

# 16115 HORIZONTAL DIRECTIONAL DRILLING

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## SPECIFIER:

CSI MasterFormat 2004 number: 33 05 21

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### PART 1 PART 1 GENERAL

#### 1.1 SUMMARY

- A. Provide all labor, materials, equipment and services necessary to install the conduits, and raceway system, as indicated on the drawings, and as specified herein using the horizontal directional drilling method.
- B. All materials provided under this section shall be listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL).
- C. The horizontal directional drilling method specified herein is for nominal diameter conduits of 6 inches or less.

#### 1.2 RELATED SECTIONS:

- A. 01150 - Mechanical and Electrical Coordination
- B. 02221 - Excavating, Backfilling, and Compaction for Utilities.
- C. 09900 - Painting.
- D. 10400 - Identifying Devices.
- E. 13740 - Intercom and Clock Raceway System
- F. 16112 - Raceways and Conduits.
- G. 16131 - Outlet, Pull, and Junction Boxes.
- H. 16450 - Grounding.

#### 1.3 REFERENCES

- A. Florida Building Code (FBC).
- B. Occupational Safety and Health Administration (OSHA).

#### 1.4 SUBMITTALS

- A. Prior to beginning work, the Contractor must submit to the A/E a work plan detailing the procedure and schedule to be used to execute the Project. The work plan shall include a description of all equipment to be used, down-hole tools, a list of personnel and their qualifications and experience list of subcontractors, a schedule of work activity, a safety plan traffic control plan (if applicable), an environmental protection plan and contingency

plans for possible problems. Work plan shall be comprehensive, realistic and based on actual working conditions for the Project. Plan shall document the thoughtful planning required to successfully complete the Project.

- B. The Contractor shall submit documentation that the proposed electrofusion personnel have been certified by the pipe or electrofusion accessory manufacturer.
- C. All drilling fluids and loose cuttings shall be contained. No fluids shall be allowed to enter any unapproved areas or natural waterways. Upon completion of the directional drill project, all excess drilling fluid and material shall be removed by the Contractor.
- D. Contractor shall submit Specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the Project. Equipment shall include but not be limited to: drilling rig, mud system, mudmotors (if applicable), down-hole tools, guidance system and rig safety systems. Calibration records for guidance equipment shall be included. Specifications for any drilling fluid additives that Contractor intends to use or might use will be submitted.
- E. Specifications on material to be used shall be submitted to A/E and material shall include the pipe, fittings, drilling mud, drilling additives and any other item which is to be an installed component of the Project or used during construction.

## 1.5 QUALITY ASSURANCE

- A. The requirements set forth herein include a wide range of procedural precautions necessary to ensure 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 herein. Adherence to the Specifications contained herein, or the A/E 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. Drilling Notes: The pipe shall be installed to the exact lines and depth shown on the plans and specifications by a bonded underground utility Contractor, with minimum of two-year experience in Horizontal Directional Drilling.
- C. Before commencing any drilling work, the Contractor shall survey work area using multiple identification methods, including but not limited to visual surface markings, potholing, ground penetrating radar, etc., to establish the location of underground utilities or other objects that may be in the drill path.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. Directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing, delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this Project.

## 2.2 PRODUCT PIPE, JOINTS AND FITTINGS

### A. PIPE

1. High Density Polyethylene (HDPE): Pipe shall be manufactured from a PE 3608 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D 3350 with a cell classification of 34564C. Pipe shall have a manufacturing standard of ASTM F 714. Pipe shall be DR 17 (100psi WPR) unless otherwise specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification form the same raw material.

### B. FITTINGS:

1. Butt Fusion Fittings: Fittings shall be PE3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350. Molded fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Fabricated fittings are to be manufactured using a Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records.
2. Electrofusion Fittings: Fittings shall be PE3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350. Electrofusion fittings shall have a manufacturing standard of ASTM F 1055. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans.
3. Flanged and Mechanical Joint Adapters: Flanged and Mechanical Joint Adapters shall be PE 3350. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D 3261. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans.

### C. DRILLING FLUID (MUD) SYSTEM:

1. Drilling fluid shall be composed of a carrier fluid (water) and drilling fluid additives (bentonite and/or polymers). Bentonite is a naturally occurring clay mineral that forms a mud when mixed with water.
2. The composition of the drill fluid is determined by the results of geological investigation executed in line with the framework of the project planned before construction.
3. The principal functions of drilling fluids used in horizontal directional drilling are:
  - a. Transporting drill cuttings to the surface by suspending and carrying them in the fluid stream flowing in the annulus between the borehole wall and the drill pipe/product.
  - b. Cleaning build-up on drill bits or reamer cutters by directing fluid streams at the cutters.
  - c. Cooling the down-hole tools and electronic equipment.
  - d. Lubricating to reduce the friction between the drill pipe/product pipe and the borehole wall.
  - e. Stabilizing the borehole, especially in loose or soft soils by building a low permeability filter cake and exerting a positive hydrostatic pressure against the borehole wall. The filter cake along with positive hydrostatic pressure reduces collapse of the borehole and prevents formation fluids (i.e. groundwater) from flowing into the borehole or drilling fluids from exiting the borehole into the formation (loss of circulation).

- f. The Contractor shall provide hydraulic power to the bore-hole with a down-hole mud motor.
- g. The following fluid properties are to be tested and considered to assure compatibility between the drilling fluid mixture and the native soil after proper identification and characterization. These fluid properties are density, viscosity, pH value, circulation, volume and solid content.
- h. The drilling fluid pressures and flow rates shall be continuously monitored and recorded by the Contractor at the pump and within the annular space within thirty (30) feet of the drilling head.

### 2.3 DRILLING SYSTEM

- A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be grounded during drilling and pull-back operations. There shall be a system to detect electrical current from the drill string and an audible alarm which automatically sounds when an electrical current is detected.
- B. The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.
- C. Mud motors shall be of adequate power to turn the required drilling tools.
- D. The drill pipe shall be constructed of high quality 4130 seamless tubing, grade D or better with thread.

### 2.4 GUIDANCE SYSTEM

- A. The method of guidance utilized in locating and steering the pilot string from entry to exit shall be state of the art. Readings shall be recorded after the advancement of each successive drill pipe and the readings plotted. Access to all recorded readings and plan and profile information shall be made available to the A/E or his representative at all times.

### 2.5 DRILLING FLUID (MUD) SYSTEM

- A. A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be a minimum of five hundred (500) gallons. Mixing system shall continually agitate the drilling fluid during drilling operations.
- B. Drilling fluid shall be composed of clean water and bentonite clay. Water shall be from an authorized source with a pH of 8.5 - 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate. The water and bentonite clay shall be mixed thoroughly and be free of any clumps or clods. No additional

material may be used in drilling fluid without prior approval from A/E. Contractor is responsible for provisions to obtain clean water for the fluid.

The Bentonite mixture used shall have the minimum viscosities as measured by a March Funnel:

1. Rock, Clay - 60 sec.
2. Hard Clay - 40 sec.
3. Soft Clay - 45 sec.
4. Sandy Clay - 90 sec.
5. Stable Sand - 80 sec.
6. Loose Sand - 110 sec.
7. Wet Sand - 110 sec.

These viscosities may be varied to best fit the soil conditions encountered, as approved by the A/E.

- C. Additives to drilling fluid such as drill soap, polymers, etc. shall be “environmentally safe” and be approved for such use. No diesel fuel will be allowed.
- D. The mud pumping system shall have a minimum capacity of 50 GPM and be capable of delivering the drilling fluid at a constant minimum pressure of 1000 psi. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, or equivalent, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system to prevent spills into the surrounding environment. Pumps and or vacuum trucks of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and facilities.

## 2.6 OTHER EQUIPMENT

- A. Pipe rollers shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe. Rollers shall be used as necessary to assist in pull back operations and in layout/fusing of material.
- B. Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used.

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. Contractor shall notify the A/E and M-DCPS Project Manager in writing at least forty-eight (48) hours before commencing any of the following activities:
  1. The setup of a drilling pit.
  2. The start of drilling operation.
  3. The installation of service pipe.

- B. Upon completion of the pilot hole phase of the operation, the contractor shall maintain a complete set of As-built records. These records shall include copies of the plan and profile drawing, as well as directional readings recorded during the drilling operation.

### 3.2 PERSONNEL REQUIREMENTS

- A. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. Each person must have at least two years directional drilling experience. A competent and experienced supervisor representing the Contractor and Drilling Subcontractor shall be present at all times during the actual drilling operations. A responsible representative who is thoroughly familiar with the equipment and type work to be performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual directional bore operation.

### 3.3 DRILLING PROCEDURE

- A. Work site as indicated on drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.
- B. Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on Drawings. If Contractor is using a magnetic guidance system, drill path will be surveyed for any surface geo-magnetic variations or anomalies.
- C. Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents or state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within two hundred (200) feet of any water-body or wetland.
- D. Pipe shall be welded/fused together in one length. Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.
- E. Pilot hole shall be drilled on bore path with no deviations greater than five percent of depth over a length of one hundred (100) feet. In the event that pilot does deviate from bore path more than five percent of depth in one hundred (100) feet, Contractor shall notify A/E, and A/E may require Contractor to pull-back and re-drill from the location along bore path before the deviation.
- F. In the event that a drilling fluid fracture, inadvertent returns or returns loss occurs during pilot hole drilling operations, Contractor shall cease operations and shall discuss corrective options with the A/E, work shall then proceed accordingly.
- G. Upon approval of the pilot hole location by the A/E, the hole enlarging, or back reaming phase of the installation shall begin. The borehole diameter shall be increased to accommodate the pullback operation of the required size of PE pipe. The type of back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the

Contractor's discretion with the final hole diameter being a maximum of twenty (20) percent larger than the outside diameter of the product pipe being installed in the borehole.

- H. The open borehole may be stabilized by means of bentonite drilling slurry pumped through the inside diameter of the drill pipe and through openings in the reamer. The slurry will also serve as an agent to carry the loose cuttings to the surface through the annulus of the borehole. These cuttings and bentonite slurry are to be contained at the exit hole or entry side of the directional bore in pits or holding tanks. The slurry may be recycled at this time for reuse in the hole opening operation or it shall be hauled by the Contractor to an approved dump site and properly disposed. A complete list of all drilling fluid additives and mixtures to be used in the directional operation will be submitted to the A/E along with their respective material safety data sheets.
- I. In the event that pipe becomes stuck, Contractor shall notify the A/E and MDCPS PM. Contractor, and/or the maintaining agency shall discuss options to A/E and MDCPS PM.
- J. Excess pipe shall be removed, and the bore hole associated with this excess pipe shall be filled with flowable fill or grout, unless the area of the excess pipe is excavated and backfilled as part of the tie-in operations.

#### 3.4 SITE RESTORATION

- A. Following drilling operations, Contractor shall demobilize equipment and restore the work-site to original condition. Any noticeable surface defects due to the drilling operation shall be repaired by Contractor.

#### 3.5 RECORD KEEPING

- A. Contractor shall maintain a daily project log of drilling operations and a guidance system log with a copy given to A/E at completion of work.

END OF SECTION