

SECTION 15054

HORIZONTAL DIRECTIONAL DRILLING

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall design, furnish, and install the proposed watermain by Horizontal Directional Drilling (HDD) construction methods, as shown on the drawings and conforming to these specifications. The work includes, but is not limited to, geotechnical investigations, design, excavations, dewatering, removal of all materials encountered in the drilling operations, disposal of all material not required in the work, grouting bulkheads, testing, cleaning, and incidentals as shown on the drawings and as specified herein.
2. CONTRACTOR shall be responsible for installing the sections(s) of the watermain, as identified on the drawings, utilizing Horizontal Directional Drilling. The HDD process begins with boring a small, horizontal hole (pilot hole) under the crossing of the obstacle (i.e. creek, highway, railroad) with a continuous string of steel drill rod. The drill rod exits on the opposite side of the obstacle, at a predetermined location. Based on the diameter of the watermain and the ground conditions encountered, the CONTRACTOR shall create a bore path by connecting to the previously installed drill rods, an auger and back reamer. Various sizes may be utilized until the desired bore path size is achieved. The number of passes of the various sizes of augers and back reamers shall be as determined by CONTRACTOR. The watermain is pulled back with a special cutting tool, or “reamer”, through the borehole and exits back at the entry pit. The intent of the process shall minimize surface disruption by utilizing the cartridge installation method. This method is characterized by the assembling of flexible restrained joint pipe and pulling-back one joint at a time.
3. CONTRACTOR is responsible for any necessary geotechnical/subsurface investigations required to establish the appropriate parameters (i.e. limiting pressures, setback distances, depth of cover, etc.) for completing the design horizontal directional drilling alignment, as per the Army Corps of Engineers Recommended Guidelines for Installation of Pipelines Beneath Levees using Horizontal Directional Drilling.

B. General:

1. CONTRACTOR shall be responsible for the final design and constructed product, and for furnishing the design data, permits, qualified labor and superintendence necessary for this method of construction.

Horizontal Directional Drilling,

2. CONTRACTOR shall furnish all items necessary to perform the HDD operation and construct the pipe to the lines and grade shown on the drawings.
3. The Work includes, but is not limited to, the following:
 - a. All types and sizes of horizontally drilled watermain except those specified under other sections or other contracts.
 - b. Supports, restraints, and thrust blocks.
 - c. Installation of all flexible restrained joint pipe and gasketing materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, polyethylene encasement, temporary construction, and all other Work required to complete the horizontally drilled watermain installation.
 - d. Incorporation of valves, and special items shown or specified into the piping systems as required and as specified in the appropriate Division 15 sections.

C. Coordination:

1. Review construction sequencing and installation procedures under other sections.
2. CONTRACTOR is responsible to coordinate between other construction contracts that may be ongoing simultaneously.

D. Related Sections:

1. Section 02351 - Excavation, Backfill, and Trenching.
2. Section 03300 – Concrete.
3. Division 15

1.02 QUALITY ASSURANCE

- A. Reference Standards: comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. AWWA Manual of Practice M41 – Installation of Ductile Iron Pipe.
 2. AWWA C600, Disinfecting Water Mains.
 3. Latest edition of AWWA C150, AWWA C151, AWWA C105.
- B. CONTRACTOR must demonstrate expertise in Horizontal Directional Drill methods by providing a list of ten utility references for which similar work has been performed in the last two years. The reference should include a name and telephone number where contact can be made to verify the CONTRACTOR'S capability. The CONTRACTOR must provide documentation showing successful completion of the project [suited] for reference. Conventional trenching experience will NOT be considered applicable.
- C. CONTRACTOR shall have installed directionally drilled pipe at least as large as the diameter proposed herein and have performed water body crossings and crossing of flood control levees.

- D. All supervisory personnel must be adequately trained and will have at least ten (10) years of experience in directional drilling. CONTRACTOR shall submit the names and resumes of all supervisory field personnel prior to the start of construction.

1.03 SUBMITTALS

- A. ENGINEER will base the review of submitted details and data on the requirements of the completed work, safety of the work in regards to the public, potential for damage to public or private utilities and other existing structures and facilities, and the potential for unnecessary delay in the execution of the work. Such review shall not be construed to relieve the CONTRACTOR in any way of his responsibilities under the contract. CONTRACTOR shall not commence work on any items requiring CONTRACTOR'S construction drawings or other submittals until the drawings and submittals are reviewed and accepted by the ENGINEER. A maximum thirty (30) day review period will be required.
- B. The CONTRACTOR, prior to construction, shall prepare and submit for information the following:
 - 1. Horizontal Directional Drilling Plan describing the equipment, methods, procedures (pilot hole drilling, insertion, reaming, pullback, coating protection, internal cleaning, internal gauging, dewatering, purging, grouting, etc.), monitoring procedures (pressures, depth, alignment, placement, entrance and exit points, etc.), construction sequence, construction scheduling, contingency plans, and other items of concern to be performed during the horizontal directional drilling process.
 - 2. Project Safety Plan.
 - 3. Arrangement drawings and technical specifications of the drilling machine and ancillary equipment (including any modifications), three-year experience record with this type of drilling machine, and a copy of the manufacturer's operation manual for this machine.
 - 4. CONTRACTOR'S construction drawings, specifications, and contingency plans shall be submitted for the following items:
 - a. Complete details of the site clearing and equipment mobilization plan (Site Preparation Plan) including, but not limited to, the methods, procedures, and equipment arrangement to be used during the clearing and mobilization of the equipment onto the site.
 - b. Complete design details and calculations of the significant parameters and constraints associated with directional drilling operations including, but not limited to: expansion/contraction, limiting overburden/critical pressures, drilling fluid mixtures and limiting pressures, drilling/boring speed, hydrostatic tests and cleaning procedures.
 - 1) Complete details of grouting techniques of the annulus between the pipeline and the directional-drilled shaft

(adjacent soil), including equipment, pumping procedures, pressures, mixtures, and plug systems.

- 2) Method of monitoring and controlling the mud and bore hole pressures during all drilling operations.
- 3) Method of monitoring and controlling the specified speed, line, and grade of excavation including, but not limited to, the methods, procedures, reliability, and necessary equipment to be used during the directional drilling operations.
- 4) Complete details of the muck/spoils containment, dewatering, drying, and removal methods, procedures, equipment, contingency plan, and off-site disposal location.
- 5) Complete details of the methods, procedures, and equipment arrangement to be used during the flexible restrained joint ductile iron pipe storage, assembly, installation, cleaning, and testing.
- 6) Proposed contingency plans for the protection of the creek, river, floodwall/levee, and other underground structures including, but not limited to, the complete details of the methods/procedures, equipment to be used, etc. for critical phases and areas of the directional drilling operations.
- 7) Statement by pipe manufacturer indicating that they have reviewed the design drawings and the CONTRACTOR'S proposed methods and agree that the pipe proposed is suitable for the application. This certification shall include recommended manufacturer's pulling loads and any other limitations or restrictions.

- c. Drawings and calculations for all sheeting and/or shoring proposed. These shall bear the seal of a Professional Engineer licensed to practice in New York State.

C. Quality Control Methods: At least 10 days prior to the start of directional drilling, CONTRACTOR shall submit a description of the quality control methods he proposes to use in the directional drilling operations to the ENGINEER. The submittal shall describe:

1. Procedures for controlling and checking line and grade.
2. Field forms for establishing and checking line and grade.

D. Safety: Procedures including, but not limited to, monitoring for gases encountered shall be submitted.

E. Hazardous chemical list as well as all MSDS and technical data sheets.

F. CONTRACTOR is required to bring to the attention of the ENGINEER any known discrepancies with actual tunneling methods that the CONTRACTOR will

be performing. This shall be stated, in writing, to ENGINEER no later than the pre-construction meeting.

- G. Record Drawings:
 - 1. CONTRACTOR required to submit certification, by a Professional Engineer licensed in the State of New York, that the directional drilling has been performed in accordance with the construction drawings, or provide signed and sealed record drawings of the installation if it varies from the design as shown in the construction drawings.
 - 2. Submit record drawings prior to the time of Substantial Completion.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site to ensure uninterrupted progress of the Work.
- B. During delivery and handling, all materials shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the materials.
- C. Equipment used for unloading shall be covered with wood or rubber to avoid damage to the exterior of the pipe, fittings, and accessories. Furthermore, all ductile iron pipe requiring polyethylene encasement, as per Section 15106, where polyethylene has been field pre-applied to the pipe shall be handled with suitably padded equipment to prevent damage to the polyethylene prior to installation. Do not drop or roll materials off trucks. All ductile iron pipe and fittings shall be handled with padded slings or other appropriate equipment. The use of cables, hooks, or chains will not be permitted.
- D. The materials shall be inspected before and after unloading. Materials that are found to be cracked, gouged, chipped, dented, or otherwise damaged will not be accepted.
- E. Interiors of pipe, fittings, and accessories shall be kept free from dirt and foreign matter.
- F. Store pipe and fittings on soil berms, heavy wood blocking, or platforms of other construction to they are not in contact with the ground.
- G. Pipe, fittings, and specials shall be unloaded opposite to or as close to the place where they are to be used as is practical to avoid unnecessary handling.
- H. CONTRACTOR shall at all times handle the pipe in a manner that does not overstress the pipe.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. Pipe for Horizontal Directional Drilling (HDD) construction shall be Ductile Iron, Class 53, flexible restrained joint pipe with a spigot retainer weldment, in accordance with Section 15106, Ductile Iron Pipe, Fittings, and Accessories.
2. Ductile iron pipe shall be installed with a double polyethylene encasement as specified in Section 15106, Ductile Iron Pipe, Fittings, and Accessories.
3. All materials must be suitable for use in potable water systems and all surfaces that come in contact with the water stream shall be NSF 61 approved.
4. All ductile iron pipe, fittings, and accessories shall be designed for a working pressure and field hydrostatic test pressure as shown in Section 15051, Buried Piping Installation and as follows herein.
5. All ductile iron pipe, fittings, and accessories must be new materials in first-class condition. Used or recycled pipe, fittings, specials, or accessory materials shall not be allowed, regardless of condition.
6. All ductile iron pipe shall be supplied from one manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. In addition to notifying UFPO for utility markout, any utility within 10 feet of the centerline of the borepath shall be surfaced marked and "potholed" at appropriate intervals to verify the horizontal and vertical location. CONTRACTOR shall install the flexible restrained joint ductile iron pipe by means of HDD using the cartridge installation method as described in section 1.01.A.2, specified, and not exceeding the allowable pulling loads as recommended by the manufacturer.
2. CONTRACTOR shall be responsible for his means and methods of HDD construction and shall ensure the safety of the Work the CONTRACTOR'S employees, the public, and adjacent property, whether public or private.
3. CONTRACTOR shall anticipate that portions of the drilled excavation will be below the groundwater table.
4. CONTRACTOR shall comply with all local, state, and federal laws, rules, and regulations at all times to prevent pollution of the air, ground, and water.

5. If there is a conflict between manufacturer's recommendations and the Drawings or Specification, request instructions from ENGINEER before proceeding.

B. Launching and Receiving Pits.

1. CONTRACTOR shall excavate, sheet, shore, dewater, and perform all other work necessary to provide adequate launching and receiving pits for his HDD operations.
2. All work shall be performed in strict accordance with OSHA regulations.
3. All sheeting, shoring, and bracing shall be designed by a New York State licensed Professional Engineer as specified in Section 1.03.B.4.c.
4. Temporary fencing shall be provided around each pit. Fencing shall be a minimum of 4 feet in height. Fencing materials, layout, and installation details shall be subject to approval by the ENGINEER.
5. Upon completion of HDD operations, all pits shall be backfilled and surface restored as specified in Sections 02351, Excavation, Backfill, and Trenching and 02900, Restoration.

C. Drilling Operations:

1. Directional drilling/boring shall use techniques of creating or directing a borehole along a predetermined path to a specified target location. This involves use of mechanical and hydraulic deviation equipment to change the boring course and shall use instrumentation to monitor the location and orientation of the boring head assembly along a predetermined course.
2. Drilling shall be accomplished with fluid assisted mechanical cutting. Drilling/boring fluids shall be an appropriate mixture of either bentonite and water or polymers and additives with water. Bentonite sealants and water will be used to lubricate and seal the mini-tunnel. It is mandatory that minimum pressures and flow rates be used during drilling operations so as not to fracture the sub-grade material around and above the bore ("frac-out").
3. CONTRACTOR shall have a mobile vacuum spoils recovery system/vehicle on-site to remove the drilling spoils from the access pits. The spoils must then be transported from the job site and be properly disposed of. Under NO circumstances shall the drilling spoils be permitted to be disposed into waterways, sanitary, storm, or any other public or private drainage system.
4. The mobile drilling system shall utilize small diameter fluid jets to fracture and mechanical cutters to cut and excavate the soil as the head advances forward. Mechanical, pneumatic, or water-jetting methods will be considered unacceptable.
5. Steering shall be accomplished by the installation of an offset section of drill stem that causes the cutterhead to turn eccentrically about its centerline when it is rotating. When steering adjustments are required, the

cutterhead offset section is rotated toward the desired direction of travel and the drill stem is advanced forward without rotation.

D. Tolerances:

1. CONTRACTOR shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 20 feet. This “as-built” plan and profile shall be updated as the pilot bore is advanced.
2. Each exit point shall be located as shown with an over-length tolerances of 10 feet for directional drills of 1,000 linear feet or less and 20 feet for direction drills greater than 1,000 linear feet. Alignment tolerance of 5 feet left/right with due consideration of the position of the other exit points.
3. The CONTRACTOR shall at all times provide and maintain instrumentation that will accurately locate the pilot bore/hole and measure drilling fluid flow and pressure.
4. CONTRACTOR shall provide and grant ENGINEER access to all data and readout pertaining to the position of the bore and fluid pressures and flows. No information pertaining to the position or inclination of the pilot bore holes shall be withheld from the ENGINEER.

E. Ream and Pullback:

1. After an initial bore has been completed, a reamer will be installed at the termination/exit pit and the pipe will be pulled back to the starting/entry pit. The reamer must also be capable of discharging liquid clay/bentonite mixture to facilitate the installation of the pipe into a stabilized and lubricated tunnel.
2. Reaming operations shall be conducted to enlarge the pilot hole after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the CONTRACTOR. Under no circumstances shall there be less than two progressively larger reamers enlarging the borehole prior to the final reaming/pull-back begins.
3. The pulling thrust exerted on the pipe shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not overstressed.
4. A swivel shall be used to connect the watermain to the drill rods to prevent torsional stresses from occurring in the pipe.
5. The lead end of the pipe shall be closed during the pullback operation.
6. Ductile iron pipe shall be assembled utilizing the “cartridge method”. As each section of pipe is joined and poly-wrapped, the pipe string shall be advanced into the drill hole a sufficient distance to allow joining of another length of pipe. This sequence shall be repeated as necessary until the entire pipe string has been pulled back.
7. The watermain shall be adequately supported by rollers and/or side booms and monitored during installations so as to prevent overstressing or buckling during the pullback operation.

8. Support/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 watermain allowing for free movement of the watermain during pullback.
 9. Upon completion of pullback of the entire pipe string, the CONTRACTOR shall conduct a low-pressure air test to demonstrate the integrity of the pipe joints. This test shall be 15 minutes in duration and be witnessed by the ENGINEER or his representative.
- F. Grouting (Annular space between the installed pipe and the adjacent soils):
1. Grouting of the annular space between the pipe and the adjacent soils with a cement or bentonite-cement mixture is required at both ends of the alignment.
 2. The grouting is to be completed immediately after the piping alignment is pulled back.
 3. The grouting procedure consists of inserting grout tubes at each outside quadrant of the pipe into the annular space as far as possible. The grout mixture is then pumped into the annulus until grout returns to the surface at the entry.
 4. Grouting pressures are to be lower than the overburden pressure or critical pressure required to initiate hydraulic fracturing.
 5. Grouting pressures are to be continuously monitored and carefully controlled to minimize the risk of hydrofracture.
- G. Connections to Valves:
1. Install valves as shown.
 2. Provide suitable adapters when valves and piping have different joint types.
 3. Provide thrust restraint at valves and at pipeline terminations.
- H. Transitions from One Type of Pipe to Another:
1. Provide all necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
- I. Handling Drilling Fluids and Cuttings:
1. CONTRACTOR shall make adequate provisions for handling the drilling fluids or cuttings at the entry and exit pits. Drilling fluids and/or cuttings shall not be discharged into the waterway.
 2. Materials shall be hauled off-site to a suitable and legal disposal site.
 3. CONTRACTOR shall conduct the directional drilling operations in such a manner that drilling fluids and cuttings are not forced into the subbottom of the waterway.
 4. Pits constructed at entry and exit point areas shall be so constructed to completely contain the drill fluid and prevent escape to the waterway.

5. The CONTRACTOR shall utilize drilling tools and procedures, which will minimize the discharge of any drill fluids. CONTRACTOR shall comply with all mitigation measures listed in the required permits and elsewhere in these specifications.
6. CONTRACTOR shall minimize drilling fluid disposal quantities by utilizing a drilling fluid plan, which allows the returned fluids to be reused.
7. As part of the installation plan specified herein before, the CONTRACTOR shall submit a drilling fluid plan, which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.
8. Upon completion of the boring and pipe installation, the CONTRACTOR will remove all spoils from the pits and site. All pits will be restored to their original conditions.

3.02 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown should be considered approximate.
2. CONTRACTOR shall determine the true location of existing piping to which connections are to be made, and location of other facilities which could be disturbed during earthwork operations, or which may be affected by CONTRACTOR'S Work in any way.
3. Conform to applicable requirements of Division 1 pertaining to cutting and patching and connections to existing facilities.

B. Taking Existing Pipelines Out of Service:

1. Do not take pipelines out of service unless approved by ENGINEER. See requirements of Division 1.
2. Notify ENGINEER in writing at least 48 hours prior to taking pipeline out of service.

3.03 TESTING OF PIPING

A. General:

1. Refer to Section 15140, Testing and Disinfection for hydrostatic/pressure testing specifications.

3.04 CLEANING, FLUSHING, AND ABANDONMENTS

A. General:

1. Refer to Section 15140, Testing and Disinfection for cleaning, flushing, and disinfection specifications.
2. All horizontal directionally drilled watermain shall be cleaned and hydrostatically tested prior to any tie-in connections with associated piping.

- B. The entire site shall be restored to a condition equal to or better than what existed prior to the Work.
- C. Comply with all permit requirements for post construction certification and/or inspections.

END OF SECTION