

APPENDIX B

TECHNICAL SPECIFICATIONS FOR HORIZONTAL DIRECTIONAL DRILLING (HDD)

I. GENERAL

1.1. DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, material, and equipment necessary to perform a complete horizontal directionally drilled (HDD) pipeline installation at the location(s) shown on the Construction Drawings. In the HDD process, the casing pipe typically serves as the carrier pipe and is referenced as such herein. When so indicated on the Construction Drawings, the Contractor may be required to install a carrier pipe inside the casing pipe.

B. Carrier pipe shall be HDPE in conformance with Appendix A, Technical Specifications for High Density Polyethylene (HDPE) Pipe and Fittings

C. Directional drilling and pipe installation shall be performed only by an experienced Contractor whose key personnel have at least 5 years' experience with directional drilling of HDPE pipe.

D. The work shall be constructed in accordance with the Contract Documents and the applicable laws, rules, ordinances, and permits of regulatory agencies including the Oregon Department of Environmental Quality, the US Army Corps of Engineers, and other local, state and federal agencies having jurisdiction.

1.2 EQUIPMENT

A. Equipment shall include, but not be limited to carrier pipe, HDD equipment, solids removal and water clean-up equipment, pipeline installation equipment, earth moving equipment, survey equipment, trailer cleaning pigs, caliper pigs, and temporary pig launchers and receivers.

B. The equipment used in HDD shall be of adequate commercial size and satisfactory working condition for safe operation and may be subject to approval by the Engineer. Such approval, however, shall not relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein.

C. The HDD equipment shall be steerable, have sufficient strength to drill the pilot hole, ream the hole to adequate diameter, and pull the carrier pipe through the hole for the length and pipe diameter indicated.

1.3 SUBMITTALS

A. The Contractor shall submit the Statement of Experience form provided at the end of these technical specifications with their bid. **Failure to submit and meet the requirements as stated within will be grounds for rejection of the bid.**

B. Shop Drawings shall be submitted by the Contractor as described below:

1. Pipe manufacturer's installation manual, which includes guidelines for handling, joining, installing, and testing HDPE.
2. Butt fusion equipment manufacturers literature. Equipment shall contain mechanisms to prevent excessive pressure during the fusion process.
3. Documentation of temperature and pressure from data logger for each butt fusion joint.

C. The Contractor shall prepare a plan, The plan shall:

1. Describe the pilot hole drilling procedure, the reaming operation, the pullback procedure, ballasting, gauging, hydrostatic testing, and dewatering procedures;
2. Illustrate the plan and profile of the bore plotted at a scale appropriate for the crossing and acceptable to the Owner. The Contractor may make changes to the proposed vertical and horizontal alignment of the installation and the location of the entry and exit points, provided these changes are first submitted in writing and agreed to by the Engineer;
3. Provide the horizontal drilling machine manufacturer's literature;
4. Identify the location for the pipe string (and rollers, if required);
5. Include a Drilling Fluid Plan, which details types of drilling fluids to be used, cleaning and recycling equipment, estimated flow rates, procedures for minimizing drilling fluid escape, and the method/location for final disposal of waste drilling fluids;
6. Identify the size of backreamer, if applicable;
7. Identify the maximum allowable pulling load on the HDPE pipe string to avoid overstressing the pipe;
8. Provide a listing of major equipment to be used; and,
9. Provide resumes of supervisory personnel to be used.

D. Detailed schedule of work including:

1. Pipe delivery.
2. Pipe string fusion.
3. Drill mobilization and set-up.
4. Pilot hole drilling.
5. Pipe pulling.
6. Testing.
7. Demobilization

8. Restoration.

E. Record Drawings

1. The Contractor shall provide a Record Drawing with as-built x-y-z coordinates within 30 days of construction completion of the HDD Crossing.
2. Record Drawings must be approved by the Engineer prior to final payment.

1.4 ENVIRONMENTAL CONSIDERATIONS

A. The Contractor shall be fully responsible for the directional drilling operation.

B. The Contractor shall take all measures necessary to protect surrounding public and private property, structures, buildings, roads, utilities, driveways, sidewalks, and appurtenances from damage due to the directional drilling work. Responsibility and payment for correction of such damage shall be the sole responsibility of the Contractor.

C. The HDD operation is to be performed in a manner to eliminate the discharge of water, drilling mud and cuttings to nearby waterways. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. The Contractor shall line all excavated pits used in the drilling operation with heavy-duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water. If inadvertent returns of drilling fluids near a structure or into a waterway occur, the Contractor shall immediately provide environmental controls and clean up to the satisfaction of, and at no additional expense, to the City.

D. When working adjacent to waterways, the general work area on the entry and exit sides of the crossing shall be enclosed by a beam to contain unplanned spills or discharge.

E. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desilter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered and dried by the Contractor to the extent necessary for legal disposal in off-site landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of locally or hauled off-site for legal disposal. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas may be checked by the Engineer for signs of unplanned leaks or seeps.

F. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at the site for use in the event of inadvertent leaks, seeps or spills.

1.5 BENTONITE

Bentonite shall be provided as specified in API Specifications 13A, Specification for Oil Well Drilling Fluids Material for freshwater drilling fluids. Any modification to the basic drilling fluid involving

additives must describe the type of material to be used and be included in Contractor's drilling plan presented to the Owner. The Owner retains the right to sample and monitor the waste drilling mud, cuttings and water.

II. EXECUTION

2.1. GENERAL

A. Directional drilling is a two-stage process consisting of drilling a pilot hole through the ground and pulling back a cable or pipe while the drilling pipe is removed.

B. A lubrication system mixes and pumps bentonite through a hollow stem drill rod to lubricate the hole, assists in the cutting of the earth and rock, and stabilizes the borehole.

C. When the drill rod exits at the correct location, a back reamer is installed to the drill rod to enlarge the hole. The carrier pipe is attached to the reamer with a swivel installed between the two to ensure that the rotating action of the reamer is not transmitted to the pipe or cable being pulled back.

D. During the pull back, drilling fluid is pumped through the hollow stem drill rod and is injected at the reamer to assist in the cutting and lubrication of the hole, the reduction of friction on the outside of the pipe, and the stabilization of the bore hole.

E. The Contractor shall erect temporary fencing around the entry and exit construction areas.

F. The Contractor shall be responsible for locating existing utilities along the projected pipeline route.

2.2 LAYOUT OF ENTRY, EXIT, AND STAGING AREAS

A. The pipe shall be laid out as shown in the Construction Drawings, and assembled in a manner that does not obstruct adjacent roads or activities adjacent to the layout areas except as show or as approved by the City. The Contractor shall confine construction activities and disturbances within the areas approved by the City.

B. Where the butt fused pipe string is laid-out within the roadway right-of-way, the Contractor shall maintain access to public and private entrances and driveways at all times. Unless otherwise indicated, access may be maintained either by trenching and installing temporary culvert pipe for slip lining of the HDPE pipe, or by supporting the HDPE pipe aurally. Where aerial crossings are used, provide a minimum of 12 feet of clearance between the bottom of the HDPE pipe and the driveway. If commercial entrances or truck traffic are to be spanned, the Contractor shall allow adequate vertical clearance. The minimum bending radius for laying out and pulling the HDPE pipe shall be 60 times the pipe outside diameter unless otherwise approved by the Engineer.

C. The Contractor shall provide copies of written and signed agreements with adjacent property owners for any arrangements made by the Contractor for use of property outside of the rights-of-way and public property shown on the Construction Drawings.

2.3 TOLERANCES

The pilot hole shall be drilled along the path shown on the Construction Drawings, or the Contractor's plan and profile approved by the Engineer, to the following tolerances:

- A. Elevation – Plus zero feet, minus five feet. The vertical path shall not exceed high points shown on the Construction Drawings.
- B. Alignment – Plus or minus two feet.
- C. Entry Point Location – The pilot hole shall initially penetrate the ground surface at the exact location intended. The angle of entry shall not exceed 75% of the allowable bending radius of the carrier pipe.
- D. Exit Point Location – The pilot hole shall finally penetrate the ground surface within:
 - 1. Plus or minus 10 feet overall length tolerance and plus or minus 5 feet left/right alignment tolerance for directional drills of 1,000 linear feet, and
 - 2. Plus or minus 40 feet of overall length and plus or minus 5 feet left/right alignment tolerance for directional drills greater than 1,000 linear feet.
- E. For gravity sewer installations, sags in the pipeline shall not exceed 25% of the nominal pipe diameter. Sags will only be allowed where the entering and exit grades are adequate to provide velocities through the sag area sufficient for moving the solids. No more than one sag area shall occur between two manholes.

2.4 PILOT HOLE

- A. The Contractor will provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure at all times. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 25 feet. This “as-built” plan and profile shall be up-dated as the pilot bore is advanced. Significant deviations between the Engineer-approved design position and the actual position shall immediately be brought to the attention of the Engineer for discussion and approval. At no point in the drilled profile shall the radius of curvature of the bore be less than that indicated on the Construction Drawings. The Contractor shall maintain and provide to the Engineer upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.
- B. The alignment of the pilot bore must be approved by the Engineer before reaming and pullback may commence. If the pilot bore fails to conform to the above tolerances, the Engineer may, at their option, require a new pilot boring to be made.
- C. The Contractor shall notify the Engineer when forward motion of operation is stopped by an obstruction. Unless directed otherwise, the pilot hole shall then be abandoned in place with the drilling fluid. With the Owner's approval, another attempt to drill the pilot hole may be made or excavation at the obstruction to alleviate the blockage may be acceptable.

D. The Contractor shall maintain close observations to detect settlement or displacement of surface and adjacent facilities. If settlement or displacement is detected, the Contractor is to immediately notify the Engineer and act to maintain safe conditions and prevent damage.

2.5 REAM AND PULL BACK

A. Upon approval of the pilot hole location by the Engineer, the hole opening or enlarging phase of the installation shall begin. The borehole diameter shall be increased incrementally to accommodate the pullback operation of the carrier pipe. The type of hole opener or 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 final hole opening diameter shall be a minimum of 40 percent larger than the outside diameter of the carrier pipe to be installed.

B. Once pullback operations have commenced, the Contractor shall continue without interruption until the pipe is completely pulled into the bore hole.

C. During the pullback operation, the Contractor shall monitor roller operation and side booms, if required, to assist the movement of the carrier pipe. Surface damage shall be repaired by the Contractor before pulling operations resume.

D. The maximum pull (axial Tension force) exerted on the carrier pipe shall be measured continuously and limited to the maximum allowed by the pipe manufacturer to prevent the pipe and/or joints from becoming overstressed. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the carrier pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense.

E. A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.

F. The pipe shall be adequately supported during installation to prevent overstressing or buckling. The Contractor shall provide adequate support/rollers along the stringing area to support the required length of the HDPE pipe. Such support/rollers shall be spaced at a maximum of 60 feet on centers. The 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 pipeline allowing for free movement of the pipeline during pullback.

G. The end of the pipe shall be closed during the pull back operation.

H. The Contractor shall pull detection wire, without splices, on top and along with the HDPE pipe.

I. After the carrier pipe is completely pulled through the bore hole, a sufficient relaxation period as recommended by the pipe manufacturer shall be provided prior to the final pipe tie-in.

2.6 HANDLING DRILLING FLUIDS AND CUTTINGS

A. To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.

B. During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site.

C. The Contractor shall conduct his directional drilling operation in such a manner that drilling fluids do not compromise nearby structures or are introduced into nearby waterways.

D. During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.

E. Waste drilling mud and cuttings shall be dewatered, dried, and stockpiled such that it can be loaded, transferred to a truck, and hauled off-site to a suitable legal disposal site.

F. All drilling mud shall be removed from the entry and exit area soils such that water will percolate and replacement sod will grow to restore original conditions.

G. Pits constructed at the entry or exit point area shall be constructed to completely contain the drill fluid and prevent its escape to waterways.

H. The Contractor shall utilize drilling tools and procedures that minimize the discharge of any drilling fluids. Contractor will comply with all mitigation measures listed in the permits and elsewhere in the Contract Documents.

I. The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the return fluids to be reused.

2.7 BUTT FUSION JOINTS

Butt fusion joining shall conform to Section 3.01A of Appendix A, Technical Specifications for High Density Polyethylene (HDPE) Pipe and Fittings.

2.8 CLEANING AND SIZING PIGS

After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dents, buckles, gouges, and internal obstructions) greater than 2-percent of the nominal pipe diameter, or excessive ovality greater than 5-percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of five feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of five feet.

2.9 TESTING

A. The pipe shall be tested after joining into continuous lengths prior to installation and again after installation. Acceptance hydrostatic test pressure shall be 150 psi at the entrance pit. The pipe ends shall be sealed with blind flanges or plugs. The Contractor shall furnish all equipment needed to test the pipelines.

B. Test methods shall conform to pipe manufacturer's recommended practices.

C. The test method will be modified to account for diametric expansion of HDPE.

1. After filling, the pipe will be subjected to a hydrostatic test pressure and allowed to stand without makeup pressure for 2 to 3 hours.

2. After the above equilibrium period, the test pressure will be attained and held for 1 hour with no leakage.

3. Allowances for expansion during final test will be made for conformance with generally accepted procedures furnished by the pipe supplier.

D. Final pressure and leakage testing shall conform to Section 3.03 of Appendix A, Technical Specifications for High Density Polyethylene (HDPE) Pipe and Fittings.

2.10 SHEETING AND SHORING

A. The Contractor shall install, maintain, and leave in place any sheeting, underpinning, cribbing, and other related items (other than that required for the boring and receiving pits) to support any structure or facility affected by the boring operations. The Owner, depending upon existing conditions, may require that additional sheeting for the excavation be left in place. If such a requirement is made, no additional compensation will be made for the sheeting left in place.

B. At the completion of the directional drilling operations, the Contractor will be required to leave all wooden sheeting in place. If steel sheeting is used, it may be removed after installation of the carrier pipe in the bore hole, but prior to installation of the joining carrier pipe; however, should damage to the roadway or any other adjacent structure occur, the Contractor shall leave all remaining sheeting in place and re-drive and leave in place any sheeting which is required to stabilize the site and prevent additional damage from occurring. The top of all sheeting left in place shall be cut off 36-inches below finished grade.

2.11 DISINFECTION

See Section 505 of the Albany Standard Construction Specifications.

2.12 SITE RESTORATION

After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions, unless otherwise specified. The Contractor shall clean up and restore to pre-construction conditions any public or private property disturbed or damaged during construction. Restoration shall include paved and unpaved surfaces, shrubbery, landscaping, trees, structures, and all else encountered.

III. MEASUREMENT FOR PAYMENT

3.1.GENERAL

The project will be considered complete following the successful:

- A. Installation of the HDPE pipeline including all incidental items, equipment and work required to successfully execute and fully complete the crossing for the intended function.
- B. Restoration of the entry and exit sites, including grading, topsoil, mulching and seeding.
- C. Testing, disinfection and bacteriological testing (if required).
- D. In the event of failure to install the directionally-drilled pipeline, the Contractor shall retain possession of any Contractor supplied HDPE pipe and remove it from the site. The bore holes shall be completely filled with grout or flowable fill to prevent future problems. If the pipe cannot be removed from the bore it shall be cut off 5 feet below ground and the pipe and space shall be grouted. No payment will be made for the failure of the Contractor to successfully install the pipeline.

STATEMENT OF EXPERIENCE REQUIREMENTS FOR HORIZONTAL DIRECTIONAL DRILLING

This form shall be completed in its entirety and a copy submitted with the bid. **Failure to submit and meet the requirements as stated in Appendix B – Technical Specifications for Horizontal Directional Drilling will be grounds for rejection of the bid.**

The City of Albany will be the sole judge in determining if the prospective contractor meets the minimum experience requirements.

Contractor:

Name: _____

Address: _____

Phone: _____

Contact Person: _____

List three successfully completed projects totaling a minimum of 100 linear feet of 6-inch or larger HDPE pipe using the proposed horizontal directional drilling technology:

#1 Project Name: _____

Owner: _____

Contact Person: _____

Size of Pipe: _____

Total Length Installed: _____

Completion Date: _____

#2 Project Name: _____

Owner: _____

Contact Person: _____

Size of Pipe: _____

Total Length Installed: _____

Completion Date: _____

#3 Project Name: _____

Owner: _____

Contact Person: _____

Size of Pipe: _____

Total Length Installed: _____

Completion Date: _____

Superintendent:

Name: _____

Address: _____

Phone: _____

Contact Person: _____

List three successfully completed projects totaling a minimum of 100 linear feet of 6-inch or larger HDPE pipe using the proposed horizontal directional drilling technology:

#1 Project Name: _____

Owner: _____

Name of Contractor Employed by: _____

Contact Person: _____

Size of Pipe: _____

Total Length Installed: _____

Completion Date: _____

#2 Project Name: _____

Owner: _____

Name of Contractor Employed by: _____

Contact Person: _____

Size of Pipe: _____

Total Length Installed: _____

Completion Date: _____

#3 Project Name: _____

Owner: _____

Name of Contractor Employed by: _____

Contact Person: _____

Size of Pipe: _____

Total Length Installed: _____

Completion Date: _____

Pipe Fusion Technicians:

Name(s):

Certified By: _____

Within the last 2 years, list projects totaling a minimum of 100 linear feet of fusion welding 6-inch or larger diameter HDPE pipe:

#1 Project Name: _____

Size of Pipe: _____ Total Length Fused: _____

Completion Date: _____

#2 Project Name: _____

Size of Pipe: _____ Total Length Fused: _____

Completion Date: _____

#3 Project Name: _____

Size of Pipe: _____ Total Length Fused: _____

Completion Date: _____