as stresses on pipe during installation.

**Materials**

00407.10 **Pipe**  - Provide high molecular weight, high density polyethylene pipe and fittings manufactured from virgin grade material, to the diameter and dimension ratio shown on the Contract Documents. The pipe shall meet all requirements dictated in ASTM F714.

1. **Markings** – Pipe materials shall be legibly marked by the pipe manufacturer with the following information:
	1. Nominal pipe diameter
	2. Dimension ratio
	3. The letters “PE” followed by the polyethylene grade per ASTM D1248
	4. Manufacturing Standard Reference
	5. A production code from which the date and place of manufacture can be determined

Pipe material shall be listed by the Plastic Pipe Institute (PPI) with a designation of PE3608 or 4710 and have a minimum call classification of 345464C as described in ASTM D3350. Pipe shall contain no recycled compound except that generated in the manufacturer’s own plant from resin of the same specification from the same raw material pipe. Pipe (excluding black colored pipe) stored outside shall not be recycled. Pipe and fittings shall be made in conformance with ASTM F714 and ASTM D3261 as modified for the specified material. The material shall have a long-term hydrostatic strength (LTHS) of 1,600 psi when tested and analyzed in accordance with ASTM D2837. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions or other injurious defects and be uniform in density and other physical properties. Any pipe not meeting these criteria will be rejected.

1. **Pipe Color** – Pipe shall be:
	1. black or gray only
	2. homogeneous throughout
2. **Standard Dimension Ratio (SDR)** – Pipe shall conform to the following or as approved or shown in the Contract Documents.
	1. Nominal Size: 4 to 12 inches
	2. Minimum Strength: DR 17

00407.11 **Drilling fluid**  - Drilling fluid shall be composed of bentonite clay, water, and non-toxic additives (as deemed necessary). The mixture shall be mixed thoroughly and be free of clumps or chunks. The viscosity shall be consistent and sufficient to suspend cuttings and maintain the integrity of the bore walls.

00407.12 Service Connections – New lateral service connections to the HDPE sewer main shall be accomplished by electrofusion saddle type fittings or approved equal. The service connection shall be specifically designed for connection to the HDPE sewer main being installed.

**Equipment**

00407.20 **Horizontal Directional Drilling Equipment**  - The directional drilling equipment shall consist of a hydraulically powered, fluid assisted, remote guided boring machine, capable of installing the pipe as shown on the Contract Documents without damage to the pipe, adjacent structures, utilities or, property. The equipment shall provide accurate and timely control of the boring head line and grade and monitor and record applied forces during all stages of operation. The equipment shall be capable of measuring and recording down hole fluid pressures throughout the drilling operation. The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets. The equipment shall also be electrically grounded at all times. The hydraulic system shall provide sufficient pressure and volume to the power the drilling operation and shall be free of leaks. It shall have a system to monitor and record maximum pull-back pressure during pull-back operations. There shall be a system to detect electrical current from the drilling string and an audible alarm which automatically sounds when an electrical current is detected.

**00407.21 Guidance System** - A Magnetic Guidance System (MGS) or proven gyroscopic system shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to eighty feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The Guidance System shall be of a proven type and shall be operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies on the surface of the drill path and shall consider such influences in the operation of the guidance system if using a magnetic system.

**00407.22** **Pipe Fusing System** – Provide pipe fusing equipment as approved by the pipe manufacturer capable of fusing pipe joints to be as strong, or stronger, than the pipe wall itself. Provide coupon testing as requested by the Owner’s Representative to demonstrate fully fused full penetration butt welded joints.

**Labor**

00407.30 **General**  - Supervisors shall have a minimum of five years experience in horizontal directional drilling. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. In all cases the supervisor must be continually present at the job site during the actual Directional Bore operation.

**Construction**

**00407.40 Bore Tracking and Monitoring** - Provide and maintain a bore tracking system that is capable of accurately locating the position of the drill head in the x, y, and z axes at all times during the pilot bore. Record and monitor these data at least once per drill pipe length or every twenty-five (25) feet, whichever is most frequent.

**00407.41 Drilling Fluid Pressures and Flow Rates** -Drilling fluid pressures and flow rates shall be continuously monitored and recorded. The pressures shall be monitored at the pump. These measurements shall be made during pilot bore drilling, reaming, and pullback operations. No mud pits or ponds will be allowed on site unless shown on the plans. Minimize drilling fluid pressure to prevent loss of fluid to surrounding pipelines, structures or the ground surface.

**00407.42 Protection of Storm Water System**  **–** Plug the outgoing pipes in storm maintenance holes during the HDD process. Upon completion of the HDD process, hydrojet clean each of the storm pipes, inlets, and inlet leads connected to these maintenance holes and then remove the plugs.

**00407.43 Reaming**  **–** Perform intermediate reams prior to performing the final ream. The incremental increase in diameter between the each of the reams shall be no more than six inches. The final ream shall be completed the same day as the pipe pullback. Following the completion of the final ream and prior to pulling the pipe, perform a proof ream and log the torque on the machine during this operation.

**00407.44 Tail String**  **–** Run a drill pipe tail string behind the reamer for the full length of the bore for all reaming passes except during pipe pullback.

**00407.45 Drilling Fluid Losses**  **-** Control operational pressures, drilling mud weights, drilling speeds, and any other operational factors required to avoid hydrofracture fluid losses to formations, and control drilling fluid spillage. If drilling fluid losses occur then drilling must be stopped immediately and the source of the loss identified. All drilling fluid losses must be completely contained prior to the resumptions of drilling. Immediately notify BES of any inadvertent returns or spills and immediately contain and clean up the return or spill.

**00407.46 Pipe Rollers** - Pipe rollers, if utilized, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.

**00407.47 Pipe Rammers** -Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of BES Representative.

**00407.55 Trenchless Service Laterals and Connections** – Inspect lateral per Section 00401.

**00407.70 Testing** -Refer tosubsection 00445.72 for pipe testing.

**Measurement**

00407.80 **Measurement**  – The quantity of pipe installed will be measured on a linear foot basis from center to center of maintenance holes or other structures, as applicable.

Service connections and laterals noted in the Contract Documents as Trenchless Service Laterals will be paid according to 00445.

Service connections will be measured as field fabricated connections according to 00445.

**Payment**

00407.90 **Payment**  - The accepted quantities will be paid at the contract price for one or all of the following items:

 **Pay Item Unit of Measurement**

(a) Horizontal Directional Drilling, HDPE, ASTM F714, DR\_\_, \_\_Inch Pipe Linear Foot

(b) Service Connections Each

In item (a), the dimension ratio will be entered in the first blank and the nominal pipe diameter will be inserted in the second blank. Item (a) includes all related excavation, shoring and bracing, backfill and compaction, and temporary pavement restoration of insertion, retrieval, and drilling fluid containment pits.

Service connections and laterals noted in the Contract Documents as Trenchless Service Laterals will be paid according to 00445.

Payment will be payment in full for furnishing all equipment, labor, materials and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for CCTV inspection, pipe cleaning, sag elimination, point repairs, leak testing, acceptance testing and surface restoration associated with this work, including restoration of pits.