

SECTION 02415
DIRECTIONAL DRILLING (BIG DRILL)

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The (PROJECT) consists of installation of (PRODUCT) USING Horizontal Directional Drilling (HDD) methods. The HDD will begin at (PROJECT ENTRY) and will extend along the proposed route at depths ranging from approximately XX to XX feet below the ground surface to (EXIT POINT)..

- B. Furnish all labor, materials, transportation, and equipment necessary for completion of the (PROJECT) work including but not limited to the following items:
 - 1. (PRODUCT) from the entry to the exit points plus connections into (MANHOLES?).
 - 2. (MANHOLES)
 - 3. (INTERCONNECTION HARDWARE TO SURFACE BUILD)
 - 4. Installation of (CASING AND ENTRY AND/OR EXIT)
 - 5. Containment, spill cleanup, and bentonite slurry monitoring for spill control.
 - 6. Diapers, absorbent material and other fuel and oil spill containment and cleanup materials.
 - 7. A stormwater control plan that meets the requirements of the (JURISDICTION) Best Management Practices guidelines.

- C. Install the (PROJECT) pipe including (PARTS)

- D. Provide drill fluid and all necessary personnel and equipment for mixing and pumping the design drill fluid at the designed rates with the required cleaning equipment for all drilling and reaming operations.

- E. Dispose of all bentonite slurry, cuttings, and pit spoil after completion of the project at a legal off-site disposal area.

- F. Dispose of all fuel, oil, or other leakage from equipment including diapers, absorbent material, and other related cleanup and spill control materials.
- G. Provide submittals in accordance with the Contract Documents.
- H. Provide access to the site for the Owner’s representative(s).
- I. Verify the integrity of the (PRODUCT) in accordance with project specifications.
- J. Obtain construction-related permits for project water and road use. Contractor shall contact (LOCAL ONE CALL CENTER UTILITY LOCATE) a minimum of 72 hours prior to any excavation or drilling and obtain utility clearance for all construction work. This utility clearance permit shall remain active for the duration of the project. It is the Contractor’s responsibility to maintain this permit as active.

1.02 EXCLUDED WORK

- A. Drill fluid design, monitoring of drill fluid during all drilling operations, modifications to drill fluid design to stay within design parameters, and tracking. This work will be provided by the Owner’s Construction Manager.
- B. Drill path design will be provided by the Owner’s Construction Manager.
- C. As-Built Plan. The Owner’s Construction Manager will provide the As-Built plan.

1.03 RELATED SECTIONS

- A. 02633 Manholes

1.04 REFERENCES

- A. This section references the following documents. They are part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section prevail.

<u>Reference</u>	<u>Title</u>
Data Report	“Geotechnical Data Report, (PROJECT AND TITLE)

Engineering Report “Geotechnical Engineering Report, (PROJECT AND TITLE).

ASTM D-3261 HDPE Welding Code

Permits

1.05 DEFINITIONS

- A. Horizontal Directional Drilling (HDD): A process of drilling a drill using steerable mechanical fluid-jet cutting tools. In some cases, mechanical reaming may be used to enlarge the drill.
- B. Pipe: The final pipe that will be left in the ground and will provide a minimum unobstructed clearance path for water distribution.
- C. Sleeve: A steel pipe left in the ground or removed but whose purpose is to contain drill fluids at each end of the drill.
- D. Bentonite Slurry: Drilling fluid consisting of a mixture of bentonite and water with additives necessary to stabilize the fluid in saline conditions expected at this site.
- E. Cuttings: Material removed from the bentonite slurry by the slurry cleaning process during the drilling process. The cuttings consist of native material from the drill path and residual slurry remaining after passing through the slurry cleaning process. This material typically has the consistency of wet mortar.
- F. Pit Spoil: The drill material and debris that settles into the bottom of the slurry pit that may be located at either end of the drill. This material is normally removed from the pit by a backhoe and contains relatively large amounts of bentonite slurry.

1.06 DESIGN CRITERIA

- A. The drillers’ construction method shall be developed to address and comply with all the drill design parameters and permit requirements. The drill was designed with the following conditions and tolerances:
 - 1. Alignment route: Use azimuth and vertical curves as shown on (DRAWINGS). Tolerance is defined as a horizontal rectangular envelope with a vertical tolerance of ± 5 feet and a horizontal tolerance of ± 10 feet.
 - 2. West end of drill is the drill rig location. The workspace is delineated on (DRAWINGS).
 - 3. East end of the drill is in Hurlbutt Road and is the pipe lay down and assembly area. The available workspace is delineated on (DRAWINGS).
 - 4. Subsurface conditions: The contractor is to design the drill method to handle the soil conditions as described in the Geotechnical Engineering Report..

5. Geometry: As shown on (DRAWINGS).
6. Incremental deflection tolerance along drill path: Maximum average of 2 degrees for three pipe or drill rod joints. The contractor is responsible for maintaining this tolerance.
7. The Contractor is to design project noise containment system to limit project noise levels to 120 DbA at a distance of 200 feet from the site and at a height of 25 feet. Additionally, each piece of equipment shall be certified to have a maximum noise output of 120 DbA at a distance of 100 feet at a height of 25 feet when operating under full load conditions.
8. The drill path is to stay within the right of way shown on project (DRAWINGS)
9. All work areas, staging areas, and storage and receiving/loading areas must stay within the construction limits indicated on project (DRAWINGS)
10. Design the drill string to accept the specified tracking and bentonite slurry monitoring systems.
11. Design the drill rig to accept the designed drill performance monitoring equipment.
12. Design a pulling sequence and methods to account for (PROJECT RESTRICTIONS)
13. Protect all utilities that have been identified within the construction area from construction related damage.
14. Maintain traffic flow as required by Permits.
15. Site restoration shall be to conditions present prior to construction.
16. Provide and remove chain link security fencing at each end of the drill during construction.

1.07 SUBMITTALS

- A. Contractor Qualification Submittal: Provide a qualification submittal for the directional drilling contractor with the bid. Include the qualifications for the horizontal directional drilling contractor, the superintendent, the tracking specialist, and the driller to demonstrate compliance with the requirements in Paragraph 1.07 A - General Company Profile and in Paragraph 1.7 B – Key Staff Requirements.
- B. Schedule Submittal: Provide with the bid a work sequence and schedule indicating the requirements presented in Section 02415 Submittals.
- C. Traffic and Safety Control Submittal: The project areas at both ends of the drill are in restricted and congested areas.
- D. Drill Method Submittal: Provide this submittal a minimum of ten (10) days before starting drilling for review and approval. This submittal shall be in compliance with the Drill Plan specified in Sections 3.1. Include the following information:

1. Scaled plan showing the following: the work zone equipment configuration at each end of the drill; location of security fencing and access points; staging and storage areas; and the location of bentonite slurry, cuttings, and pit spoil handling areas.
 2. Equipment list including make and model number and specifications of all major equipment proposed for use on this project. The Contractor is responsible for the final determination of the drill rig size. The Contractor shall submit a suitably sized drill rig for the project and provide in the submittal documentation demonstrating that the selected drill rig has completed similarly sized and length drills in similar soil conditions.
 3. Drilling procedure. It is recognized and accepted that the Contractor may need to adjust drilling procedures and equipment as new information is developed during the drill. The intent of this requirement is providing the contractor's initial approach to the project to demonstrate constructability.
 4. Material list including bentonite and bentonite additives proposed for the project along with Material Safety Data Sheets (MSDS) for all materials used on the site, and water source for drilling operations.
- E. Bentonite Slurry Control and Tracking Coordination Submittal: Provide this submittal a minimum of ten (10) days prior to drilling. The intent of this submittal is to coordinate the contractor activities with the drill fluid and tracking specialist.
- F. Daily Construction Reports: Provide to the Owner a daily field report by the morning of the day following the work reported indicating progress for that day, issues that effect project performance that occurred that day such as breakdown causes and times, obstructions, or bentonite slurry release and cleanup, number of crew on the job, and hours worked. Include in the daily reports at least 2 readings obtained on two separate work days indicating compliance with noise restrictions specified in Paragraph 1.5-A7 of project related noise during full operational conditions and equipment loads.
- G. Material Certification: Provide certification of the HDPE pipe material at the time of delivery to the site.
- H. Cuttings, Bentonite Slurry, and Pit Spoil Disposal Submittal: Provide within 30 days of completion of the drills a list of volumes of all cuttings, bentonite slurry, and pit spoil disposed of off site and the location of the disposal area.

1.08 QUALITY ASSURANCE

- A. General Company Profile: The general company profile shall provide: a summary of the company's present size in terms of gross annual revenue; number of projects completed per year for the last five years; years of operation; number of full-time employees and engineering staff; a list of similar size projects, two of which must be (SIMILAR PROJECT), that have been completed within the past five years including project name, contract amount, length, diameter, and soil conditions for the drill; and three project references with project descriptions,

value of contract, and current name and phone number for a reference. The general company profile shall demonstrate that the company or a company principal has a minimum of five years continuous experience in horizontal directional drilling; owns the equipment necessary to do this project; has a minimum of two full time drillers, one of which must meet the requirements of Paragraph 1.7 – B; and has the financial resources and meets the insurance requirements to do this project.

- B. Key Staff Requirements: Provide resumes of key staff that will be assigned to this project. Key staff shall demonstrate on their resumes that they meet the following qualifications:
 - 1. Driller: Minimum five years experience as a horizontal directional driller and have completed at least two projects of similar length and conditions.
 - 2. Superintendent: Minimum three years experience with the bidding company as a superintendent and have a minimum of one similar project experience.

1.09 QUALITY CONTROL

- A. The Owner's representative will be on site full time during construction and assess the performance of the Contractor's field methods with respect to the intent of the approved Contractor's submittals. The Contractor will permit access to the work site for the Owner's representative and provide, as requested, incremental drilling and tracking data and other project field data to the Owner's representative.
- B. No changes in these key staff will be permitted without prior written approval by the OWNER'S CONSTRUCTION MANAGER. Key staff shall be on-site full-time during all drilling operations.
- C. Before the Owner accepts the installation, the Contractor shall verify the integrity of the HDPE pipe by successfully passing (SIZE) diameter pig through the pipe and completing a pressure test on the pipe.
- D. Annular Pressure Monitoring: The supplied annular pressure diagram allows an increase or decrease of 20% from the theoretical circulating pressure. Steps can be taken to maintain annular pressure within the range specified on the Annular Pressure Diagram. Any increase or decrease of annular pressure outside the specified range must be reported to the Owner or Owner's Representative immediately.
- E. Annular pressure shall be monitored and recorded using equipment as specified in the Equipment List. If the annular pressure tool is incompatible with an Electronic Data Recorder (EDR) system, a direct output must be supplied to the Owner. Annular pressures shall be monitored and recorded in the Annular Pressure Report. Annular pressure must be recorded at the start of each joint, the middle of each joint (~15 ft) and the end of each joint (~30 ft). The minimum and maximum annular pressure experienced during the joint must also be recorded; the minimum

and maximum pressures are not necessarily the pressures recorded at the start, middle and end of each joint, they are the minimum and maximum values as measured throughout the whole joint. The time of each recorded measurement must also be recorded.

- F. Before the annular pressure tool is used, it must be calibrated as specified by the manufacturer and a record kept of the calibration.
- G. Drilling Fluid Monitoring: Drilling fluid parameters (density, viscosity and sand content) must be measured and recorded every two hours, after a noticeable change in fluid returns or after a spike or drop in annular pressure as outlined in the Drilling Fluid Parameter Report.
- H. Fluid density shall be measured using a balance beam scale as specified in the Equipment List. All components of the scale shall be cleaned and calibrated at the beginning of each shift and cleaned before and after each measurement is taken. If any damage is suspected to any part of the scale, the scale must be calibrated according to the manufacturer's specifications. Damaged components must be replaced immediately. Drill fluid initial density should be 1050 kg/m³ maximum with an allowable increase to 1120 kg/m³ throughout the drill.
- I. Viscosity shall be measured and recorded with a Marsh funnel as specified in the Equipment List. Viscosity shall be maintained between 50 and 80 centipoises (cP) throughout the drill.
- J. Sand content shall be measured and recorded with a sand content measurement kit as specified in the Equipment List. Sand content should be kept below 1% to avoid excessive increases in fluid density as well as wear and damage to equipment. Sufficient centrifuges, or owner-approved sand cleaning equipment, should be employed to remove sand particles without negatively affecting the drilling fluid flow rates.

1.10 JOB CONDITIONS

- A. Refer to instructions to bidders and the Geotechnical Engineering Report. The contractor must also attend a mandatory pre-bid meeting to assess existing conditions for their activities.
- B. Comply with all state and local permit requirements and (LOCAL JURISDICTION) contractor registration requirements.
- C. Make all necessary arrangements and include in the bid all cost for obtaining water.
- D. Make all necessary arrangements and obtain all permits and include all cost necessary for transportation and off-site disposal of excess bentonite slurry, cuttings, and pit spoils. Clean all debris or other material dropped onto paved Roads during the disposal process to the satisfaction of the Owner's

representative.

- E. The OWNER'S CONSTRUCTION MANAGER will designate two survey benches within 200 feet of the drill site that can be relied on for location and elevation. The tracking and related survey will be the responsibility of the Specialty Tracking Contractor. All other surveys necessary for the project are the responsibility of the Contractor.
- F. Work hours for running equipment are not restricted.
- G. The work assembly area at the (ENTRY) is delineated on (DRAWINGS). All work and parking for personnel shall be restricted to the area delineated on the project drawings.
- H. Work at the (EXIT) is delineated on (DRAWINGS). All work at the exit shall be restricted to the area delineated on the project drawings.

1.11 SCHEDULE

- A. Coordinate with the OWNER'S CONSTRUCTION MANAGER as necessary to keep the schedule.

PART 2 PRODUCTS

2.01 PIPE

- A. XXXX
- B. YYYY

2.02 BENTONITE SLURRY

- A. Water quality is anticipated to include fresh, brackish, and saline conditions. Bentonite mixtures require stabilization for these types of conditions to properly function. Both salt and calcium flocculates bentonite slurry and can destroy the mudcake on the side of the drill, both of which can result in hydraulic fracturing of the drill and possibly a release of drill slurry to the surface. A proper mixture of bentonite and additives along with pH monitoring provides the best chance for the bentonite slurry to do the intended job. The contractor is responsible for selecting the drill slurry mixture.

2.03 TRACKING SYSTEM

- A. A tracking system provided by the OWNER'S CONSTRUCTION MANAGER will be used. The OWNER'S CONSTRUCTION MANAGER will also provide system Specifications required for mating with drilling equipment.

2.04 MANHOLES

A. ZZZ

PART 3 EXECUTION

3.01 Drill Plan

A. The geotechnical investigation has identified fill, organic deposits, sand and silt at both entry and exit locations and organic deposits and sand throughout the majority of the drill path. This drill plan is split into zones and highlights areas of the drill path to consider throughout construction. This drilling plan was developed to provide a suggested way of safely drilling in each zone. This plan is to be used in conjunction with safe drilling practices and the Annular Pressure Diagrams to ensure the drill is properly monitored and controlled. The Contractor is fully responsible to implement a safe and effective drilling plan that meets the criteria outlined in this plan.

B. Zone # 1 Entry 0 - 85 feet approx. (measured depth) Zone Highlights: Casing through (MATERIALS)

Casing:

Pilot Hole

Annular Pressure:

Drilling Fluid:.

(CONTINGENCY PLAN FOR DRILL FLUID CONTAINMENT)

- C. Zone # 2 XXX - YYY feet approx. (measured depth)

Zone Highlights: Sand, Organic Deposits

Pilot Hole (7-10’):

Drilling Fluid:

Annular Pressure:

High Pressure:

Low Pressure:

Reaming Passes:

Environmental:

- D. Zone # 3 XXX- YYY feet approx. (measured depth) Zone Highlights: Sand, Organic Deposits, possibly casing

Pilot Hole (7-10’):

Drilling Fluid:

Annular Pressure: .

High Pressure: .

Low Pressure:

Reaming Passes:

Environmental: .

3.02

PREPARATION

- A. Notifications: Provide notification to the OWNER'S CONSTRUCTION MANAGER a minimum of 72 hours before mobilizing onto the site. Provide notification 48 hours in advance of drilling. Provide notification 48 hours in advance of acceptance verification tests on the HDPE pipe.

- B. Construct the perimeter bentonite slurry, cuttings, and pit spoil control system in accordance with Best Management Practices in the local area. The system shall provide positive containment for all drilling fluids and drainage from drill cuttings and prevent any of the drill fluid or drainage fluids or other drill fluid contaminated material or fluid from entering the river waters either by topping or breaching including under storm conditions.
- C. Measure equipment noise with all equipment running at operating speed as specified in Paragraph 1.5 – A7 prior to starting drilling. Provide the data and certification that the noise complies with project specifications.
- D. Establish a secure and contained construction work area at the drill rig. As the work areas are in a public area, construct a temporary chain link safety fence around the area.
- E. Expose all utilities within 15 feet of the drill path and leave exposed until after completion of the pilot drill. Use an air-vacuum system to expose the utilities. Specifically, expose the gas line on Hurlbutt Road.
- F. Maintain the work site in a clean and safe manner.

3.03 SURVEY AND TRACKING CONTROL SYSTEMS

- A. Provide support and coordination for the survey and tracking equipment as required by the tracking specialists.
- B. The drill will proceed guided by either a wire line or electromagnetic survey system. The guidance system incorporates two separate tracking devices to accurately locate and steer the bit. The first system incorporates angle and magnetic directional sensors (magnetometers and accelerometers) contained within a non-magnetic drill collar that is attached to the top of the mud motor. The second system is a surface tracking system used to provide an independent measurement using directional sensors of the drilling bit position. Signals are relayed between the surface and the tool to calculate the position of the bit.

3.04 BENTONITE SLURRY, CUTTINGS, AND PIT SPOIL CONTROL SYSTEM

- A. Place a plastic liner under all slurry, cuttings, and pit spoil handling areas and establish a system to contain all slurry-contaminated liquids within this containment area.
- B. Line all trucks or otherwise contain slurry, cuttings, and pit spoil liquids when transporting to the disposal area. Wash excess material and spillage from all vehicles before leaving the controlled construction area. Wash down all Roads along any haul route in spillage areas to clean slurry spillage if it occurs as soon as practical after spillage occurs and at least on the same day as the spillage.

- C. Monitor bentonite slurry return at the drill mouth. Record slurry loss zones on the daily log when larger than approximately 50% of the slurry being injected into the drill. Inspect the drill path for slurry release during any period of recordable slurry loss. Obtain slurry density periodically for slurry going down hole and slurry return before recycling and record in the daily report.
- D. Annular Pressure Monitoring shall be undertaken through the use of an annular pressure device. This tool will measure annular pressure and convey this information real-time to the surface. This data will be compared with expected values from the supplied Annular Pressure Model. The trends of the circulating pressure information will be assessed and additional wiper passes completed if the information is not what is expected. For example, if the pressure trend increases past the upper limit shown on the supplied Annular Pressure model when it is not expected, the drilling will be halted and the Owner's Representative alerted, and may only resume once the condition has been corrected (i.e. Wiper pass, Drilling fluid analysis)
- E. During the entire drilling and reaming operations, monitoring of the drilling processes will be critical. Pit Volumes for all mud tanks, SPM sensors for pumps, drilling fluid flow and pressure sensor, rotary torque, hook load sensor, depth tracking and monitoring sensors, annular pressure readings, and other sensors as required shall be monitored and recorded on the EDR system.

3.05 SPILL CONTROL

- A. Spill and bentonite slurry management shall be in accordance with requirements stated in the project permits.
- B. Have controls in place to stop drilling activity, assess the drill path for observable releases, and control any observable release in a timely manner. Notify the OWNER'S CONSTRUCTION MANAGER of circulation losses greater than 25% of down hole pump volumes and for all observable bentonite slurry releases at the earliest opportunity and confirm in writing by the end of the work shift.
- C. Be prepared to contain a potential observable blowout or bentonite slurry release. On observing a slurry release, stop all drilling operations, contain the release, and clean up the release. The contractor is responsible for all notifications, cleanup, disposal, and environmental restoration that may be required as a result of an observable release. Cleanup must be to before release conditions.
- D. Delay cost, cleanup cost, containment cost, environmental restoration cost, and any other cost that may be incurred by the Contractor because of an observable bentonite slurry release are the sole responsibility of the Contractor.

3.06 INSTALLATION OF PIPE

- A. Drill to the design line and grades within the project tolerances. Place sleeves at the ends of the bore as necessary to contain bentonite slurry.
- B. Prepare the pipe by welding pipe sections together using butt fusion welds performed by a certified welder. Welding shall conform to the ASTM HDPE welding requirements.
- C. Pull the pipe to the end of the drill leaving sufficient pipe to reach the two manholes at the ends of the drill.
- D. Verify that the pipe is acceptable by successfully passing a plug with a minimum outside diameter of inches through the casing and by completing a hydrostatic test on the installed pipe.
- E. Should the Contractor abandon a hole for his/her convenience before the hole is completed, then seal the drill hole and re-drill at no additional cost.

3.07 ACCEPTANCE

- A. Acceptance is based on successfully completing the defined work. Successful completion consists of installing the pipe, successfully completing the pigging and pressure testing of the pipe, installing the two manholes, installing the connector couplings on the end of the HDPE and placing the pipe through the manhole wall, backfilling the manholes to the base of pavement, and acceptable site restoration.

END OF SECTION