SECTION 330507.13 - UTILITY DIRECTIONAL DRILLING

This section specifies horizontal directional drilling for installation of distribution facilities for various piping systems including water, sewer, and gas in congested and confined or deep areas or unstable soils, where conventional excavation is economically prohibitive, socially disruptive, or unsafe.

This section is most appropriate for "mini-horizontal directional drilling," a practice for installing pipelines up to about 12 inches in diameter in segments up to about 600 lineal feet at depths to about 15 feet. Installation equipment is characterized by thrust or pullback capability of up to 20,000 lb., with torque less than 950 ft.-lb. Mini-horizontal directional drilling machines weigh less than 9 tons.

Horizontal directional drilling consists of drilling a pilot bore along a predetermined path, then pulling pipe back through pilot bore. If necessary, pilot bore is enlarged by reaming while pipe is pulled through pilot bore. Bore is steered by proper orientation of drill bit as it is pushed along the alignment by an aboveground hydraulic jack. Orientation and tracking of drill bit is determined by aboveground-radio detection device that receives signals generated by transmitter contained within drill bit. Radio signals are translated into depth and alignment. Drilling fluid is injected into bores to minimize friction and provide soil stabilization. Drill bit rotation in soil wetted by drilling fluid creates a slurry, which stabilizes surrounding soil and prevents collapse of bore and loss of lubrication. Drilling fluids must be designed for soil and ground-water conditions. Sumps confine free-flowing slurry at ground surface during drilling or pipe installation that might damage surrounding areas. Residual slurry should be removed from surface, and site should be restored to preconstruction conditions.

Carefully coordinate requirements for conduit carrying flammable or explosive products or highly volatile substances under pressure with appropriate regulatory requirements.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Excavation for approach trenches and pits.

Horizontal directional drilling.

Pipe.

Drilling fluid system.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 036000 - Grouting: Filling of abandoned boreholes.

Section 310001 - Soils for Earthwork: Subsoil fill as required by this Section.

Section 310000 - Excavation, Trenching, & Fill: Excavation of subsoil, trenching, and installation and compaction requirements as required by this Section.

Section 315000 - Excavation supports as required by this Section.

Section 312323.33 - Flowable Fill: Alternative fill materials.

Section 330505.31 - Hydrostatic Testing: Sanitary sewer pipe testing.

Section 330505.33 - Infiltration and Exfiltration Testing: Sanitary sewer pipe testing.

Section 330505.43 - Mandrel Testing: Sanitary sewer pipe testing.

Section 330597 - Identification and Signage for Utilities: Underground pipe markers.

Section 331413 - Public Water Utility Distribution Piping: Potable-water pipe testing.

Section 331416 - Site Water Utility Distribution Piping: Potable-water pipe testing.

Section 335216 - Gas Hydrocarbon Piping: Pipe testing.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this section, with designations, numbers, and complete document titles.

* + - * 1. American Association of State Highway and Transportation Officials:

AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.

* + - * 1. American Water Works Association:

AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. , for Water Transmission and Distribution.

AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.

AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In. , for Water Distribution and Transmission.

* + - * 1. American Welding Society

AWS D1.1 - Material And Design, Fabrication, Inspection, And Qualification

* + - * 1. ASTM International:

ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [**12 400 ft-lbf/ft3**].

ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort [**56,000 ft-lbf/ft3**].

ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.

ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.

ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.

ASTM F1056 - Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings.

ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.

* + - * 1. North American Society for Trenchless Technology:

NASTT - Horizontal Directional Drilling Good Practices Guidelines.

* + - * 1. Plastics Pipe Institute:

PPI TR-46 - Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe.

* + - 1. COORDINATION

Edit paragraph below based on project location. Remove if not applicable. Designer is responsible for determining the entity(s) with which the Work needs to be coordinated. It is anticipated that the Designer would complete initial coordination as part of the project design phases.

* + - * 1. Coordinate Work of this Section with [**New York** **State**] [**County**] [**City**] [**Town**] [**Village**] of <**Insert Agency/Municipality**> and utilities within construction area.
			1. PREINSTALLATION MEETINGS
				1. Convene meeting with Director’s Representative a minimum of [**one week**] [**<\_\_\_> weeks**] prior to commencing Work of this Section.
			2. SUBMITTALS

Only request submittals needed to verify compliance with project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data:

Identify source of water used for drilling.

Submit copy of approvals and permits for use of water source.

* + - * 1. Shop Drawings:

Submit technical data for equipment, method of installation, and proposed sequence of construction.

Include information pertaining to pits, dewatering, method of spoils removal, and equipment size, capacity, and capabilities, including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade, detection of surface movement, name plate data for drilling equipment, and mobile spoils removal unit.

* + - * 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate paragraphs for additional certifications.

* + - * 1. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
				2. Qualifications Statement:

Coordinate following subparagraph with requirements specified in qualifications article.

Submit qualifications for driller.

Edit paragraph below based on project location. Remove if not applicable. Designer is responsible for determining the entity(s) with which the Work needs to be permitted. It is anticipated that the Designer would complete initial coordination as part of the project design phases.

* + - * 1. Submit [**New York State**] [**County**] [**City**] [**Town**] [**Village**] of <**Insert Agency/Municipality**> [**Highways**] [**Public Works**] occupancy permit for installations [**along**] [**under**] public throughways and lands.
				2. Written Drilling Procedure: Describes in detail proposed method and entire operation but not limited to the following:

Size, capacity and arrangement of equipment, drawn to scale.

Location and size of drilling and receiving pits.

Dewatering and methods of removing spoils material.

Method of installing detection wire and pipe.

Type, location and method of installing locator station.

Method of fusion pipe segment and type of equipment.

Type of cutting head.

Method of monitoring and controlling line and grade.

Detection of surface movement.

Bentonite drilling mud for information only.

Products information, material specifications, and handling procedures.

Material safety data sheet and special precautions required.

Method of mixing and application.

* + - * 1. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.
				2. Quality Control Submittals:

Contractor’s Qualifications Data:

Firm name, address, and phone number.

Period of time that the firm has been in the business of performing horizontal directional drilling.

Names and addresses of 5 similar projects completed by the firm. Include the name and phone number of contact person.

Field Supervisor Qualifications Data:

Name of the person supervising the horizontal directional drilling.

Period of time that the person has performed/supervised horizontal directional drilling.

Names and addresses of three similar projects that the person has worked on during the past three years.

* + - 1. CLOSEOUT SUBMITTALS
				1. Project Record Documents: Record actual locations of pipe and [**invert**] [**centerline**] elevations.
				2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
				3. Reproducible as-built drawings showing dimensions, accurate locations, and depth of burial at 100 ft intervals. Marked-up contract drawings will not be acceptable.
				4. Issue a written report at the conclusion of the installation phase, stating whether or not specifications and approved manufacturer’s installation recommendations.
				5. Furnish a certified report to the Director’s Representative.
				6. Record actual horizontal location of installed pipe.
				7. Show depth and location of abandoned bores.
				8. Record depth and location of drill bits and drill stems not removed from bore.
				9. The submittal will not relieve the Contractor of complete responsibility to the successful performance of the intended installation procedure.
			2. QUALITY ASSURANCE

Include this article to specify compliance with overall reference standards affecting products and installation included in this section.

* + - * 1. Perform Work according to the following:

NASST - Horizontal Directional Drilling Good Practices Guidelines.

ASTM F1962.

PPI TR-46.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate. This can be removed if not applicable to the project.

* + - * 1. Perform Work according to <**Insert Agency/Municipality**> standards.

Include following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain [**copy**] [**<\_\_\_> copies**] of each standard affecting Work of this Section on Site.
				2. Pre-Installation Conference: Before the work is scheduled to commence, a conference will be called by the Director’s Representative at the Site for the purpose of reviewing the Contract Documents and discussing requirements for the Work. The conference shall be attended by related trade Contractors (if any), their qualified installers and Field Supervision.
			1. QUALIFICATIONS

Coordinate following paragraph with requirements specified in submittals article.

* + - * 1. Contractor: The firm performing the Work of this Section shall have been regularly engaged in performing horizontal directional drilling for a minimum of 10 years, and shall have completed 5 similar projects of size and complexity over the last 5 years.
				2. Field Supervisor: The person supervising the Work of this Section shall have been regularly engaged in performing horizontal directional drilling for a minimum of 5 years and shall have supervised 3 similar projects of size and complexity over the last 3 years.
			1. DELIVERY, STORAGE, AND HANDLING
				1. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
				2. Handling:

Use shipping braces between layers of stacked pipe.

Support pipes with nylon slings during handling.

* + - * 1. Storage:

According to manufacturer instructions.

Stack piping lengths no more than three layers high.

Store field joint materials in original shipping containers in dry area indoors.

* + - * 1. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Protect pipe from entry of foreign materials and water by installing temporary covers, completing sections of Work, and isolating parts of completed system.

Provide additional protection according to manufacturer instructions.

* + - 1. PROJECT CONDITIONS
				1. Complete horizontal directional drilling so as not to interfere with, interrupt, or endanger surface and activity thereon.

Designer to verify subsurface requirements of the horizontal directional drilling installation in accordance with the project conditions. This will be based on the findings of the Geotechnical Investigations/Report.

* + - * 1. Do not use horizontal directional drilling in rock stratum or subsoil consisting of boulders and underground obstructions that impede the process.
				2. Follow applicable ordinances, codes, statutes, rules, and regulations of State of New York, 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.”
				3. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

1. PRODUCTS
	* + 1. HORIZONTAL DIRECTIONAL DRILLING
				1. Performance and Design Criteria:

Drilling Steering System: Remote with continuous electronic monitoring of boring depth and location.

Turning capability will be affected by flexibility of selected drilling equipment. Plastic piping materials are more flexible than drill stems and reaming rods used to form bore hole and can accommodate whatever radius equipment can produce. Designer to verify equipment capabilities for required pipe sizes.

Directional Change Capability: 90 degrees with 35-foot radius curve.

Directional drilling techniques and soil conditions may allow for much greater distances between boring pits. Directional drilling can be used for larger pipe sizes. Designer to verify equipment performance and conditions affecting drilling operations to obtain optimal project results.

Minimum distance for single bores and between boring pits:

Pipe Size [**1**] to [**1-1/2**] Inches: [**400**] feet.

Pipe Size [**2**] to [**2-1/2**] Inches: [**350**] feet.

Pipe Size [**3**]to [**6**] Inches: [**300**] feet.

Pipe Size<**\_\_\_\_\_\_\_\_**> Inches: <**\_\_\_\_\_\_\_\_**> feet.

Ratio of Reaming Diameter to Pipe OD:

Nominal Pipe Diameter of [**6**] Inches and Smaller: Maximum of 1.5.

Nominal Pipe Diameter Larger Than [**6**] Inches: Submit recommended ratio and reaming procedures for review by Director’s Representative.

* + - * 1. Water Source:

Potable.

Choose one of the two paragraphs below.

Obtained from [**Facility**].

[**Contractor to provide potable water supply.**]

* + - * 1. Underground Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
				2. Materials:

Drilling Fluid: Liquid bentonite clay slurry; totally inert with no environmental risk.

Mechanical- and bell-joint ductile iron and bell-, mechanical-, and glued-joint PVC are not conducive to directional drilling installation. Use of fused PE and PVC with internal joint restraints for water and sewer systems makes directional drilling cost effective compared to open-cut construction methods. Trenchless placement is preferred for pressure-collections system installation in congested areas.

PE pipe can connect to existing ductile-iron and PVC systems. Restrained-joint PVC pipe can be used where required. Utility companies can use trenchless installation methods while maintaining and repairing systems utilizing existing methods.

* + - * 1. PVC Piping:

Pipe: Comply with ASTM D1785, Schedule [**40**] [**80**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Pipe:

Comply with ASTM D2241.

Classification: [**SDR-26 for 160-psig pressure rating**] [**SDR-41 for 100-psig rating**] [**SDR-21 for 200-psig rating**], calculated according to ASTM D2837.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Pipe: As indicated on pipe schedule.

Materials:

Comply with ASTM D1784.

[**Minimum**] Cell Classification: [**12545-C**].

Fittings:

Comply with ASTM [**D2466; Schedule 40**] [**D2467; Schedule 80**].

End Connections: [**Threaded; ASTM D2464**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Pipe and Fittings:

Water Pipe: Refer to Section 331416.

Sanitary Sewerage Pipe: Refer to Section 333100.

Joints:

[**Socket, solvent welded; ASTM D2855**].

Specify threaded or flanged end connections if later removal is required.

End Connections: [**Socket, solvent welded; ASTM D2855**] [**threaded**] [**or**] [**flanged**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Joining Method:

Water Pipe: Refer to Section 331416.

Sanitary Sewer Pipe: Refer to Section 333100.

When joining HDPE pipe at ends of directional drilling runs fusion bond to adjacent pipe section using butt fusion.

Mechanical couplings are not permitted for joining of directional drilled pipe sections.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. PVC Piping:

Pipe: Comply with AWWA C900, Class [**165**] [**235**].

Materials:

Comply with ASTM D1784.

[**Minimum**] Cell Classification: [**12545-C**].

Fittings: Comply with AWWA C111, cast iron.

Joints:

Comply with ASTM D3139.

Seal: Compression gasket ring.

ASTM D2239 includes six side wall thicknesses, ranging from SIDR 19 to SIDR 5.3. SIDR 19 most closely matches schedule 40 pipe.

* + - * 1. Polyethylene (PE) Piping:

Pipe:

Comply with ASTM D2239.

Classification: SIDR [**19**], calculated according to ASTM [**D3035**] [**F714**].

Materials:

Comply with ASTM D3350.

[**Minimum**] Cell Classification: [**324433-C**].

Fittings:

Type: Molded.

Comply with ASTM [**D3261; butt**] [**D2683 and F1056; socket**] welded.

Joints:

Specify threaded or flanged end connections if later removal is required.

End Connections: [**Socket, solvent welded; ASTM D2855**] [**threaded**] [**or**] [**flanged**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

ASTM D3035 piping is available in 10 different wall thicknesses ranging from DR 32.5, thinnest, to DR 7, thickest, with pressure ratings from 160 PSIG to 840 PSIG (1.1 to 5.79 MPA). Coordinate wall thickness and pressure rating with intended service conditions.

* + - * 1. Polyethylene (PE) Piping:

Pipe: Comply with [**AWWA C901**] [**AWWA C906**] [**ASTM D3035, DR <\_\_\_\_\_\_\_\_> for <\_\_\_\_\_\_\_\_>-psig pressure rating**].

Materials:

Comply with ASTM D3350.

[**Minimum**] Cell Classification: [**324433-C**].

Fittings:

Comply with AWWA [**C901**] [**C906**].

Style: Molded [**or fabricated**].

Joints:

Specify threaded or flanged end connections if later removal is required.

End Connections: [**Socket, solvent welded; ASTM D2855**] [**threaded**] [**or**] [**flanged**].

Select bedding and cover material type based on project conditions. If more than one type is required, edit following paragraph. Caution: consider using material "Type" coding in this section for uniformity of reference.

* + - * 1. Subsoil Fill: < > , as specified in Section [**310001 – Earthwork Materials**]; excavated and reused soil with no rocks more than 6 inches in diameter, frozen earth, or foreign matter.
				2. Drilling Fluid:

Bentonite drilling mud compatible with environment.

Waste oil or environmentally non-compatible polymers cannot be part of composition.

* + - * 1. Detection Wire: TW, THW, THWN, or HMWPE insulated copper, 10 gage or thicker wire.
				2. Locator Station.

Underground, Flush Mounted:

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.

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.

Light blue cast iron or high-impact plastic locking lid that will withstand AASHTO H-20 traffic loads and ultra-violet rays.

Mark locking lid to identify pipeline with permanent identification such as P.S. Locator.

Terminal block made of high dielectric material which is made of phenolic resin, plastic, micarta, Lexan or Bakelite for each locator station. Terminal block furnished with two 3/16-inch threaded studs, nuts, and washers made of nickel-plated brass.

Manufacturers: C.P. Test Services, Inc., Model Mini – Test Station; Handly, Industries, Model T2IS2, or equal.

Manhole Mounted:

Waterproof enclosure made from cast aluminum, galvanized steel, high-impact plastic, Lexan, Gyrlyn, or equal.

Light blue schedule 40 PVC pipe or schedule 40 galvanized steel with outside diameter of at least 3/4-inch to mount enclosure.

Use similar materials for pipe and enclosure to fasten enclosure onto pipe following manufacturer's instructions.

Manufacturers:

Cott Manufacturing Company, Model Finklet or Finkplate, 2 leads.

Gerome Manufacturing Company, Inc., Model Testox Series 300, 2 leads.

Approved equivalent.

* + - 1. MIXES
				1. Grout: As specified in Section 036000 - Grouting.
				2. Flowable Fill: As specified in Section 312323.33 - Flowable Fill.
1. EXECUTION
	* + 1. EXAMINATION
				1. Verify that connections [**to existing piping system**], <**\_\_\_\_\_\_\_\_**> sizes, locations, and [**invert**] [**centerline**] elevations are according to Drawings. Report any discrepancies to the Director’s Representative.
			2. PREPARATION
				1. Underground Utilities: Refer to Section 023313 – Underground Utility Locator Service.

Locate and mark-out existing, underground utilities along directional drill path. Perform Level A locator service in all project areas.

Determine vertical orientation and depths of utility lines along directional drill path.

* + - * 1. Maintain access to existing [**facilities**] [**services**] **[and]** indicated to remain; modify pipe installation [**indicated on Drawings**] to maintain access to existing facilities.
				2. Locate and identify utilities indicated to remain and protect from damage.
				3. Identify required lines, levels, contours, and data locations.
				4. Protect plant life, lawns, [**rock outcroppings,**] and other features remaining as portion of final landscaping.
				5. Protect benchmarks [**such as**] [**existing structures**] [**fences**] [**sidewalks**] [**paving**] [**curbs**] and survey control points from excavating equipment and vehicular traffic.
				6. Establish pipe elevations with not less than [**5**] feet of cover.
				7. Pit Preparation:

Excavate pits following contract documents are as specified by the Director’s Representative.

Dewater pits as required and as directed.

Insert services required to be separated from other services. Separation distance shall be per NYSDOH requirements and the 10 States Standards for separation distances between water and sanitary/storm sewer piping. Typical separation distance is 10’ horizontal.

* + - * 1. Establish minimum horizontal separation of [**10 feet**] between water mains, sanitary sewer piping, and storm sewer piping per NYSDOH requirements.
			1. INSTALLATION
				1. General.

Determine drilling length and equipment pull strength for type of soil encountered.

Provide method to control line and grade.

Provide and maintain instrumentation that accurately locates pilot hole.

Drill pilot hole along path following Drawings to these tolerances:

Vertical alignment plus or minus 0.5 foot. Vertical path of pilot hole must not establish new high points not shown on Drawings.

Horizontal alignment plus or minus 1.0 foot.

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.

At completion of pilot hole drilling, furnish tabulations of horizontal and vertical alignment to Director’s Representative.

When water is encountered.:

Provide and maintain dewatering system of sufficient capacity to remove water. Refer to Section 312319 - Dewatering.

Keep excavation free of water until backfill operation is in progress.

Perform dewatering in manner that removal of soils particles are held to minimum.

Dewater into sediment trap.

Maintain close observation to detect settlement or displacement of surface and adjacent facilities.

Notify Director’s Representative immediately if settlement or displacement is detected.

Maintain safe conditions and prevent damage.

* + - * 1. Drilling Operation.

Drilling Fluids.

Maintain drilling fluid in bore hole to increase stability of surrounding soil and reduce drag on pulled pipe.

Dispose of drilling fluid and other spoils at location following laws, ordinances, rules, and regulations of local jurisdiction.

Transport excess fluids and other spoils to disposal site, at no additional cost to the contract.

Minimize drilling fluid at locations other than entry and exit points. Immediately clean up any drilling fluids that inadvertently surface.

Provide clean water for drilling, at no cost to the contract, and as directed by the Director’s Representative.

Pilot Hole Drilling.

Angle entry hole so that the curvature of pilot hole does not exceed allowable radius of HDPE pipe.

Be able to make turn of up to 90 degrees and maintain curvature not to exceed allowable bending radius of HDPE pipe.

Alignment adjustment and restarts:

Follow pipeline alignment on Drawings within tolerances specified herein. Before adjustments, notify Director’s Representative for approval.

Notify Director’s Representative when forward motion of operation is stopped by an obstruction.

Abandon in place with drilling fluid, unless Directors’ Representative directs otherwise.

Upon the Director’s Representative’s approval, attempt second installation at approved location or excavate at point of difficulty and install HDPE pipe by trench methods specified in Section 310000.

Withdrawals, abandonments, and restarts are at no additional costs to the Contract when horizontal directional drilling is provided as an option of installation of pipe.

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.

Keep the number of boring pits to a minimum.

Verification of Accuracy:

Calibrate and verify electronic monitor accuracy during first 50 feet of bore in presence of Director’s Representative before proceeding with other drilling.

Excavate minimum of four test pits spaced along first 50 feet of bore to verify required accuracy.

If required accuracy is not met, adjust equipment or provide new equipment capable of meeting required accuracy.

After completing pilot bore, remove drill bit.

* + - * 1. Drilling Obstructions:

Perform subsurface utility location as required prior to commencing drilling operations.

If obstructions are encountered during drilling, notify Director’s Representative immediately.

Do not proceed around obstruction without approval of Director’s Representative.

For conditions requiring more than 3 feet of deviation in horizontal alignment, submit revised Shop Drawings to Director’s Representative for approval before resuming Work.

Include following subparagraph for drilling within public rights-of-way.

Maintain adjusted bore alignment within easement or right-of-way.

* + - * 1. Installing HDPE Pipe

Provide a swivel to reaming assembly and pull section of pipe to minimize torsional stress on pull section after drilling pilot hole.

Hold reaming diameter to 1.5 times outside diameter of HDPE pipe being installed.

Protect pull section as it proceeds during pull back so it moves freely and is not damaged.

Pull detection wire along with HDPE pipe. Extend wire into locator station at each end of the HDPE pipe.

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 pull back of HDPE pipe.

Test pit pipe installation to verify horizontal and vertical alignment at Director’s Representative’s direction.

One test pit every 500 feet along length of pipeline, if not within environmentally sensitive and/or protected area.

Director’s Representative may order additional test pits for each test pit that reveals pipeline installation is not in compliance with the Contract Documents at no additional cost to the Contract.

Replace portions of pipeline not in compliance with the Contract Documents at Director’s Representatives direction and at no cost to the Contract.

* + - * 1. Installing Locator Station

Location Stations:

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.

In areas scheduled to be improved identify and protect station locations immediately after installation.

Space 3 stakes equally around the station.

Extend at least 4 feet above existing grade.

Detection Wire.

Install detection wire without splices unless specified on the plans.

Terminate detection wire inside locator box using proper sized crimp type connection on wire ends.

Neatly coil slack wire in test station below terminal board.

Locate wires on top and along HDPE pipe.

Allow adequate slack and support to protect wires from damage during backfilling operations.

Test each detection wire for continuity after backfill is completed.

If test for continuity is negative, repair or replace at Director’s Representative’s direction.

After continuity is verified, connect each detection wire to terminal block in locator station.

* + - * 1. Slurry Removal and Disposal:

Contain excess drilling fluids at entry and exit points until recycled or removed from Site; provide recovery system to remove drilling spoils from access pits.

Drilling Spoils:

Remove, transport, and legally dispose of drilling spoils.

Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.

When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.

If drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.

Complete cleanup of drilling fluid at end of each working day.

* + - * 1. Backfilling:

Install backfill as specified in Section [**310000 - Earthwork**].

Backfill approach trenches and pits with subsoil fill to contours and elevations [**as indicated on Drawings**] [**of surrounding existing grade**]

Compact subsoil fill as specified in Section **[310000 - Earthwork]** [**to minimum 95 percent of maximum density**] [**to minimum <\_\_\_\_\_\_\_\_> percent of maximum density**].

* + - 1. TOLERANCES
				1. Maximum Variation from Horizontal Position: [**12**] inches.
				2. Maximum Variation from Vertical Elevation: [**2**] inches.
				3. Minimum Horizontal and Vertical Clearance from Other Utilities: [**12**] inches.
				4. Deviation:

If pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, rebore, and reinstall pipe in correct alignment.

Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

* + - 1. FIELD QUALITY CONTROL
				1. Upon completion of pipe installation, test pipe according to the following:

Sanitary Sewer Pipe Testing: As specified in Section [**330505.31–- Hydrostatic Testing**] [**330505.33–- Infiltration and Exfiltration Testing**] [**330505.43–- Mandrel Testing**].

Water Distribution Pipe Testing: As specified in Section [**331413–- Public Water Utility Distribution Piping**] [**331416–- Site Water Utility Distribution Piping**].

If tests indicate Work does not meet specified requirements, remove Work, replace, and retest. Coordinate with the Director’s Representative.

Select test standards referenced in following paragraph appropriate for fill materials and project requirements. Consult geotechnical report. Select compaction test method appropriate to fill materials being used and project requirements.

* + - * 1. Compaction Testing:

Comply with [**ASTM D1557**] [**ASTM D698**].

If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

Specify frequency of testing.

Frequency of Compaction Testing: [**One**] [**Two**] for each lift.

* + - * 1. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than [4] <**\_\_\_\_\_\_\_\_**> days on Site for installation, inspection, startup, field testing, and instructing Director’s Representative’s personnel in maintenance of equipment.
				2. Certify that equipment for drilling has been properly set up and is ready for drilling.
			1. MAINTENANCE AND RESTORATION
				1. Restore grades to original levels where settlement or damage due to performance of the Work has occurred. Correct conditions contributing to settlement. Remove and replace improperly placed or poorly compacted fill materials.
				2. Restore pavements, walks, curbs, lawns, and other surface features damaged during performance of the Work to match the appearance and performance of existing corresponding features as closely as practicable.
				3. Topsoil and seed or sod damaged lawn areas in accordance with 329200 – Turf and Grasses.
			2. CLEANING
				1. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits.
				2. Clean up excess slurry from ground.
				3. Restore approach trenches and pits to original condition.
				4. Remove temporary facilities for drilling operations.

END OF SECTION 330507.13