

SECTION A – SPECIAL PROVISIONS /TECHNICAL SPECIFICATIONS

1.0 MATERIALS

1.0.1 CONCRETE

Concrete shall conform to the requirements of Section 90 of the Standard Specifications.

Concrete curbs, gutters, and sidewalks shall conform to the requirements in Section 73, "Concrete Curbs and Sidewalks," of the Standard Specifications, the Standard drawings, and these Technical Specifications.

All concrete work shall be constructed true to grade, alignment and neatly placed to the dimensions shown on the plans.

Concrete placed as a repair shall include reinforcing steel dowels placed at 12-inches on center. Reinforcing steel dowels shall be embedded into existing concrete at minimum of 6-inches. Reinforcing steel bars shall be a minimum of 6-inches from the edge of existing concrete. Dowels may be embedded with a friction fit method. Dowels shall conform to City of Stockton Standard Plans.

Concrete to be placed for sidewalk shall be placed over 4-inches of class II aggregate base or 4-inches of sand. Either option is to have a minimum relative compaction of 90%. Concrete shall conform to City of Stockton Standard Plan No. R-50 through R-55.

The price of the item bid for this work shall include full compensation for furnishing all labor, materials, tools, equipment, excavating, removal and disposal of excess material, setting and removal of forms, placing concrete around columns, required doweling, placing concrete slab and walkway and all incidental work necessary to complete the project as shown on the plans and described herein. Any bid item that contains the words "repair concrete" or "replace concrete" shall include costs for such quantity as reasonably assumed by the Contractor.

1.0.2 AGGREGATE BASE

Aggregate base shall be class 2 and shall conform to the provisions in Section 26, "Aggregate Bases" of the Standards Specifications and these Technical Specifications.

The aggregate shall be a maximum 3/4" size and graded per 26-1.02A of Standard Specifications and placed on a prepared subbase at a specified depth as shown on the plans.

Aggregate bases shall be delivered in uniform mixtures and free from pockets of coarse or fine material. Where required thickness is 0.50 foot or less, the base may be spread and compacted in one layer. In areas where the thickness is more than 0.50 feet, the base material shall be spread and compacted in two (2) layers of approximately equal thickness. Each layer shall be spread and compacted in a similar manner. The finish surface of the base shall not vary more than 0.05 foot above or below the established grade.

The price paid for aggregate base shall include full compensation for furnishing all labor, materials, tools, and equipment for doing all work involved in placing and compacting the aggregate base as shown on the plans and as specified under the Standard Specifications and these Technical Specifications, and no additional compensation will be allowed.

1.0.3 ASPHALT CONCRETE

Asphalt Concrete shall conform to the requirements in Section 39, "Asphalt Concrete," of the Standard Specifications and these Technical Specifications.

Asphalt concrete shall be Type "A." Aggregate shall conform to the 1/2-inch maximum coarse or medium

grading as determined by the Engineer. At the contractor's option, and with approval of the Port of Stockton Engineer, aggregate may be 3/4-inch maximum, medium grading, with the exception of the final course.

Aggregate conforming to the 3/8-inch maximum grading will be permitted for use in driveways, dikes, as leveling course and other areas with approval of the Engineer.

The amount of asphalt binder to be mixed with the aggregate shall be between 5 percent and 7 percent by weight of the dry aggregate. The performance grade of the asphalt binder shall be PG 64-10 unless otherwise shown on the plans.

Paint binder (tack coat) shall be applied at a rate of approximately 0.05 gallons per square yard, unless otherwise shown on the plans.

When the asphalt concrete is to be produced in a batch plant, the asphalt concrete shall be proportioned and mixed by the automatic method. The provisions of Section 39-3.03A(1) shall not apply.

All steel-tired rollers shall be of the tandem type.

The dumping of material in a window, in accordance with Section 39-6.01, shall be limited to 750 feet in advance of the paving machine unless otherwise permitted by the Engineer.

Unless otherwise shown on the plans, asphalt paver-equipment used to place asphalt concrete shall be equipped with full automatic screed and grade sensing controls, which shall control the longitudinal grade and transverse slope of the screed. The controls shall be actuated by grade and slope references.

Corrections on account of deviations from the references shall be longitudinal grade and transverse slopes shall be furnished and installed by the Contractor.

Should the Contractor elect to use a ski device sensing from subgrade for longitudinal control, the minimum length of the device shall be 30 feet. The device shall be a rigid unit mounted on multiple supports. Each support shall act independently of others and the finished grade shall not be affected by the action of a single support.

When the asphalt concrete gutters are designated on the plans, a stringline or wire grade reference shall be required to control longitudinal grade of the gutter. The gutter shall be water tested before acceptance.

The maximum deviation from a true grade shall not result in ponding water for depth exceeding 0.04 foot.

Surfacing operations shall be conducted in such a manner that, at the end of each day's work, the distance between the ends of adjacent surfaced lanes shall not be greater than can be completed in the following day of normal surfacing operations.

Portable delineators in conformance with Section 12-3,-04, "Portable Delineators," of the Standard Specifications shall be furnished and placed at a maximum spacing of 300 feet on tangents and 100 feet on curves along any edge of new surfacing which has a drop off of more than 0.10 foot. Delineators shall be staggered when required on both sides of traffic.

1.0.4 DUCTILE IRON PIPE

Ductile Iron Pipe shall comply with ANSI A21.51 (AWWA C151) and be installed at the locations shown on the project plans. Pipe shall be of standard thickness with standard cement lining (USA Std. A21.4). Mechanical joint or flanged joint fittings shall comply with ANSI A21.11 (AWWA C111) and ANSI A21.10 (AWWA C110) respectively. The outside surfaces of Ductile Iron pipes and fittings shall be coated with a bituminous coating 1 mil thick in accordance with ANSI A21.6 or ANSI A21.51.

1.0.5 VALVES

This specification includes four (4) inch through twelve (12) inch diameter gate valves for buried service in a domestic water system.

Gate valves shall be Mueller 2360 series resilient wedge gate valves or approved equal. Valve ends shall be mechanical joint or flanged in accordance with AWWA C500 unless otherwise specified.

Valves for use with flanged pipe shall be case with Class 150 flanges, dimensions and drilling shall conform to ASA B16.1. Flange bolt holes shall be spot faced if flanged fillets interfere with bolt heads and nuts.

The inlet flange for tapping gate valves shall be provided with Class 150 flange for attaching to tapping sleeve. The flange shall have a mechanical projection compatible with a machined recess in the tapping sleeve. Tapping sleeves shall be mechanical joint and mechanical joint and flange unless deviation is permitted by the Engineer.

All stem seals and gate valves shall be O-rings only. Valves requiring operating wrenches exceeding six (6) feet in length shall have extension and guides installed in valve boxes.

The open direction shall be left (counter clockwise) and the closed direction right (clockwise). Valve boxes shall be Christy G-5 or approved equal. Valve risers shall be C900 PVC.

1.0.6 POLYVINYL CHLORIDE (PVC) WATER PIPE

Polyvinyl Chloride Pipe shall be furnished in the classes, sizes, and grades, designed on the plans and Technical Specifications.

Polyvinyl Chloride Pipe shall meet the requirements of AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe." All pipe shall meet the requirements of DR 18 or the requirements of DR 14 when specified, with cast iron O.D.

All pipe shall be suitable for use as pressure conduit. Provisions shall be made for expansion and contraction at each joint with an "O" ring elastomeric gasket seal meeting the requirements of ASTM D-1869 and F-477. Solvent welded joints will not be permitted. The bell section shall be designed to be at least as strong as the pipe wall.

Fittings for the PVC pipe shall be cast iron only.

1.0.7 TRAFFIC STRIPES AND PAVEMENT MARKINGS

Materials for traffic stripes and pavement markings shall conform to the provisions in Section 84 of the Standard Specifications and shall be thermoplastic. In the case where only a portion of a pavement marking is disrupted, the entire pavement marking element shall be replaced, including removal of existing markings if necessary.

Full compensation for replacing traffic stripes and pavement markings shall be considered as included in the price paid for the bid item, and no additional compensation will be allowed therefor.

1.0.8 PIPE COUPLERS

Couplers for connecting PVC water pipe shall be Smith-Blair or an approved equal. They shall be supplied in the correct size as dictated by size of the pipe being joined and installed per the manufacturers recommendations. Costs shall be included in the price for the related work and no additional compensation will

be allowed.

1.0.9 BACKFLOW PREVENTERS

Backflow preventers for domestic water services shall be lead free reduced pressure principle assemblies approved for use by the State Water Resources Control Board for use on potable water services. They shall be selected appropriately for the configuration of the installation, i.e. horizontal or vertical. Acceptable manufactures are Wilkins, Watts, and Febco.

1.0.10 SPECIFICATION FOR HIGH DENSITY POLYETHYLENE (HDPE) PIPE, FITTINGS, AND JOINING/FUSION FOR FIRE PROTECTION

SCOPE

- A. This specification covers the material, joining methods and testing procedures for Factory Mutual approved high density polyethylene pipe (HDPE) piping system for fire protection lines underground

HIGH DENSITY POLYETHYLENE PIPE MATERIALS

A. Resin and Material Requirements:

- 1. The resin material shall meet the specifications of ASTM D 3350 with a minimum cell classification of 445474C. HDPE pipe and fittings shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

B. HDPE Pipe

- 1. Pipe shall be made of HDPE material with a minimum material designation code and minimum cell classification as noted in Section A above. The HDPE pipe shall be manufactured in a plant approved by Factory Mutual and meet the standards of FM 1613. The facility shall have the necessary testing equipment to verify that the pipe meets the requirements of Factory Mutual and applicable ASTM standards. The manufacture of the HDPE resin shall certify the cell classification indicated.
- 2. 16 inch HDPE pipe shall have a manufacturing standard of ASTM F 714 and shall be SDR 9. Pipe shall be manufactured by an ISO 9001 certified manufacturer.
- 3. Pipe shall meet AWWA C906 and shall be listed as meeting NSF-61.
- 4. The pipe manufacturer shall have an ongoing Quality Control program for incoming and outgoing materials, and shall assure that the pipe will meet the material requirements of Factory Mutual and this specification. HDPE resins for manufacturing of pipe shall be checked for density, melt flow rate, and percent carbon. The facility shall have the necessary testing equipment to verify that pipe meets the AWWA and NSF standards. Pipe shall be checked for outside diameter, wall thickness, length, and surface finish on the inside and outside. The Manufacturer's production facilities shall be open for inspection by the Owner or Engineer.
- 5. All pipe shall be marked with Factory Mutual Approved diamond logo and marked according to its pressure designation as Class 250.

6. Pipe shall be color coded for fire service. The color coding shall be permanently co-extruded stripes on pipe outside surface as part of the pipe's manufacturing process. Painting HDPE pipe to accomplish color coding is not permitted. Firewater service shall be color coded with red stripes.

C. HDPE Fittings

1. Butt Fusion Fittings- Fittings shall be made of HDPE material with a minimum material designation code and minimum cell classification as noted in High Density Polyethylene Pipe Materials Section A.1. The HDPE fittings shall be manufactured in a facility approved by Factory Mutual with testing equipment to verify that the fittings meet the requirements of Factory Mutual. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans or accepted by owner/engineer. All fittings shall meet the requirements of AWWA C906.
 - a. Molded fittings shall comply with the requirements of ASTM D 3261.
 - b. All fabricated elbows, tees, and reducing tees shall also meet the requirements of ASTM F 2206, and manufactured by an approved manufacturer holding an ISO 9001 quality system certificate. Each fitting will be additionally marked per ASTM F 2206 section 10 including the nominal size and fitting EDR. Fabricated fittings shall be manufactured using a McElroy DataLogger to record fusion pressure and temperature, and shall be stamped with unique joint number that corresponds to the joint report. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained for a minimum of 5 years as part of the quality control and will be available upon request of owner. Test results to validate ASTM F 2206 section 7.3 and 9 shall be provided to owner or owner's representative upon request.
2. Bolted Connections - Flanges and MJ Adapters must be FM approved and will have a pressure rating equal to the pipe unless otherwise specified on the plans.
 - a. Metallic back-up rings (Van-Stone style lap joint flanges), convoluted or flat plate, shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class D (or B or E), ASME/ANSI B 16.5 Class 150, ASME/ANSI B 16.1 Class 125, or ASME/ANSI B16.47 Series A.
 - b. Flange assemblies shall be assembled and torqued according to PPI TN-38, "Bolt Torque for Polyethylene Flanged Joints."
 - c. Where shown on the drawings, transitions to mechanical joint fittings and valves shall be accomplished using a MJ Adapter with kit. The D.I./HDPE mechanical joint adaptor shall consist of:
 1. A molded or fabricated HDPE mechanical joint transition fitting
 2. A rubber gasket
 3. A mechanical joint backup drive ring
 4. Corten mechanical joint tee bolts
3. Identification – All fittings shall be marked with Factory Manual Approved diamond logo and marked according to its pressure designation as class 250. Fittings are typically not striped for service indication.

D. Fusion Unit Requirements

1. All Fusion Equipment, whether new or used, rented or owned, shall comply with the requirements of ISO 12176-1 "Equipment for Fusion Jointing Polyethylene Systems".
2. If the contractor owns butt fusion equipment, the equipment must be serviced within 3 months prior to use for this project. The machine must be environmentally friendly and in satisfactory working order. The hydraulic system must be leak free. The pressure gage and thermometer must be checked for accuracy. For projects with pipe quantities of 5000' or longer, the fusion equipment should be serviced by a McElroy Authorized Service and Repair Center with at least one McElroy Certified Master Mechanic on staff within 3 months from the first fusion on the project.
3. Rental Fusion Equipment must be maintained by a McElroy Authorized Service and Repair Center with at least one McElroy Certified Master Mechanic on staff. When requested by owner or his authority, an inspection report detailing the components inspected prior to arrival at jobsite will be provided.

PIPELINE LOCATING MATERIALS

- A. Tracer Wire- All HDPE pipe shall be installed with an extra high-strength, copper clad steel tracer wire including 45 mil HDPE jacket that has a minimum average break load of at least 1150 lbs. Tracer wire gauge shall be 12 AWG, 10 AWG, or 8 AWG depending upon application and installation procedure. This wire shall be continuous and brought up in the valve boxes at the ends of each line segment with splices made only by methods per the equipment manufacturer's recommendation. All miscellaneous splicing components shall be furnished and installed by the Contractor.

CONSTRUCTION DETAILS

GENERAL

- A. All HDPE pipe and fittings shall be cut, joined, and installed in accordance with the manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe systems.

TRANSPORTATION, UNLOADING, HANDLING, AND STORAGE

- A. The manufacturer shall package product in a manner designed to deliver the pipe and fittings to the project neatly, intact and without physical damage. During transportation each pipe shall rest on suitable pads, strips skids, or blocks securely wedged or tied in place.
- B. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. The handling of the pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.
- C. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2. All pipe and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior

surface or interior of the pipe. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid.

- D. Materials, if stored, shall be kept safe from damage and shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources. The contractor shall be responsible for all security, damage and loss of pipe, excluding Acts of God.
- E. The interior of the pipe as well as all sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or foreign matter at all times. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent insects, animals, or foreign material from entering the pipe line or pipe section. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted. Use waterproof nightcaps to prevent the entrance of any type of natural precipitation into the carrier or containment pipe and will be secured to the pipe in such a manner that the wind cannot blow them loose. Where possible, the pipe shall be raised and supported at a suitable distance from the open end such that the open end will be below the level of the pipe at the point of support.

RECEIPT INSPECTION

- A. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are installed or lowered into the trench to be laid. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10% or more are not acceptable and must be removed and discarded. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor.

FUSION AND JOINING

- A. Fusion Joining Requirements:
 - 1. All HDPE pipe shall be joined to itself by the heat fusion process which produces homogeneous, seal, leak tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.
 - 2. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN- 42. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F 2620. Considerations should be given to adverse weather conditions, such as temperatures below freezing, precipitation, or wind, and provisions shall be accepted by the owner/engineer.
- B. Fusion Operators:
 - 1. The employer of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual. The employer is responsible for documenting all training and qualification records for that individual, including compliance to any code requirements for fusion/bonder operators
 - 2. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project. Training received more than two years prior to

operation with no evidence of activity within the past 6 months shall not be considered current.

3. When the fusion machine operator is employed by the HDPE pipe and fusion machine supplier, the supplier shall maintain an ISO 9001 Certified Quality Management System.

C. Butt Fusion Equipment

1. The pipe butt fusion machine shall be a self-contained hydraulic fusion machine capable of butt fusing HDPE pipe. The carriage must be removable from the chassis for in-ditch use. The machine must be compatible with an electronic data recording device. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord of appropriate gauge (25' minimum), and hydraulic extension hoses (minimum of four). The butt fusion machine will be McElroy, or approved equivalent.
2. In areas where there may be insufficient space to lay out the entire length of fused pipe to be pulled-back, the Contractor shall utilize a continuous HDPE pipe fusion equipment such as a PolyHorse by McElroy or other means in order to fuse the length of pipe necessary for the installation. The Contractor shall be responsible for securing and obtaining permission/permits from adjacent property if necessary, for staging and/or fusing of the pipe and HDD equipment at no additional cost to the Owner.

D. Fusion Data Recording

1. McElroy DataLogger or equivalent fusion data recorder shall be used to record all fusion welds on hydraulically operated fusion machines. The device shall be capable of meeting the requirements of ASTM F 3124, "Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings". The device, or combination of devices, shall record the following variables of each fused joint:
 - a. Heater surface temperature- immediately before inserting the heater plate, measure with a pyrometer and manually enter into the weld record.
 - b. Gauge pressure during the initial heat cycle
 - c. Gauge pressure and elapsed time during the heat-soak cycle
 - d. Heater removal (dwell) time
 - e. Gauge pressure and elapsed time during the fusing/cool cycle
 - f. Drag pressure
 - g. Pipe diameter and wall thickness
 - h. Type of HDPE material(Specification and Classification) and manufacturer
 - i. Fusion Machine Identification
2. The device shall record the operator name and a unique operator ID number, along with the date and time of each weld.
3. Records showing the device is up to date on all required calibration should be available for review when requested.
4. All fusion welds should be traceable to the report (via operator and weld ID) with an indentation weld stamp or by permanent paint marker/pen next to fusion weld.
5. A weld location map may be requested, prior to commencement of work, by the owner or owner's representative.

E. Butt Fusion Examination and Testing

1. Examinations

- a. Visual: For pipe sections, examine the full exterior circumference for bead uniformity before cutting. After cutting the pipe section, review the interior bead. All beads should have visually acceptable bead formation as shown in Fig 4 and Appendix X2 of ASTM F2620. In addition, the following characteristics are expected:
 1. There shall be no evidence of cracks or incomplete fusing
 2. There shall be no evidence of captured objects (e.g., pipe shavings, facer ribbons) between bonded surfaces.
 3. Variations in upset bead heights on opposite sides of the cleavage and around the circumference of fused pipe joints are acceptable.
 4. The apex of the cleavage between the upset beads of the fused joint shall remain above the base material surface
 5. Fused joints shall not display visible angular misalignment, and outside diameter mismatch shall be less than 10% of the nominal wall thickness
 6. Fusion data record review that meet criteria of section 6-2.1 can be used as additional verification of visual indicators.
- b. Fusion Data Record Review
The fusion data record for each fused joint shall be compared to the approved fusion procedure. The reviewer shall verify the following:
 1. That all data required by section 6-1.1 was recorded
 2. Interfacial pressure was within the acceptable range
 3. Heater surface temperature was within the acceptable range
 4. Butt fusion pressure applied during the fusing/cool cycle was correctly calculated to include drag pressure, fell within the acceptable range for the applicable size and agrees with the recorded hydraulic fusing pressure.
 5. Butt fusing pressure was reduced to a value less than or equal to drag pressure at the beginning of the heat soak cycle.
 6. Fusing machine was opened at the end of the heat soak cycle, the heater was removed, and the end were brought together at the fusion pressure with the acceptable time range
 7. Cooling time at butt fusing pressure met the minimum time specified
- c. If the recorded data in section D, Fusion Data Recording, is outside the limits of the acceptable range, the joint is unacceptable, and must be removed and replaced.
- d. Frequency. Records for test fusion joints should be reviewed immediately after the joint is completed. Fusion joints for jobsite fusions should be reviewed daily or before being covered with backfill.

2. Mechanical Tests

- a. Contractor shall mechanically test the first fusion of each operator and each machine used on the project. Installation shall not continue until a fusion test has passed the test. Additional mechanical test are not required as long as long as the fusion are reviewed with the frequency specified in section E.1.D. Testing of fusion joints with no fusion data record review shall be at a frequency specified by the Owner or Engineer.
- b. The fusion shall be allowed to cool completely, then fusion test straps shall be cut out.

- c. All samples shall be labeled with operator information. Testing must be done at 73 degrees F plus or minus 5 degrees. The test temperature and sample size are critical to testing. Testing performed at cold or elevated temperatures may not give similar results to tests performed at ambient temperatures.
- d. Each pipe sample weld shall be subjected to testing at two locations 180 degrees apart from each other in the joint weld. All specimens shall be tested by one of the following methods:
 - 1. Reverse Bend Test are allowed for pipe sizes 4" IPS or smaller. The specimens shall be removed and tested in accordance with ASTM F 2620, Appendix X4.
 - 2. Guided Side Bend Test are allowed for all pipe sizes 4" IPS and larger. The specimens shall be removed and tested in accordance to recommendations and procedures provided by McElroy Manufacturing.
 - 3. Hydrostatic Burst Test is allowed for pipe sizes 2"-24". The specimen length should measure 6 times pipe diameter with the butt fusion joint in the center of the specimen. The specimen should be tested in a tank filled with water, and testing conditions monitored and recorded with computerized equipment. The specimen will be tested at 4 times pipe rated pressure for 5 minutes with no failure of joint allowed.
- e. Results of any mechanical test should be documented. Information on the weld and operator should be transferred from the sample to the testing record.

FLUSHING, CLEANING, AND DISINFECTING

- A. All mains shall be cleaned and flushed to remove all dirt, sand, debris and other foreign matter. The Contractor shall be responsible for developing a flushing plan to be submitted to the Engineer for approval prior to flushing.
- B. Disinfection (Potable water systems)
 - 1. Cleaning and disinfecting of potable water systems shall be in accordance with AWWA C651 and AWWA M55 Chapter 10, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition).
 - 2. The liquid disinfection chemical solution should be limited to less than 12% active chlorine. The time-duration of the disinfection should not exceed 24 hours. Chlorine tablets or powders are not permitted.
 - 3. Upon completion, the system should be thoroughly flushed with fresh water, and retested to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water tubing and branch lateral pipes.

TESTING AND LEAKAGE

- A. The contractor shall insure testing can be accomplished in a safe manner, including protection of personnel, equipment, and public in the event of a failure during testing. The contractor shall restrain pipe, components, and test equipment as required. All pumps, valves, temporary connections, meters, gauges and other measuring devices shall be furnished, installed and

operated by the Contractor and all such equipment and devices and their installation shall be approved by the Owner's Engineer.

- B. The pressure gauges or data recorders should be calibrated and sufficiently sized to provide mid-range data (pressure tested will not be below 10% or greater than 90% of gauge capacity) that result in easy reading, interpretation. Gauges shall be accurate to within 2% of full scale with increments no greater than 2 psi.
- C. The test pressure may be up to 1.5 times the FM pressure class, based on the lowest point in elevation in the test section.
- D. Test pressures require consideration of thermal conditions. Polyethylene piping materials are typically pressure rated at 73°F (23°C) and PE piping at temperatures greater than 80°F (26°C) require reduced test pressures. (Note that higher pipe temperatures should consider both ambient temperatures and radiant solar heating of exposed black HDPE pipe) Guidance for elevated temperatures can be found in the appendix of Chapter 3 (Material Properties) of the PPI Handbook of PE Pipe.
- E. Pressure Pipelines-Pressure testing shall be tested at 200psi and conducted in accordance with requirements and recommendations of ASTM F 2164 (Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure), AWWA M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.
 - 1. The section of pipe to be tested shall be filled with potable or generally clean water (uncontaminated river/lake water) approved by the Owner/Engineer. While the system is being filled with water, air shall be carefully and completely exhausted.
 - 2. The Contractor shall not perform hydrostatic testing against valves in an existing system.
 - 3. The test procedure for HDPE pipe consists of two steps: 1) the initial phase or expansion phase and 2) the test phase. During the initial/expansion phase, sufficient make-up water shall be added hourly for 3 hours to return to the test pressure. During the test phase, the expansion phase pressure is reduced by 10 psi to test phase pressure and monitored for at least one hour (3 hours maximum).
 - 4. Under no circumstances shall the total time under test exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason, depressurize the test section and permit the system to "relax" for eight (8) hours prior to the next testing sequence.
 - 5. In accordance with section 9.8 of ASTM F 2164, the pipe shall pass if the final pressure is within 5% of the test phase pressure for the testing period (3 hours maximum). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.
- F. All pressure and leakage testing shall be done in the presence of a representative of the Owner and Engineer.

2.0 CONSTRUCTION DETAILS

2.0.1 EXISTING FACILITIES

Protection of existing facilities shall conform to all the applicable provisions in Section 15 of the Standard Specifications and these Technical Specifications.

All known obstructions to the work are indicated on the attached plans. However, the Port of Stockton cannot guarantee the accuracy of this information. The Contractor will be held responsible for the maintenance and protection of or damage of existing facilities, structures, obstructions, and all underground facilities shown on the plans or brought to the Contractor's attention during the contract.

The Contractor shall notify owner agencies for locations of utilities or facilities prior to excavation. Any damage, which is caused by the operations of the Contractor to any facility, utility, or structure, shall be immediately repaired by him to the satisfaction of the owning agency and the Engineer and no extra work or additional payment will be allowed or made for any repair of utilities, facilities, or structures damaged by the Contractor.

The existing sewer and water systems must be kept operational throughout construction. After completion of construction, the old pipe shall be shut down, abandoned in place and filled with concrete where specified. The Contractor shall coordinate with Port of Stockton staff when shut downs and bypasses of the existing systems are needed. The Contractor shall submit a sewer bypass plan or temporary water supply plan for Port of Stockton review and approval.

Connections to the existing water system shall be done using isolation plates and jumpers per City of Stockton Standard Plan No. W-5 & W-6. The Contractor shall review their proposed methods with the Port of Stockton and receive approval prior to execution. Costs for this work as well as any minor lengths of pipe, couplers, or fittings shall be included in the bid item, for connecting to existing utility.

2.0.2 DUST CONTROL AND WATERING

Dust control and watering shall conform to the provisions in Section 10 and 17 of the Standard Specifications and these Technical Specifications.

At the request of the contractor, water for dust control and project construction will be furnished by the Port of Stockton without cost to the Contractor. Water is available from fire hydrants within the project area. Necessary precautions to prevent dust nuisance shall be taken during all phases of construction, on non-working days, and to final acceptance of the work.

Full compensation for furnishing watering equipment and applying water shall be considered as included in the price paid for the various contract items of work, and no additional compensation will be allowed therefor.

2.0.3 ADJUSTING FRAMES AND COVERS TO GRADE

Upon completion of placing the asphalt concrete, the Contractor shall be required to adjust all existing manhole frames, water valve frames, and miscellaneous facilities to within 1/8 inch of finished grade using new materials similar in character to those in the original structure. Raising devices may not be used without approval of the Port of Stockton Engineer. Frames and covers broken or lost as a result of the Contractor's operations shall be replaced with new frames and covers conforming to the appropriate Standard Plan. Payment for adjusting manhole frames, water valve frames, and other miscellaneous facilities to grade shall be included in the contract price paid per the appropriate contract item for installing asphalt concrete and shall include full compensation for furnishing all labor, materials, adjusting facilities to grade, as shown on the plans and as specified under these Technical Specifications, and no additional compensation will be allowed therefore.

2.0.4 FINISHING ROADWAY

Finishing roadway shall conform to the provisions in Section 22 of the Standard Specifications and these Technical Specifications.

Upon completion of the work, and prior to requesting final inspection, the work area shall be thoroughly cleaned of all rubbish, construction forms, stakes, excess material, and equipment, and all portions of the work shall be left in a neat and orderly condition. The final inspection will not be made until this has been accomplished.

Full compensation for finishing roadway shall be considered as included in the price paid for the various contract items of work requiring finishing, and no additional compensation will be allowed therefore.

2.0.5 TRAFFIC CONTROL

Traffic control shall conform to the applicable provisions in Section 12 of the Standard Specifications, the MUTCD California Supplement, the project encroachment permit, and these Technical Specifications. The Contractor will be required to keep all residents and businesses notified of the work schedule as it affects their access. The roads shall remain open at all times. If the contractor anticipates a necessary road closure, he shall inform the Port of Stockton of such 7 days in advance, receive Port of Stockton permission and prepare a detour plan acceptable to the Port of Stockton.

Contractor shall submit a traffic control plan. The traffic control plan shall address all aspects of the project and demonstrate adequate safety for the entirety of the project. Traffic control plan shall also detail traffic safety outside of working hours.

The Contractor shall be responsible for supplying, installing and maintaining such fences, barriers, lights, signs and flagging personnel as are necessary to give adequate warning to the public at all times that the road or street is under construction and of any dangerous conditions to be encountered as a result thereof.

All barricades to be used at night shall be reflectorized with "reflective sheeting" a minimum of fifty (50) square inches of reflective sheeting shall be used on each side of the barricade. Reflective-type paint will not be acceptable.

All flagging personnel shall wear brilliant fluorescent red or orange jackets while flagging traffic.

2.0.6 LAYING PIPE (OPEN CUT INSTALLATION OF PVC OR DIP)

Each section of pipe and each fitting shall be thoroughly cleaned out before it is installed. All pipe, fittings, valves, etc., shall be carefully lowered into the trench by suitable tools or equipment, in such manner as to prevent damage to the pipe, lining, coating, fitting, or other appurtenances. Under no circumstances shall pipe or accessories be dropped into the trench. The pipe shall be laid true to line, with no visible change in alignment at any joint, unless curved alignment is shown on the plans. Where curved alignment is shown on the plans, the maximum deflection recommendation for the type of pipe and joint being used shall be adhered to.

Whenever pipe laying is discontinued for short periods, or when work is stopped at the end of the day, the open ends of all mains shall be closed with watertight plugs or bulkheads.

The plug or bulkhead shall not be removed unless or until the trench is dry.

Trench backfill shall conform to City of Stockton Standard Plan No. R-36 & R-37 and any additional details shown on the project plans. The Contractor is responsible for providing and paying for compaction testing on the trenches to assure compliance with the project standards. Testing shall be done by an approved third party. At the beginning of backfill operations, the soil technician shall be onsite to observe the backfill and compaction methods and test the backfill at various depths as determined by the Port of Stockton Inspector. Subsequently,

a compaction test is required every 200 feet at approximate locations determined by the Port of Stockton. If the initial compaction tests are failing, the soils technician may make suggestions for alternate backfill materials or methods. All testing results shall be supplied to the Port of Stockton in writing in a timely manner. Costs for compaction testing shall be included in the contract price for pipe installation.

Hot Mix Asphalt shall be placed per Section 39 of the Standard Specifications and shall be placed as Minor Hot Mix Asphalt. Minor Hot Mix Asphalt shall receive compaction efforts using the Method Specification per Section 39 of the Standard Specifications.

All pipe installations shall include detectable warning tape placed over the pipe per the manufacturers recommendations. It shall be appropriately sized and labeled per the type of pipe being installed. Water pipe installation shall also include tracer wire appropriately.

Payment for all pipe installations shall include costs of all necessary fittings and other appurtenances whether implied or stated.

2.0.7 THRUST BLOCKS

Thrust blocks shall be Class B concrete with one and one half (1-1/2") maximum size aggregate and shall conform to the provisions of Section 90, "Portland Cement Concrete," of the Standard Specifications and these Technical Specifications:

- 1) Size of thrust blocks shall be as designated on the City of Stockton Standard Plan No. W-12.
- 2) Payment for thrust blocks shall be included in the contract price for linear foot of pipe.

2.0.8 TESTING OF POTABLE WATER MAINS (PVC AND DUCTILE IRON)

Water mains shall be pressure tested, disinfected, flushed and tested for bacteria twice (initial and 24-hr) at the Contractor's expense. All testing shall comply with current AWWA standards. Chlorinated water from testing shall be de-chlorinated prior to any discharge to the Port of Stockton systems.

The test for hydrostatic pressure shall commence at least seven (7) days after the last concrete thrust block has been cast with a standard cement or at least after thirty-six (36) hours with high early strength cement and after backfilling and compacting to a depth of twelve inches (12") or more above the top of the pipe. The Contractor shall take the necessary precautions to insure the pipe fittings, couplings, valves, and other appurtenances are not displaced during the test. The pipe shall be filled with water at least 24 hours (twenty-four) prior to the test. Each section of the completed pipe under the test shall be subjected to a hydrostatic test pressure of one hundred fifty (200) pounds per square inch for two (2) hours. Note HDPE pipe is tested for 3 hours. During this part of the test, all pipes shall be inspected for leaks, and any leaks, failures, or imperfect construction revealed during the period of tests shall be corrected by the Contractor at his own expense. Tolerances shall be determined by the Port of Stockton.

It shall be Contractor's responsibility to locate and repair the points of line failure; fill, compact the trench, and re-test the section of line in the event the line fails the leakage test.

2.0.9 PIPE LINE ABANDONMENT

Pipelines and water valves that are designated to be abandoned in place shall adhere to this specification and the project plans. Pipelines 10" or greater in diameter shall be filled with flowable concrete, per manufacturers recommendations. A concrete mix design shall be submitted for approval. The Contractor shall supply documentation of the quantity used to complete this portion of the work. Pipes less than 10" in diameter shall be plugged with 12" of concrete. Valve abandonment costs shall be included in the price for pipeline abandonment and shall include removal of surface metal, backfill with concrete, and surface restoration to match adjacent existing conditions.

2.0.10 WORK HOURS, PUBLIC NOTIFICATIONS

Work hours are between 7 am and 6pm Monday through Friday. Contractor must request 72 hours in advance of working on weekends and weekend hours will be 8am to 6pm unless otherwise approved by the Port of Stockton Engineer. Contractor is to notify affected business and residential owners of any project work in the area 48 hours in advance with door signs and street barricades containing a notice of the work schedule.

2.0.11 SURVEYING

The Port of Stockton will provide one set of survey stakes for the required work. It is the Contractor's responsibility to protect said survey markers. Additional survey work and re-staking of lost or destroyed survey markers will be done by the Port of Stockton at the Contractor's expense.

2.0.12 CLEANUP

This work shall consist of cleaning up of the site and facility.

Upon completion of the work, the Contractor shall clean the site of all debris and waste materials. All concrete edges of the walkways shall be backed with dirt and tamped in place.

No measurement for separate payment shall be made for any of the work specified in this section, and all costs in accordance therewith shall be considered as included in the contract price for the item to which the work is pertinent.

2.0.13 HAZARDOUS WASTE REMOVAL CERTIFICATION

The Prime Contractor is required to have a hazardous substance removal certificate or have a listed subcontractor at time of bid that has a hazardous substance removal certificate. If any hazardous materials are discovered, contractor to be compensated per specification section 01250.

2.0.14 HORIZONTAL DIRECTIONAL DRILLING

GENERAL

1. SCOPE OF WORK

The Contractor shall furnish all labor, equipment, and materials necessary to install the designated 16 inch High Density Polyethylene Pipe by horizontal directional drilling (HDD) at the locations shown on the Contract Drawings.

The directional drilling scope shall include, but not be limited to steerable directional drilling equipment, operator control cabin, mud plant, entry and exit pits, pumps, hoses, and other equipment, conductor casing, sheeting, location signs as required, miscellaneous appurtenances to complete the entire Work as shown on the Contract Drawings, and restoration of the project site to pre-existing conditions. HDD operations shall be performed within the easements shown on the Drawings.

2. SUBMITTALS

- A. Pipe pullback load and pipe stress calculations. (P.E. stamp-optional)
- B. Specifications and torque / pullback capacity of HDD drill rig and pump capacity / specifications.
- C. HDD work plan, including installation of conductor casing pilot hole drilling, reaming, and pullback procedures and anticipated rates; calculation of drilling fluid volumes required for pilot hole and

each reaming pass, calculation of maximum drilling speed compatible with pump capacity and soil conditions; solids control plans; equipment and pipe layout areas; tie-ins; and surface restoration.

- D. Contingency plans, for remediation of potential problems that may be encountered during drilling operation.
- E. Description of pipe testing: internal gauging, hydrostatic testing, etc.
- F. Qualifications of superintendent and key personnel, along with Cal/OSHA certification for Site Safety Representative.
- G. Construction activity schedule
- H. As-built pilot bore profile.
- I. Pipe filling and testing before, during, and after pullback.
- J. Frac-out and surface spill contingency plan.
- K. Details of soil separation plan along with disposal of spoils and drilling fluids.
- L. Details for locating, monitoring, and protecting of adjacent utilities, structures, and facilities.
- M. Safety plan
- N. Description of Equipment and Materials, including pullhead, swivel, cutting and reaming tools, safety equipment, pumps, tanks, mixing equipment, containment and clean-up equipment.
- O. Equipment Layout: The Contractor shall submit sketches depicting the layout and locations of equipment within the rig side work area and pipe layout area, including any proposed drilling fluid containment and recirculation tanks. The Contractor shall confirm that all operations shall be completely contained within the work area.
- P. Pipe Testing: The Contractor shall submit a test plan that will be used to confirm no damage was caused to the pipe during pullback operations. Testing of the pipe shall be in accordance with Project Specifications
- Q. Qualifications: Submit written documentation of HDD superintendent and key personnel experience in accordance with this specification. Submit evidence of Cal/OSHA certification for the Site Safety Representative.
- R. As Built Drawings:
 - 1. The Contractor shall submit As-Built drawings to the Engineer. All As-Built drawings shall have been reviewed and accepted by the Engineer prior to Contractor's de-mobilization. All drawings shall be legible with dimensions accurately shown and clearly marked in English.
 - 2. Drawings and photographs transmitted by a facsimile will not be accepted.
- S. Schedule: At least fifteen (15) days prior to mobilization, the Contractor shall submit a detailed schedule for the HDD installation showing all major construction activities and durations, with beginning and completion dates shown. The schedule shall be updated at least every two weeks or more frequently, as directed by the Engineer, and shall include:
 - 1. Utility locate requests and visual confirmation of all crossing utilities and all parallel utilities within ten (10) feet laterally of the bore centerline.

2. Rig mobilization and setup.
 3. Conductor casing installation (If HDD crew deems it required).
 4. Pilot bore drilling.
 5. Pre-reaming and reaming.
 6. Layout and joining of pipe.
 7. Pressure testing of pipe prior to pullback.
 8. Final reaming and pullback of pipe.
 9. Pressure testing of entire pipeline after installation.
 10. Cleanup, surface restoration, and demobilization.
- T. Pilot Bore As-Built Profile: The Contractor shall submit an as-built profile of the pilot bore within 48 hours of completion of the pilot bore.
- U. Frac-Out and Surface Spill Contingency Plan: A Frac-out and Surface Spill Contingency Plan shall be prepared for the installation of pipeline using HDD. This plan shall be submitted to the Engineer prior to construction. The Contractor shall submit letter signed by an authorized representative of Contractor, confirming that the plan will be followed. The contingency plan for inadvertent returns/hydrofracture shall address all potential pathways for release of drilling fluid, and shall address containment, cleanup, and mitigation measures as well as reporting procedures and points of contact for regulatory and permitting agencies. The Plan shall address releases to the ground surface and to any environmentally sensitive areas.
- V. Soil Separation Plant and Plans for Disposal
1. The Contractor shall submit details on the pump and cleaning plant. Include dimensions, manufacturer's specifications, pump capacity, noise rating, and soundproofing details on the system.
 2. Pump capacity should be specified for water at sea level elevation, and adjusted for actual elevation and fluid viscosity.
 3. Provide details on the generator, including dimensions, noise ratings at twenty-five (25) feet, and soundproofing. Confirm that the generator and other on-site equipment can be operated without exceeding the maximum allowable noise tolerances specified in permit.
 4. Plans for Disposal of Spoils and Drilling Fluids: The Contractor shall submit plans for disposal of waste materials resulting from the pipeline construction, including drilling fluids, cuttings, waste oil, fuel, discharge water, etc. The Contractor shall identify the disposal site and submit a letter indicating willingness and legal authority to accept the described and anticipated waste products.
- W. Description of Equipment and Materials: The Contractor shall submit detailed descriptions of all equipment and materials to be used for the pipeline installation. Equipment and material submittals shall include the directional drill rig, drill rig anchoring system, the mud system, drill bits, mud motors, reamers or hole openers, pipe rollers for pullback, drilling fluid and additives, pipe pull head, and pipe pulling swivel. Descriptions of equipment shall include manufacturers' specifications, calibrations, appropriate drawings, photographs, and descriptions of any modifications since manufacture. Descriptions of drilling fluid additives shall be accompanied by

Materials Safety Data Sheets (MSDS) and manufacturers' descriptions and warranties.

3. PERFORMANCE REQUIREMENTS

- A. Equipment: The Contractor shall provide all equipment, materials, and personnel necessary for completing the installation as shown on the plans and specified herein. The equipment and materials shall include but are not limited to:
1. Directional drilling rig with all ancillary equipment, including drill pipe, drilling fluid, cutting tools, reaming bits, swivels, expanders, motors, pumps, hoses, mixing equipment, drilling fluid processing equipment (cuttings separation equipment), spare parts, pipe handling equipment, crane, backhoe, roller, side boom tractors, control cabin, control equipment, and office equipment.
 2. Drilling fluids, water, fuel, lubricant, polymers, or other additives.
 3. Any other expendable or re-usable materials, supplies, and equipment needed for the installation.
- B. The drilling equipment shall be capable of advancing through the geologic conditions to be encountered at the site as anticipated by the Contractor.
- C. The drilling fluid shall be designed for the geologic conditions to be encountered at the site as anticipated by the Contractor.
- D. The drilling system shall include a fluid pump and separation plant that can achieve the rates of drilling fluid pumping, spoil separation, and slurry cleaning required by the Contractor to achieve planned production rates for the soils and rock as anticipated by the Contractor. Shaker screens and hydrocyclones may be required for efficient separation of spoils. The Contractor is advised that the separation plant must fit within the allowable work areas.
- E. All spoil and slurry must be contained in trucks, tanks, approved recirculation pits, or other containers at all times. Dumping of spoil or slurry on the ground, discharge into sewers, or discharge into the water bodies will not be permitted. All spoils will be transported and disposed of off-site at an approved disposal facility that meets all State of California and local requirements.
- F. Perform all work within work areas.
- G. The pipeline shall be installed using the radii of curvatures and entry and exit angles shown on the Drawings, unless deviations are approved in writing by the Engineer.
- H. Pipe rollers and lifters shall be required to help the transition of the carrier pipe into the bore. The number of pipe rollers and lifters shall be determined by the Contractor and submitted as part of the work plan.
- I. Surface settlement or heave of utilities and other features above the HDD centerlines and within the zone influenced by the HDD construction shall be limited to values that avoid damage. The Contractor shall repair any damage resulting from settlement or heave caused by HDD activities at no additional cost to the Port. The Contractor shall grout any excessive voids caused by or encountered during drilling as specified in this section and in accordance with industry accepted methods.
- J. Safety: It shall be the Contractor's sole responsibility that all work is done in conformance with all applicable federal, state, and local safety requirements. Required safety equipment and procedures shall be employed by the Contractor at all times.
- K. Pipe: The fabricated pipe will be pressure-tested by the Contractor prior to pullback and after

installation is completed, in accordance with requirements specified in the Project Specifications.

- L. The Contractor shall allow access to the Engineer and shall furnish necessary assistance and cooperation to aid the Engineer in observations and data and sample collection, including, but not limited to the following:
1. The Port and Engineer shall have full access to the operator control container prior to, during, and following all HDD operations. This shall include, but not be limited to, providing visual access to real-time operator control screens, gauges, and indicators.
 2. The Port and Engineer shall have full access to the slurry separation plant prior to, during, and following all HDD operations. This shall include, but not be limited to, full access to shaker screens, hydrocyclones, conveyor belts, and slurry and spoil holding tanks. The Engineer shall be allowed to collect soil samples from the shaker screens and/or spoil holding tanks on the slurry separation plant a minimum of once per drill pipe section, and whenever changes in conditions are observed or suspected.
4. QUALITY ASSURANCE (CONTRACTORS shall submit items required in 4.A. & 4.B. in their bid)
- A. Contractor Qualifications and Experience: The Contractor shall have at least five (5) years of demonstrated successful experience installing pipelines using the horizontal directional drilling process on at least five (5) projects with similar diameters, installation lengths, and ground and groundwater conditions. At least three (3) of the projects must include sixteen (12) inch outer diameter or larger pipeline installations. These projects shall include individual bore lengths of at least 1,000 feet under similar soil conditions. The Contractor shall demonstrate successful completion of at least three (3) projects where pipe was installed with horizontal directional drilling techniques. The Contractor shall furnish evidence of successful experience by including project COMPANY, project name, location, diameter, length, depth, ground conditions, any problems encountered and how resolved, and any claims and how resolved.
- B. Qualifications and Experience of Contractor Personnel: The Contractor shall employ skilled, experienced superintendent(s), drill rig operators, welders, and key personnel. The superintendent(s) and drill rig operators shall have at least three (3) years of successful experience using the HDD process, on at least five (5) projects with similar diameters, pullback length, and ground conditions. The projects should include individual bores of at least 12 inches pipe diameter and at least 1,000 feet in length. The Contractor shall furnish resumes of the superintendent(s) and operators. Personnel experience records should include project names, locations, pullback lengths, ground conditions, pipe materials, project description, project COMPANY, engineer, and references with names, addresses, and telephone numbers. The superintendent and operators listed in the submittal shall be on site during all construction related activities required for the HDD installation.
- C. Advance Notice and Inspections: The Contractor shall provide at least 72 hours advance written notice to the Engineer of the planned inception of major drilling activities, including pilot bore launch, pre-reaming, reaming, and pipe pullback. The Contractor shall immediately notify the Engineer, in writing, when any significant problems are encountered or if ground conditions are considered by the Contractor to be materially and significantly different than those represented within the Contract Documents. All work by the Contractor shall be performed in the presence of the Engineer, unless Engineer grants prior written approval to perform such work in Engineer's absence.

PRODUCTS

5. DRILLING FLUIDS
- A. The Contractor shall select drilling additives and fluid mixture proportions to ensure continuous circulation, bore stability, reduce drag on the pipe, and completely fill the annular space between the bore and the pipe to ensure stability and control settlement. Management and disposal of

drilling fluids shall be the Contractor's responsibility. Drilling fluids shall not be disposed of on-site or discharged to sanitary or storm sewers, or any water way.

6. DRILL PIPE

- A. The Contractor shall provide high quality drill pipes that have been inspected and determined to be adequate for the project requirements. Bent, cracked, or fatigued drill pipes shall not be used. Threads must be in good condition. The length of each drill pipe shall be measured and recorded.

CONSTRUCTION DETAILS

7. GENERAL

- A. The Contractor shall provide adequate control of surface water and drilling fluids drainage and runoff, and provide silt fences, hay bales, and wattles to prevent surface water or drilling fluids from entering any waterway or vernal pool.
- B. The Contractor shall not initiate HDD until all submittals are received, reviewed, and accepted by the Engineer or Port.
- C. The Contractor shall not initiate HDD until all required permits are obtained.

8. PROTECTION OF UNDERGROUND UTILITIES

- A. The Drawings show existing buried utilities that are believed to be near the directional drill alignment. There is no guarantee that these utilities are located as shown or that other utilities are not present. It shall be the Contractor's responsibility to locate all nearby utilities or other potential subsurface obstructions that may interfere with the work.
- B. The Contractor shall notify "One Call" system to request marking of utilities that subscribe to One Call, and shall individually notify all other known or suspected utilities to request marking of their utilities.
- C. The Contractor shall confirm that all requested locates are made prior to commencing drilling operations.
- D. The Contractor shall make all diligent efforts to locate any unmarked or abandoned utilities using all available information, maps, and drawings.
- E. The Contractor shall request, obtain, and use maps and drawings from utility owners depicting updated as-built locations of all utilities to assist in locating and protecting utilities.
- F. The Contractor shall visually confirm and stake all existing lines, cables, or other underground facilities including exposing all crossing utilities and utilities within ten (10) feet laterally of the centerline of the designed drilled path.
- G. The Contractor shall control drilling practices to prevent damage to existing utilities.
- H. The Contractor shall be responsible for all losses and repairs occasioned by damage to underground utilities resulting from drilling operations.
- I. The Contractor shall make diligent effort to locate surface evidence of any other potential subsurface obstructions, such as piers and piles.

9. WORK STAGING AREA

- A. Work Staging: The Contractor shall limit staging and work operations to the areas shown on the Drawings, or as otherwise accepted in writing by the Engineer, for storage of equipment and materials, parking, pipe layout, drilling, and other work.

- B. Construction Impacts: The Contractor shall maintain the work area in a manner that shall minimize adverse impacts on other public use activities. The Contractor shall proceed with work in a safe, orderly manner, while maintaining the work site free of debris and unnecessary equipment and materials.
- C. Control of Drilling Fluids: The Contractor shall follow all requirements of the Frac-Out and Surface Spill Contingency Plan as submitted and approved and shall control operational pressures, drilling mud weights, drilling speeds, and any other operational factors required to avoid hydrofracture, fluid losses to formations, and drilling fluid spillage. This includes any spillages or returns at entry and exit locations or at any intermediate point. All inadvertent returns or spills shall be promptly contained and cleaned up. The Contractor shall immediately notify~ Engineer of any inadvertent returns or spills and immediately contain and clean up the return or spill.
- D. Combustible Materials: Combustible materials (fuel, oil, lubricants, etc.) shall be stored off- site or in a well-ventilated storage facility removed from the immediate vicinity of the drilling area by at least twenty (20) feet.
- E. Temporary Lighting: The Contractor shall procure and maintain all temporary lighting needed for Contractor's operations, safety, testing, and inspection. Temporary lighting shall be removed after completion of construction. Barricades, Warning Signs, and Lights:
- F. The Contractor shall, in accordance with approved Traffic and Safety Plans, erect appropriate barriers, warning lights, and signs, painted with approved colors, warnings, and graphics to ensure adequate warning to personnel and the public.
- G. Removal of Temporary Facilities: At the completion of construction, the Contractor shall remove all temporary facilities installed by the Contractor. Unused soil, aggregate, and other materials shall be removed and disposed of at approved sites in accordance with all Federal, State, and Local regulations. Any damage to streets, lawns, common areas, and sidewalks shall be restored to original or better conditions. All disturbed areas shall be re-vegetated.

10. MOBILIZATION

- A. The Contractor shall mobilize all equipment, materials, and personnel necessary to construct the pipeline using the HDD process at the locations shown in the Drawings.
- B. Entry Area: The Contractor shall set up temporary workspace within the areas shown on the Drawings. Appropriate precautions and measures shall be employed by the Contractor to prevent erosion, surface drainage, and spillage of drilling fluids or other materials that could adversely impact the environmental quality of the site. Silt fences, hay wattles, and hay bales shall be used to line the work area to minimize erosion and contain any spillages or runoff. Shovels, brooms, buckets, and barrels shall be kept on-site to facilitate containment and cleanup. A vacuum truck or trailer unit shall be on standby and capable of responding within one hour to any spill or inadvertent return incident.
- C. Exit Area: The exit area shall have a drilling fluid pit for containing drilling fluids and cuttings. Appropriate precautions and measures shall be employed by the Contractor to prevent erosion, surface drainage, and spillage of drilling fluids or other materials that could adversely impact the environmental quality of the site. Hay bales or wattles shall be used to line the exit area to minimize erosion and runoff. Containment and cleanup equipment shall be available to contain and clean up any surface spills and frac-outs.
- D. Pipe Layout Area: Layout area shall be free of stones, wood, debris and obstructions. Pipe rollers shall be provided by the Contractor to facilitate pipe pullback.

11. HORIZONTAL DIRECTIONAL DRILLING

- A. **Drill Rig Capacity:** The capacity of the directional drilling system used by the Contractor shall be adequate to install the specified pipeline. Drill rig shall be capable of a minimum 100,000 lbs. pullback and shall be able to install the proposed diameter pipe in a continuous run of a minimum of 1500 feet.
- B. **Pump Capacity:** The pump used by the Contractor shall be adequate to supply the required flow rate and pressures at the anticipated drilling fluid viscosity at all times. Drilling speeds shall not exceed pump capacity.
- C. **Bore Tracking and Monitoring:** At all times during the pilot bore the Contractor shall provide and maintain a walkover bore tracking system that is capable of accurately locating the position of the drill head in the x, y, and z axes. The Contractor shall record the data at least once per drill pipe length or every thirty (30) feet whichever is more frequent.
- D. **Deviations between the recorded and design bore path shall be calculated and reported on the daily log. If the deviations exceed tolerances specified elsewhere, such occurrences shall be reported immediately to the Engineer. The Contractor shall undertake all necessary measures to correct deviations and return to design line and grade.**
- E. **Drilling Fluid Pressures and Flow Rates:** Drilling fluid pressures and flow rates shall be continuously monitored and recorded by the Contractor. The pressures shall be monitored at the pump.
- F. **Drilling Fluid Viscosity and Density (Mud Weight):** The Contractor shall measure and record drilling fluid viscosity and density at least two (2) times per shift with at least two (2) hours between readings, using calibrated Marsh funnel and mud balance. These measurements shall be included in daily logs submitted to the Engineer. The Contractor shall document modifications to the drilling fluids, by noting the types and quantities of drilling fluid additives and the dates and times when introduced. The reason for the addition of drilling fluid additives or other modifications shall be documented and reported.
- G. **Location of Entry and Exit Points:** Entry and exit points shall be as shown on the Drawings, unless otherwise approved in writing by the Engineer. The Contractor shall employ licensed, experienced surveyors to locate the entry and exit points, and to establish horizontal and vertical datum for the bore and the pipe layout and fabrication areas.
- H. **Pilot Bore:** The pilot bore shall follow the design path of the bore shown on the Drawings.
- I. **Horizontal and Vertical Tolerances:** Horizontal and vertical deviations shall be less than plus or minus three (3) feet from the design path centerline. The Contractor shall continuously monitor horizontal and vertical position and record the position at least once per drill pipe length, or at thirty (30) feet intervals, whichever is most frequent.
- J. **Radius of Curvature:** The radius of curvature shall not be less than that shown on the Drawings. The radius of curvature shall be calculated over the distance of three (3) drill pipe sections.
- K. **Entry and Exit Tolerances:** The location of the entry and exit points shall be as shown on the Drawings. The Contractor shall be solely responsible for all work necessary to correct excessive deviations from line and grade, including re-drilling, redesigning connections, and acquiring additional easement, at no additional cost to the Port and without schedule extension.
- L. **Pre-reaming and Reaming:** The pilot bore shall be pre-reamed and reamed using equipment and methods submitted by the Contractor. The Contractor shall completely ream the bore to the final diameter prior to pullback.
- M. **Hydrostatic Pretest:** The Contractor shall perform hydrostatic water pressure test in accordance with Project Specifications prior to pipe pullback.

N. Pipe pullback

1. The pipe shall be installed by pulling it into the reamed bore path in a continuous operation, behind a final reaming tool selected by the Contractor.
 2. The pipe shall be isolated from excessive torsional and axial stresses by a swivel device.
 3. All measurements shall be made, recorded, and submitted on the daily logs during final reaming and pipe pullback.
 4. The Contractor shall take appropriate steps during pullback to ensure that the pipeline will be installed without damage.
 5. Pipeline Support: The pipelines shall be adequately supported during installation so as to prevent overstressing or buckling. The Contractor shall provide adequate support/rollers along the pipe layout area to support the required length of the pipe for the bore. Such support/rollers shall be spaced at a maximum of 60 feet on centers, and 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. The pipe layout area shall be cleared of all large stones, construction debris, or other foreign objects that could damage the pipe during pullback.
 6. The end of the pipe shall be closed during the pull back operation.
 7. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately before joining.
 8. The Contractor shall at all times handle the pipe in a manner that does not overstress or otherwise damage the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense.
 9. If needed, the pipe shall have water added as it enters the bore to achieve neutral buoyancy and reduce pullback loads and to ensure that adequate internal pressure is maintained at all points to counter balance collapse pressures.
 10. The Contractor shall monitor and inspect pipe rollers and method for suspending pipe at entry during the pullback operation to avoid damage to the pipe.
 11. The Contractor shall cease pullback operations if the pipe is damaged and shall remove the pipe from the bore and repair the pipe per Port requirements or replace the damaged pipe before resuming installation.
- O. Final Hydrostatic Test: The Contractor shall conduct a final hydrostatic test of the installed pipeline. Final test shall be in accordance with Project Specifications. The Contractor shall repair any defects discovered during this test, and repeat until the pipe passes the test.
- P. Obstructions: The Contractor shall notify the Engineer immediately in the event that any obstruction is encountered that prevents further advancement of the drill pipe, or pullback of the pre-reamer, reamer, and/or pipe. The Contractor shall make all diligent and reasonable efforts to advance past the object by drilling slowly through the object, or pulling back and drilling along a new bore path that avoids the object, or excavating and exposing and removing the object, and all other reasonable attempts to continue the bore. The Contractor shall notify the Engineer of proposed measures to attempt to advance past the object, prior to initiating the attempt. If the

Contractor attempts to pullback and re-drill, the Contractor shall adhere to line and grade tolerances established in this specification section, unless the Engineer approves variance, in writing, prior to the Contractor's attempt to re-drill. The Contractor and Engineer shall investigate the cause and together determine an appropriate response. Appropriate response may include revisions to equipment or methods, retraction and re-drilling of a portion of the bore, or abandonment of the hole. If abandonment is deemed necessary, the Contractor shall recover, to the extent practicable, any drill pipe, product pipe, and tools in the bore, and properly abandon the bore by contact grouting, unless otherwise directed in writing by the Engineer. If the bore is abandoned, the Contractor shall be allowed to begin a second attempt to install the pipeline at an alternate location subject to approval, in writing, by the Engineer. The Contractor shall take all reasonable actions to complete the installation with minimal delays.

- Q. Site Restoration and Demobilization: The Contractor shall remove all equipment, materials, drilling fluids, muck, waste, and debris from the site and restore the site to its original condition upon completion of the installation. Restoration and demobilization shall be completed by the Contractor within seven (7) days of the completion of the pipeline installation.
- R. Settlement Monitoring: The Contractor shall monitor for settlement or heave before and during drilling and grouting operations.

(END OF SECTION)