

DIVISION 2 - SITEWORK
SECTION 02446 - HORIZONTAL DIRECTIONAL DRILLING FOR
DEDICATED PUBLIC FORCE MAINS AND FOR GRAVITY LATERALS
WITH SLOPES OF 2% OR GREATER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall furnish all soils and site investigation, labor, material, and equipment necessary to perform a complete horizontal directionally drilled (HDD) force main pipeline installation, or a gravity sewer lateral with a slope of 2% or steeper, at the suitable location(s) as an alternate method to specified open trench installation. The scope includes, but is not limited to:
1. Clearing, grading, and general site/access preparation necessary for construction operations.
 2. Transportation of all equipment, labor, consumables and company supplied material to and from the job site.
 3. Assembly of High Density Polyethylene (HDPE) pipe.
 4. Erection of drilling equipment at the rig sites.
 5. Drilling of a pilot hole along the alignment defined on the Drawings and as specified herein.
 6. Reaming the pilot hole as specified herein to a diameter suitable for installation of the HDPE pipe.
 7. Pulling the assembled HDPE pipe through the reamed hole with tracer wire for future pipe location.
 8. Testing of the HDPE pipe after installation.
 9. Clean-up and final restoration of all work areas.

1.2 QUALITY ASSURANCE

- A. The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the Engineer's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.
- B. Directional drilling and pipe installation shall be performed only by an experienced Contractor specializing in directional drilling and whose key personnel have at least 2 years experience in this Work, in particular, pilot hole steering and position monitoring, reaming and backpulling.
- C. Field supervisory personnel: Experienced in the performance of work and tasks as stated herein for minimum of 2 years.

1.3 SUBMITTALS

- A. Submit for information only.
1. Presentation of similar experience in the last 5 years.

2. Include, but not limited to, owner name, address, telephone number, contact person, date and duration of work, location, pipe information (including type, size and length), and contents handled by pipeline.
 3. Supervisory field personnel and historical information of HDD experience.
 - a. At least one field supervisor listed must be at site when HDD operations are in progress.
- B. For dedicated sewer mains, submit the following in accordance with Section 01300. Submittals not required for privately owned gravity sewer laterals.
1. Working Drawings and written procedure describing in detail proposed method and entire operation for information only including, but not limited to:
 - a. Size, capacity and arrangement of equipment.
 - b. Location and size of drilling and receiving pits.
 - c. Dewatering and methods of removing spoils material.
 - d. Method of installing detection wire and force main pipe.
 - e. Type, location and method of installing locator station.
 - f. Method of fusing pipe segment and type of equipment.
 - g. Type of cutting head.
 - h. Method of monitoring and controlling line and grade.
 - i. Detection of surface movement.
 - j. Bentonite drilling mud for information only:
 - 1) Products information, material specifications, and handling procedures.
 - 2) Material safety data sheet and special precautions required.
 - 3) Method of mixing and application.
- C. Submit daily logs of construction location, progress and events, including observations of location and elevation of significant soil strata boundaries and brief soil descriptions, and jacking pressures and torsional forces, if applicable.

1.4 PROJECT CONDITIONS

- A. Contractor shall made all necessary investigations of soil, utility crossings, and any other subsurface conditions that could affect the successful use of the HDD method for installation of the force main pipeline in the areas proposed for its use. Test pits shall be opened to locate all existing utility crossings as part of the investigation. Test pits shall be opened at approximately 250' intervals (or closer) where utility location test pits are insufficient. No subsurface investigation was performed for the preparation of the Contract Documents.
- B. Complete HDD so as not to interfere with, interrupt, or endanger surface and activity thereon.
- C. Follow applicable ordinances, codes, statutes, rules, and regulations of Commonwealth of Pennsylvania, applicable municipal building codes, regulations of any affected Railroad Company, and applicable regulations of Federal Government, OSHA 29CFR 1926, and applicable criteria of ANSI A10.16-1995 (R2001), "Safety Requirements for Tunnels, Shafts, and Caissons."
- D. The contractor will at all times provide and maintain instrumentation which will accurately locate the pilot hole and measure drilling fluid flow discharge rate and pressure. The Engineer will have access to these instruments and readings at all times.

PART 2 PRODUCTS

2.1 MATERIALS

A. Pipe.

1. HDPE: In accordance with Section 02710. The Contractor shall verify that the specified pipe is expected to perform satisfactorily for the HDD installation process. The Contractor is responsible for selecting a thicker pipe wall material than that specified if needed to stay within the allowable tensile stress limits as specified by the pipe manufacturer.

B. Drilling Fluid:

1. 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.
2. Bentonite drilling mud shall be compatible with environment.
3. Waste oil or environmentally non-compatible polymers cannot be part of drilling fluid composition.

C. Detection Wire: TW, THW, THWN, or HMWPE insulated copper, 10 gage or thicker wire.

D. Locator Station.

1. Underground, Flush Mounted:
 - a. Tube minimum 15 inches long with minimum inside diameter of 2-1/2-inches made of non-corrosive material, schedule 40 PVC, HDPE, or equal.
 - b. Factory attached cast iron or high-impact plastic collar with ribs to prevent rotation when removing locking lid after locator station is set in concrete.
 - c. Light blue cast iron or high-impact plastic locking lid that will withstand AASHTO H-20 traffic loads and ultra-violet rays.
 - d. Mark locking lid to identify pipeline with permanent identification such as P.S. Locator.
 - e. Terminal block made of high dielectric material which is made of phenolic resin, plastic, micarta, Lexan or Bakelite for each locator station.
 - 1) Terminal block furnished with two 3/16-inch threaded studs, nuts, and washers made of nickel plated brass.
 - f. Approved manufacturers:
 - 1) C.P. Test Services, Inc., Model Mini.
 - 2) Handly, Industries, Model T2IS2.
 - 3) Or approved equal.
2. Manhole Mounted:
 - a. Waterproof enclosure made from cast aluminum, galvanized steel, high-impact plastic, Lexan, Gyrlyn, or equal.
 - b. Light blue schedule 40 PVC pipe or schedule 40 galvanized steel with outside diameter of at least 3/4-inch to mount enclosure.
 - c. Use similar materials for pipe and enclosure to fasten enclosure onto pipe following manufacturer's instructions.
 - d. Approved manufacturers:
 - 1) Cott Manufacturing Company, Model Finklet or Finkplate, 2 leads.
 - 2) Gerome Manufacturing Company, Inc., Model Testox Series 300, 2 leads.
 - 3) Or approved equal.

E. Equipment

1. General

- a. As a minimum, the directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform a 200' bore and pullback the sewer pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the bore, a guidance system to accurately guide coring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, personnel meeting the training requirements, and all other equipment required to complete the installation. The Contractor has the option of using a drilling fluid recycling system capable of removing solids from the drilling fluid so that the fluid can be re-used.
2. Prior to delivery to the site, all drilling equipment shall be serviced, inspected for damage and repaired as necessary. The equipment shall be in good, safe operating condition.
3. Whenever possible, the HDPE pipe should be joined by the method of thermal butt-fusion, as outlined in ASTM D-2657, Heat Joining Polyolefin Pipe and Fittings. Comply with the procedures and tolerances recommended by the pipe manufacturer. Joints shall be performed by adequately trained and qualified personnel.

PART 3 EXECUTION

3.1 PREPARATION

- A. Excavate pits following Working drawings and Section 02213.
- B. Provide equipment to guard against electrocution (such as ground mats, ground cables, hot boots and gloves) and an alarm system on drilling equipment capable of detecting electrical current as it approaches near electric lines.
- C. Test pit all known underground utility crossings before starting the HDD operation following Section 02213. 'Soft-dig' methods may be used for test pitting in lieu of trench excavation.
- D. The Contractor shall take precautions to protect the pipe while it is being handled and stored.

3.2 OPERATION

- A. General.
 1. The Engineer must be notified 48 hours in advance of starting work for dedicated sewer lines. For privately owned laterals, coordinate inspection in accordance with the sewer permit requirements. For public mains, the Directional Bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made. The Engineer approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.
 2. The Contractor shall take responsibility for the restoration of any damage caused by heaving, settlement, separation of pavement, escaping drilling fluid, or the directional drilling operation, at no cost to the Owner.
 3. The Contractor is responsible for obtaining all necessary permits. Copies of each permit shall be available to the Engineer at the work site.
 4. Determine drilling length and equipment pull strength for type of soil encountered.
 5. Provide method to control line and grade.
 - a. Provide and maintain instrumentation that accurately locates pilot hole.
 - b. Drill pilot hole along path following Drawings to these tolerances:
 - 1) Vertical alignment plus or minus 0.5 foot for force main sewers, and plus or minus 2" for gravity laterals. Vertical path of pilot hole must not establish new high points

- not shown on Drawings. Pipe may be installed deeper than minimum shown on the drawings, if approved by the Engineer.
- 2) Horizontal alignment plus or minus 1.0 foot.
 - 3) Maintain a minimum 18" clearance from the tolerance zone of existing utilities as much as possible.
- c. Include electronic monitoring of horizontal and vertical drilling head location. Obtain accuracy range within 1 inch of actual position of pipeline. Record position readings at maximum of 10 foot intervals.
 - d. At completion of pilot hole drilling, furnish tabulations of horizontal and vertical alignment to Engineer.
 - e. For gravity laterals, pilot holes may be eliminated in-lieu-of cleanout excavations spaced at 75 foot intervals. When cleanout holes are excavated, contractor shall confirm that adequate positive continuous slope is achieved from building to sewer main. When acceptable slope is determined, pipe may be cut and cleanout installed on the lateral main line.
 - f. If adequate positive continuous slope is not achieved, the inadequate horizontal directional drilled pipe shall be abandoned and a new pipe shall be installed. For pipes where portion of the drilled area is found to be adequate, the property owner and contractor may have the option to abandon and re-drill only the inadequate portion; or open cut and replace the inadequate sloped pipe with hand laid open trench pipe.
6. When water is encountered.
 - a. Provide and maintain dewatering system of sufficient capacity to remove water.
 - b. Keep excavation free of water until backfill operation is in progress.
 - c. Perform dewatering in manner that removal of soils particles are held to minimum.
 - d. Dewater into sediment trap following Section 02270.
 7. Maintain close observation to detect settlement or displacement of surface and adjacent facilities.
 - a. Notify Engineer immediately if settlement or displacement is detected.
 - b. Maintain safe conditions and prevent damage.

B. Drilling Operation.

1. Drilling Fluids.
 - a. Maintain drilling fluid in bore hole to increase stability of surrounding soil and reduce drag on pulled pipe.
 - b. Dispose of drilling fluid and other spoils at location following laws, ordinances, rules, and regulations of the State and the local jurisdiction.
 - c. Transport excess fluids and other spoils to disposal site, at no additional cost to the owner, and pay any disposal costs.
 - d. Minimize drilling fluid at locations other than entry and exit points. Maintain a vacuum truck onsite during all drilling and immediately clean up any drilling fluids that inadvertently surface.
 - e. Provide clean water for drilling and hydrostatic testing, at no cost to the Owner.
 - f. Drilling fluids and other spoils shall not be discharged into sanitary or storm drain systems, ditches, or waterways.
2. Pilot Hole Drilling.
 - a. Angle entry hole so that curvature of pilot hole does not exceed allowable bending radius of HDPE pipe.
 - b. Be able to make a turn of up to 90 degrees and maintain curvature not to exceed allowable bending radius of HDPE pipe.

- c. Alignment Adjustment and Restarts.
 - 1) Follow pipeline alignment on Drawings within tolerances specified herein. Before adjustments, notify Engineer for approval.
 - 2) Notify Engineer when forward motion of operation is stopped by an obstruction.
 - a) Abandon in place with drilling fluid, unless Engineer directs otherwise.
 - b) Upon Engineer's approval, attempt second installation at approved location or excavate at point of difficulty and install HDPE pipe by trench method following Section 02225.
 - 3) Withdrawals, abandonments, and restarts are at no additional cost to the Owner when HDD is provided as an option of installation of pipe.
 - 4) Exercise caution including, but not limited to, locating utilities, drilling downholes (test pits) to observe drill stems or reamer assembly to clear other existing utilities at locations following Drawings.

3.3 INSTALLATION

A. Installing HDPE Pipe.

- 1. Provide a swivel to reaming assembly and pull section of pipe to minimize torsional stress on pull section after drilling pilot hole.
- 2. Hold reaming diameter to 1.5 times outside diameter of HDPE pipe being installed.
- 3. Protect pull section as it proceeds during pull back so it moves freely and is not damaged.
- 4. Pull detection wire along with HDPE pipe. Extend wire into locator station at each end of HDPE pipe.
- 5. When connecting to adjacent pulled or non-pulled section of HDPE pipe, allow pull section of pipe to extend past termination point. Make tie-ins the next day after pullback of HDPE pipe.
- 6. Test pit pipe installation to verify horizontal and vertical alignment at Engineer's direction. The Contractor may utilize utility crossing test pit locations for verification, with the Engineer's approval
 - a. One test pit for every 500 feet along length of pipeline, minimum for force main pipe. Per prior sections, gravity laterals shall be confirmed with the installation of cleanouts at 75' spacings.
 - b. Engineer may order additional test pit for each test pit that reveals pipeline installation is not in compliance with Contract Documents at no additional cost to the Owner.
- 7. Replace portions of pipeline not in compliance with Contract Documents at Engineer's direction and at no additional cost to the Owner.

B. Installing Locator Station (for dedicated pressure pipes only – not required for gravity laterals).

- 1. Locator Stations.
 - a. Install at each end of HDPE pipe in accordance with the specifications.
 - b. Flush mount underground locator install similar to typical cleanout detail with 4" thick concrete apron extending 6" around all sides of the lid and collar.
 - c. When HDPE pipe is connected to another type of pipe material, continue detector wire over connecting pipe, so locator station is installed out of paved area.
 - d. In areas scheduled to be improved identify and protect station locations immediately after installation.
 - 1) Space 3 stakes equally around the station.
 - 2) Extend at least 4 feet above existing grade.
 - 3) Flag with orange fluorescent wrap within 6 inches from top of stakes.
 - e. Manhole mounted locator station: install in accordance with manufacturer's recommendations.

2. Detection Wire.
 - a. Install detection wire without splices.
 - b. Terminate detection wire inside locator box using proper sized crimp type connectors on wire ends.
 - c. Connect each wire to terminal maintaining at least 18 inches slack in each wire for underground flush mounted locator stations.
 - d. Neatly coil slack wire in test station below terminal board.
 - e. Locate wires on top and along HDPE pipe.
 - f. Allow adequate slack and support to protect wires from damage during backfilling operations.
 - g. Test each detection wire for continuity after backfill is completed.
 - 1) If test for continuity is negative, repair or replace at Engineer's direction.
 - 2) After continuity is verified, connect each detection wire to terminal block in locator station.

3.4 FIELD QUALITY ASSURANCE

- A. Perform field hydrostatic testing of HDPE pipe as directed by the Engineer.
- B. Contractor shall maintain a daily project log of drilling operations and a guidance system log with a copy given to Engineer at completion of project. As-built drawings shall be verified for accuracy by the Engineer.

3.5 RESTORATION

- A. After successful installation and testing of the HDPE pipe is complete, the drilling pit and receiving pit, and all test pits shall be backfilled as specified in Section 02225.
- B. The areas used for the drilling and receiving pits, test pits and any other areas disturbed by the drilling equipment shall be restored in accordance with the Contract Documents.

END OF SECTION