SECTION 02350 DIRECTIONAL DRILLING

PART 1 GENERAL 1.1 WORK INCLUDED

A. Furnish all labor, materials and equipment required to install 6" nominal diameter water main pipe or 12" and 14" nominal diameter casing pipe using directional drilling method of Installation where shown on the Drawings. DIRECTIONAL DRILLING MAY ALSO BE USED IN LIEU OF THE OPEN CUT METHOD IF DESIRED BY THE CONTRACTOR; HOWEVER, NO ADDITIONAL PAYMENT WILL BE MADE FOR DIRECTIONAL DRILLING (if the contractor elects to directional drill areas called out as open cut, the contractor shall be paid at the contract unit price for open cut for those areas). The pipe size, type and length shall be as specified herein and as shown on the Drawings. Work hall include and not be limited to proper installation, testing, restoration of underground tilities and environmental protection and restoration

- B. The Contractor shall be responsible for all installation processes and procedures ssociated with the installation by horizontal directional drilling in accordance with this specification C. The directional drill shall be accomplished by first drilling a pilot hole to design standards.
- and then enlarging the pilot hole on larger than 1.5 times larger than the outer diameter of the pipe and fittings to accommodate the pull back of the pipe through the enlarged hole. See CONDITIONS OF THE CONTRACT and GENERAL REQUIREMENTS, which contain information and requirements that apply to the Work specified herein and are mandatory for this project.
- 1.2 SCOP A. This specification covers high density polyethylene pipe (C906, DR 11) and restrained joint polyvinyl chloride pipe (C900, DR-18), with ductile iron inside diameters of 6" - 14" installed by the directional drilling method.
- 1.3 REFERENCE DOCUMENTS
- A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail. Unless otherwise specified, references to documents shall mean the documents in effect at the time of design, bid, or construction, whichever is earliest. If referenced documents
- have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was C. American Society for Testing Materials (ASTM)
- 1. ASTM D1784: Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly ASTM D1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

3. ASTM D2122: Standard Test Method for Determining Dimensions of Thermoplastic

- Pipe and Fittings 4. ASTM D2152: Test Method for Degree of Fusion of Extruded ASTM D2/12: Feel welder for Digres of Housing Exhibits Exhibits and the Exhibits and the Poly (Vinyi Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
 ASTM D2241: Poly (Vinyi Chloride) (PVC) Plastic Pipe (SDR-PR)
 ASTM D2665: Poly (Vinyi Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and
- 7. ASTM D2774-08 Standard Practice for Underground Installation of Thermoplastic
- Pressure Piping 8. ASTM D2837: Standard Test Method for Obtaining Hydrostatic Design Basis for
- Thermoplastic Pipe Materials 9. ASTM D3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC)
- Sewer Pipe and Fittings 10. ASTM D3350: Standard Specification for Polyethylene Plastics Pipe and Fitting
- 11. ASTM F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe ASTM F1055: Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
 ASTM F1057: Standard Practice for Estimating the Quality of Extruded Poly (Vinyl
- oride) (PVC) Pipe by the Heat Reversion Technique 14. ASTM F1290-98a (2004) Standard Practice for Electrofusion Joining Polyolefin Pipe
- 15. ASTM F1962-05e1 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River
- Crossings 16. ASTM F2164-02(2007) Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure 17. ASTM F2620-09e1 Standard Practice for Heat Fusion Joining of Polyethylene Pipe
- and Fittings
- American Water Works Association (AWWA 1. AWWA C110: American National Standard for Ductile-Iron and Gray-Iron Fittings, 3inch through 48-inch, for Water and Other Liquids 2. AWWA C111: American National Standard for Rubber-Gasket Joints for Ductile-Iron
- Pressure Pipe and Fittings 3. AWWA C153: AWWA Standard for Ductile-Iron Compact Fittings for Water Service 4. AWWA C605: Standard for Underground Installation of Polyvinyl Chloride (PVC)
- Pressure Pipe and Fittings for Water
- AWWA C651: Standard for Disinfecting Water Mains
 AWWA C900: Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in, through 12 in. (100mm Through 300mm), for Water Distribution
 AWWA C906: Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4" Through
- 63°, for Water Distribution and Transmission 8. AWWA M23: AWWA Manual of Supply Practices PVC Pipe—Design and 9. AWWA M55: AWWA Manual of Water Supply Practices PE Pipe - Design and
- E. National Sanitation Foundation (NSF)
- NSF14: Plastic Pipe System Components and Related Materials NSF61 Drinking Water System Components – Health Effects

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F. UNI-PUB-08 Tapping Guide for PVC Pressure Pipe

1.4 REQUIREMENTS

В.

C.

- General Products delivered under this specification shall be manufactured only from distribution pipe and couplings conforming to AWWA C900 (PVC) or C906
- Materials HDPE - Pipe and fittings shall be made from virgin resins exhibiting a minimum cell classification of PE 345444C as defined in ASTM D3350 with an established hydrostatic-design-basis of 1600 psi for water at 73°F. The resin shall be listed by the PPI (Plastic Pipe Institute) in its pipe-grade registry Technical Report (TR) 4,
- "Listing of Plastic Pipe Compounds" Polyvinyl Chloride Pipe (PVC) – Restrained Joint PVC pipe and couplings shall be made from unplasticized PVC compounds having a minimum cell classification of 12454-B, as defined in ASTM D1784. The compound shall qualify for a Hydrostat Design Basis (HDB) of 4000 psi for water at 73.4 Degrees F, in accordance with the requirements of ASTM D2837.
- 1. The pipe products shall have been tested and approved by an independent thirdparty laboratory for continuous use at rated pressure. Copies of Agency approval
- reports or product listing shall be provided to the Engineer. Products intended for contact with potable water shall be evaluated, tested, and certified for conformance with NSF Standard 61 by an acceptable certifying organization D. Dimensions
- 1. Outside diameters and wall thicknesses shall follow the Dimension Ratio (DR) listed the specification as prescribed in AWWA C900 for PVC or AWWA C906 for HDPE. HDPE pipe diameters must be ductile iron outside diameter (DIOD). Laying lengths are 20 feet standard for PVC and 40 or 50 feet for HDPE.
- E. Joints HDPE Pipe
- 1. HDPE pipe shall be fusion joined in accordance with ASTM F2620 for butt fusion or ASTM F1290 for electrofusion. Only flanges or other mechanical joint systems proven for HDPE pipes shall be used.
- 2. Connections to other pipe materials shall be made with "Harvey Style" HDPE mechanical joint (MJ) adapter kits. PVC Pipe
- The pipe shall be joined using non-metallic couplings which, together, have been designed as an integral system for maximum reliability and interchangeability. High-strength flexible thermoplastic splines shall be inserted into matting

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Couplings shall be designed for use at the rated pressure of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the leakage est requirements of ASTM D3139. F. Marking: Pipe shall be legibly and permanently marked with the following information. Manufacturer and Trade Name Nominal Size & DR Rating/Pressure Class (NSF-61)

restraint with evenly distributed loading

precision-machined groves in the pipe and coupling to provide full 360 degree

- Manufacturing Date Code Pipe and fittings shall also bear the mark of the certifying agency(s) which have
- tested and approved the product for use in fire protection applications. G. WORKMANSHIP
- 1. As defined in AWWA C900, PVC pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.
- As defined in AWWA C906, PE pipe and fittings shall be homogeneous throughout and free from voids, cracks, inclusions, and other defects, and shall be as uniform as commercially practicable in color, opacity, density, and other physical characteristics

1.5 LOCATIONS

- A. Locations where directional boring is required are indicated on the plans B. Directional boring may be utilized in lieu of open cut for areas not specifically indicated as directional bore areas on the plans. No additional payment will be made for utilizing directional bore method in lieu of open cut.
- 1.6 SUBMITTALS

complete the project

- A. Directional drilling contractor's qualifications and experience.
- B. Work plan: Prior to beginning work, the CONTRACTOR must submit to the ENGINEER a work plan detailing the procedure and schedule to be used to execute the project. The work plan should include a description of all equipment to be used, down-hole tools, a list of personnel and their qualification and experience (including backup personnel in the event that an individual is unavailable), list of subcontractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), an environmental protection plan and contingency plans for possible problems. Work plan should be comprehensive, realistic and based on actual working conditions for this particular project. Plan should document the thoughtful planning required to successfully
 - Material: Specifications on material to be used shall be submitted to ENGINEER. Material shall include the pipe, fittings and any other item which is to be an

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installed component of the project. The following product data is required at a

Pipe Size

- Dimensionality
 Pressure Class per applicable standard Color
- Recommended Minimum Bending Radius
 Recommended Maximum Safe Pull Force
- Fusion technician qualification for FPVC
- Equipment: Submit specifications on directional drilling equipment to be used to nsure that the equipment will be adequate to complete the project. Equipment ensure that the equipment will be adequate to complete the project. Equipment shall include but not be limited to: drilling rig, mud system, mud motors (if applicable), downhole tools, guidance system, rig safety systems. Calibration records for guidance equipment shall be included. Specifications for any drilling fluid additives that CONTRACTOR intends to use or might use shall be automited.

1.7 QUALITY ASSURANCE

- A. All directional drilling operations shall be done by a qualified directional drilling CONTRACTOR with at least (3) years experience involving work of a similar nature to the work required of this project B. Notify ENGINEER and OWNER a minimum of three (3) days in advance of the state of
- C. All work shall be performed in the presence of the OWNER or ENGINEER.

PART 2 PRODUCTS

- 2.1 HIGH DENSITY POLYETHYLENE PIPE A. The polyethylene pipe material shall meet AWWA C906 standards for Polyethylene pipe and fittings with a DR of 11. The pipe OD sizes shall be available in ductile iron pipe
- The pipe is to be joined by heat fusion, flanges or other mechanical joint systems proven for HDPE pipes. Both pipe and fittings must be NSF listed by the manufacturer with the pipe bearing the "NSF" logo or mark.
- Where HDPE pipe is upsized to meet the required design ID, ductile iron reducers shall be used to connect to fittings and valves or the fittings and valves may be upsized to meet the pipe OD.
- 2.2 POLYVINYL CHLORIDE PRESSURE PIPE FOR POTABLE WATER The pipe shall be joined using a separate PVC coupling with beveled edges, built in sealing gaskets and restraining grooves. The restraining splines shall be square and nade from Nylon 101.

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Plyvinylchloride pipe shall be manufactured in a standard 20' nominal length. В. Polyvinylchloride pipe shall be blue in color for potable water use.

D. Pipe shall be marked as follows:

- ominal pipe size Dimension Ratio, Standard Dimension Ratio, or Schedule
- AWWA pressure class AWWA standard designation number
- NSF-61 mark verifying suitability for potable water service Extrusion production-record code
- Trademark or trade name Cell Classification 12454 and/or PVC material code 1120 may also be included 10. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.
- 2.2.1 JOINTS
- The pipe shall be joined using non-metallic couplings which, together, have been designed as an integral system for maximum reliability and interchangeability. Hightrength flexible thermoplastic splines shall be inserted into matting precision-machine groves in the pipe and coupling to provide full 360 degree restraint with evenly distributed
- Couplings shall be designed for use at the rated pressure of the pipe with which they are tilized, and shall incorporate twin elastomeric sealing gaskets meeting the of ASTM F477. Joints shall be designed to meet the leakage test requirements of ASTM
- 2.2.2 CONNECTIONS AND FITTINGS FOR PRESSURE APPLICATIONS Connections shall be defined in conjunction with the coupling of project piping,
- as well as the tie-ins to other piping systems. B. DUCTILE IRON MECHANICAL AND FLANGED FITTINGS
- Acceptable fittings for use with fusible polyvinylchloride pipe shall include standard ductile iron fittings conforming to AWWA/ANSI C110/A21.10, or AWWA/ANSI C153/A21.53 and
- WWA/ANSI C111/A21.11. Connections to fusible polyvinylchloride pipe may be made using a restrained o
- non-restrained retainer gland product for PVC pipe, as well as for MJ or flanged
- Bends, tees and other ductile iron fittings shall be restrained with the use of hrust blocking or other means as indicated in the construction documents.
- 3. Ductile iron fittings and glands must be installed per the manufacturer's
- C. PVC GASKETED, PUSH-ON FITTINGS
 - 02350-6

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drilling crew and in safety. Each person must have at least two years directional drilling

- pipe during handling and pullback operations
- be used to assure adequate support and excessive sagging of the product pipe.
- 2. A sufficient quantity of rollers and spacing, per the pipe supplier's guidelines shall 2.4 PERSONNEL REQUIREMENTS
 - All personnel shall be fully trained in their respective duties as part of the directional
- Pipe rollers, if required, shall be of sufficient size to fully support the weight of the
- C. PIPE ROLLERS
- assuring a smooth wall against the pipe cross-section at all times. 2. Pipe pull heads shall be specifically designed for the pipe to be used as
- B. PIPE PULL HEADS 1. Pipe pull heads shall be utilized that employ a positive through-bolt design
- For gravity application and on-grade drilling, sonde/beacon or approved equipment applicable for grade increments of 1/10th of one percent shall be used.
- Point of rotation of the head shall also be monitored.
- dimensions: a. Offset from the baseline b. Distance along the baseline, and
 c. Depth of cover.
- agnetic detection system. The drilling head location shall be monitored in three
- 2. The drilling head shall be remotely steer-able by means of an electronic o
- G. DRILLING CONTROL SYSTEM Calibration of the electronic detection and control system shall be verified prior to the start of the bore
- 4. Closed-loop drilling fluid system and a drilling fluid cleaning system should be used to whatever extent practical, depending upon project size and conditions. Under no circumstances shall drilling fluid that has escaped containment be reused in the drilling system.
- posed of. The use of spill containment measures shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps, vacuum truck(s), and/or storage of sufficient size shall be n place to contain excess drilling fluid.
- The delivery system shall have filters or other appropriate in-line equipment to ent solids from being pumped into the drill pipe. 3. Used drilling fluid and drilling fluid spilled during drilling operations shall be
- fluid in accordance with the drilling equipment pull-back rating at a constant

- DRILLING FLUID DELIVERY AND RECOVERY SYSTEM 1. The drilling fluid pumping system shall have a minimum capacity to supply drilling 02350-8
- 3. The mixing system shall continually agitate the drilling fluid during drilling
- fluid for the proje 2. The mixing system shall be able to ensure thorough mixing of the drilling fluid. The drilling fluid reservoir tank shall be sized for adequate storage of the fluid.
- MIXING SYSTEM 1. Drilling fluid mixing system shall be of sufficient size to mix and deliver drilling
- e. No additional chemicals or polymer surfactants shall be allowed to be added to the drilling fluid unless they have been submitted per this specification.
- and maintain the integrity of bore wall(s). d. Drilling fluid shall be disposed of off-site in accordance with local, state and federal requirements and/or permit conditions.
- . The water and additives shall be mixed thoroughly to assure the absence o any clumps or clods. No hazardous additives may be used c. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings
- a. Drilling fluid shall be composed of clean water and the appropriate additive for the fluid to be used. Water shall be from a clean source and shall meet the mixing requirements of the mixture manufacturer(s).
- A. DRILLING FLUID (DRILLING MUD)
- C. Drill head shall contain all necessary cutters and fluid jets for the operation, and shall be of the appropriate design for the ground medium being drilled. D. DRILLING FLUID SYSTEM
- B. The system must be able to control the depth and direction of the drilling
- DRILL HEAD A. The horizontal directional drilling equipment shall produce a stable fluid lined tunnel with the use of a steer-able drill head and any subsequent pre-rearing
- B. The drilling rig hydraulic system shall be of sufficient pressure and volume to power drilling operations. The hydraulic system shall be free from leaks. C. The drilling rig shall have a system to monitor pull-back hydraulic pressure during pull-back operations
- rotate, push and pull drill pipe while delivering a pressurized fluid mixture to a drill The machine shall be anchored to withstand the pulling, pushing and rotating forces required to complete the project.

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- A. The directional drilling machine shall consist of a hydraulically powered system to
- emergency and contingency plan as submitted per these specifications. B. DRILLING RIG

C.

- The directional drilling equipment, as a minimum, shall consist of a directional drilling rig of sufficient capacity to perform the bore(s) and pull-back of the pipe(s), a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies An equipment shall be in good, sale operang contains that satisfies which we have a same same set is a same set of the duration of this project. All required equipment shall be included in the
- Bolts and nuts for buried service shall be made of non-corrosive, high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21.11 regardless of any other protective coating. 2.3 DRILLING SYSTEM EQUIPMENT GENERAL
- F. CONNECTION HARDWAR
- ipe, and shall be restrained as indicated in the construction documents. Expansion-type mechanical couplings shall be rated at the same or greater pressure carrying capacity as the pipe itself
- E. EXPANSION AND FLEXIBLE COUPLINGS Expansion-type mechanical couplings shall be manufactured for use with PVC
- pressure pipe, and shall be restraine as indicated in the construction Sleeve-type couplings shall be rated at the same or greater pressure carrying capacity as the pipe itself.
- D. SLEEVE-TYPE COUPLINGS Sleeve-type mechanical couplings shall be manufactured for use with PVC
- Bends, tees and other PVC fittings shall be restrained with the use of thrust blocking or other restraint products as indicated in the construction documents. PVC gasketed, push-on fittings and mechanical restraints, if used, must be
- Acceptable fittings for use joining fusible polyvinylchloride pipe other sections of fusible polyvinylchloride pipe or other sections of PVC pipe shall include gasketed PVC, push-on type couplings and fittings, including bends, tees, and couplings as shown in the drawings.
- Acceptable fittings for use with fusible polyvinylchloride pipe shall include standard PVC pressure fittings conforming to AWWA C900 or AWWA C905.

Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion process. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

B. A competent and experienced supervisor representing the CONTRACTOR and Drilling

fore is made in a timely and satisfactory manner

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

3.2 DELIVERY AND OFF-LOADING

3.3 HANDLING AND STORAGE

3.4 FUSION PROCESS

A. GENERAL

Subcontractor shall be present at all times during the actual drilling operations. responsible representative who is thoroughly familiar with the equipment and type of wor

to be performed must be in direct charge and control of the operation at all times. In all

cases, the supervisor must be continually present at the job site during the actual Directional Bore operation. The CONTRACTOR and Subcontractor shall have a

sufficient number of competent workers on the job at all times to insure the Directional

Personnel who are unqualified, incompetent or otherwise not suitable for the performance

The ENGINEER must be notified 3 days in advance of starting work. The Directional Bore shall not begin until the ENGINEER is present at the job site and agrees that proper preparations for the operation have been made. The ENGINEER's approval for

B. All work under this specification affecting the Indiana Department of Transportation (INDOT) property, right-of-way or facilities shall be carried out to the full satisfaction of the INDOT authorized representative. The CONTRACTOR shall fully inform himself of all

All equipment used by the CONTRACTOR on Owner's property and right-of-ways may

be inspected by the OWNER or the Owner's Representatives and shall not be used if considered unsatisfactory by OWNER or Owner's Representatives.

The Contractor shall be fully responsible for all damages arising from his failure to comply with the regulations and the requirements of these Specifications.

otection of the ends during transportation to the site. Any pipe damaged in shipment

Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify owner or engineer immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and remove lies even even where the shipment should be checked for guantity and the shipment should be shipment should be checked for guantity and the shipment shipment should be shipment should be checked for guantity and the shipment shipment should be shipment should be checked for guantity and the shipment shipment shipment shipment should be checked for guantity and the shipment shipment

Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA

Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.

If appropriate unloading equipment is not available, pipe may be unloaded by removing

Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as

rejected and removed at once from the work. Damaged areas, or possible areas of

damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the owner or

Any scratch or gouge greater than 10% of the wall thickness will be considered significant

Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the

al. Care shall be exercised when handling the pipe to not cut, gouge, scratch or

pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or

the pipe is to be solved to periods of year of honger, the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque

material while permitting adequate air circulation above and around the pipe as required

1. Pipe shall be handled in a safe and non-destructive manner before, during, and

Fusible polyvinylchloride pipe shall be fused by qualified fusion technicians, as

Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.

4. Only appropriately sized and outfitted fusion machines that have been approved

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being fused, per the pipe supplier's guidelines.

by the pipe supplier shall be used for the fusion process. Fusion machines must

a. HEAT PLATE - Heat plates shall be in good condition with no deep gouges

or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good

condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe

eing fused. Insert pins shall be installed with no interference to carriage

b. CARRIAGE – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size

c. GENERAL MACHINE - Overview of machine body shall yield no obvious

d. DATA LOGGING DEVICE - An approved datalogging device with the current

version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent

defects, missing parts, or potential safety issues during fusion.

110V power source shall be available to extend battery life.

5. Other equipment specifically required for the fusion process shall include the

recommendations.

B. JOINT RECORDING

fusion machine at all times.

a. Pipe rollers shall be used for support of pipe to either side of the machine

b. A weather protection canopy that allows full machine motion of the heat

c. An infrared (IR) pyrometer for checking pipe and heat plate temperatures

Facing blades shall be used for fusible polyvinylchloride pipe, which are specifically designed for cutting FPVC.

d. Fusion machine operations and maintenance manual shall be kept with the

Plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's

after the fusion process and in accordance with this specification and pipe

D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approve

otherwise abrade the piping in any way.

supplier's guidelines.

documented by the pipe supplier.

corporate the following elements

F. Pipe shall be stored and stacked per the pipe supplier's guidelines

and can be rejected unless determined acceptable by the owner or engineer

dividual pieces. Care should be taken to insure that pipe is not dropped or damaged.

E. During removal and handling, be sure that the pipe does not strike anything. Significant

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impact could cause damage, particularly during cold weather.

Pipe should be carefully lowered, not dropped, from trucks.

A. All pipe shall be bundled or packaged in such a manner as to provide adequate

M23 or AWWA M55, and all of the pipe supplier's guidelines shall be followed

shall be replaced as directed by the owner or engineer.

proper pipe size, color, and type.

inning the installation shall in no way relieve the CONTRACTOR of the ultimate

sponsibility for the satisfactory completion of the work as authorized under the

nents of the INDOT as it pertains to specific project and shall conduct all his work

of this project shall be removed from the job site and replaced with a suitable person.

- 3.5 DRILLING OPERATIONS 1. Bore path and alignment are as indicated in the contract documents. The path of the bore may be modified based on field and equipment conditions. Entry and
- A. GENERAL

- exit locations and control-point elevations shall be maintained as indicated in the contract documents unless approved otherwise by Owner or Engineer.

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B. LOCATION AND PROTECTION OF UNDERGROUND UTILITIES

	DATE		PTION PTION STION	BY	
	SPRINGBROOK	SECTION 6	FCRWD SANITARY SEWER	SPECIFICATIONS	
No. No. STATE OF STATE OF MOIANE MOIA					
	DRAWN BY TS/TD/GM/EW CHECKED BY KE DATE SEPTEMBER 14, 2021 SCALE N/A SHEET				
	C8.12 FCRWD SANITARY SEWER SPECIFICATIONS				

 Correct location of all underground utilities that may impact the HDD installation is the responsibility of the Contractor, regardless of any locations shown on the drawings or previous surveys completed 2. Utility location and notification services shall be contacted by the Contractor prior

 All existing lines and underground utilities shall be positively identified, including exposing those facilities that are located within an envelope of possible impact of HDD installation as determined for the project specific site conditions. It is the Contractor and HDD system operator's responsibility to determine this envelope of safe offset from existing utilities. This will include, but is not limited to, soil conditions and layering, utility proximity and material, HDD system and equipment, and foreign subsurface material.

Work site as indicated on drawings shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be Contractor shall confine all activities to designated work areas.

D. DRILLING LAYOUT AND TOLERANCES

to the start of construction.

variations or anomalies.

C. SITE LOCATION PREPARATION

E. PILOT HOLE BORE

3.6 PIPE PULL-BACK AND INSERTION

3.7 CLEANUP

jurisdictional laws.

connection plans.

Saddle Tapping per Uni-Pub-8.

bolted design for 10" mains.

strictly prohibited.

3.9 PIPE SYSTEM CONNECTIONS

F. REAMING

1. The drill path shall be accurately surveyed with entry and exit areas placed in the appropriate locations within the areas indicated on drawings. If using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic

Instrumentation shall be provided and maintained at all times that accurately locates the pilot hole, measures drill-string axial and torsional loads and measures drilling fluid discharge rate and pressure. 3. Entry and exit areas shall be drilled so as not to exceed the bending limitations of the pipe as recommended by the pipe supplier.

 Pilot hole shall be drilled along bore path. In the event that the pilot bore does deviate from the bore path, it may require contractor to pull-back and re-drill from the location along bore path before the deviation

 The Contractor shall limit curvature in any direction to reduce force on the pipe during pull-back. The minimum radius of curvature shall be no less than that specified by the pipe supplier and as indicated on the drawings.

 After successfully completing the pilot hole, the bore hole shall be reamed to a diameter which meets the requirements of the pipe being installed. The following table is offered as an estimated guide: Nominal Pipe Diameter Bore Hole Diameter

 < 8 inches</th>
 Pipe Dia. + 4 inches

 8 inches to 24 inches
 Pipe Dia. X 1.5

 > 24 inches
 Pipe Dia. X 1.5

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2. Multiple reaming passes shall be used at the discretion of the Contractor and shall conform to this specification.

3. In the event of a drilling fluid fracture, returns loss or other loss of drilling fluid, the Contractor shall be responsible for restoring any damaged property to original condition and cleaning up the area in the vicinity of the damage or loss.

Pipe shall be fused prior to insertion, if the site and conditions allow, into one continuous B. Contractor shall handle the pipe in a manner that will not over-stress the pipe prior to insertion. Vertical and horizontal curves shall be limited so that the pipe does not bend insertion. past the pipe supplier's minimum allowable bend radius, buckle, or otherwise become imaged. Damaged portions of the pipe shall be removed and replaced.

C. The pipe entry area shall be graded as needed to provide support for the pipe and to w free movement into the bore hole. 1. The pipe shall be guided into the bore hole to avoid deformation of, or damage

2. The pipe may be continuously or partially supported on rollers or other Owner and Engineer approved friction decreasing implement during joining and insertion, as long as the pipe is not over-stressed or critically abraded prior to, or during

3. A swivel shall be used between the reaming head and the pipe to minimize torsion stress on the pipe assembly D. Buoyancy modification shall be at the sole discretion of the Contractor, and shall not exceed the pipe supplier's guidelines in regards to maximum pull force or minimum bend radius of the pipe. Damage caused by buoyancy modifications shall be the responsibility

E. Once pull-back operations have commenced, the operation shall continue without interruption until the pipe is completely pulled through the bore hole.

F. The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, or movement and distortion of surface features. Any damages caused by the Contractor's operations shall be corrected by the Contractor.

Following the installation, the project site shall be returned to a condition equal to or better than the pre-construction condition of the site. All excavations will be backfilled and compacted per the construction documents and jurisdictional standards. All pavement and hardscape shall be repaired per applicable jurisdictional standards, excess materials shall be removed from the site, and disturbed areas shall be re-landscaped. All drilling fluid shall be properly disposed of per these specifications and all applicable

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B. Contractor shall verify that all utilities, structures, and surface features in the project area 3.8 PREPARATION PRIOR TO MAKING CONNECTIONS INTO EXISTING PIPING SYSTEMS

Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the contractor 1. Field verify location, size, piping material, and piping system of the existing pipe.

 Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents. 3. Have installed all temporary pumps and/or pipes in accordance with established

B. Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

A. Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines and as indicated in the construction documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines B. If possible, pipe installed via HDD shall be filled with water prior to making any onnections to the existing system or other portions of the project.

3.10 TAPPING FOR POTABLE WATER APPLICATIONS Tapping saddles for HDPE pipe shall be as recommended by the manufacturer, and tapping shall be performed in accordance with the manufacturer's recommendations. Tapping for PVC pipe shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. apping for PVC shall be performed in accordance with the applicable sections for

Service saddles shall be bronze or brass and shall be Ford S90/S91, Mueller H-13000, S-13000, or approved equal. Hinged design shall be used for 4" - 8" mains and 2-piece

All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings. Equipment used for tapping shall be made specifically for tapping PVC pipe: Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are

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 Manually operated or power operated drilling machines may be used. Taps may be performed while the pipeline is filled with water and under pressure ('wet'

ap,) or when the pipeline is not filled with water and not under pressure ('dry' tap). 3.11 TESTING

- A. Cleaning and flushing are to be done by the CONTRACTOR in accordance with the B. Directional drilling pipe shall be tested by CONTRACTOR after pullback. The average pressure shall be maintained at 150 psi for six hours. The test pump and water supply shall be arranged to allow accurate measurements of the water required to maintain the test pressure. Any material showing seepage or the slightest leakage shall be replaced as directed by the OWNER at no additional expense to the OWNER.
- C. Hydrostatic testing of HDPE pipe should be performed in accordance with ASTM F2164. D. The manufacturer's recommendations on pipe stretch allowances, bend radius and tensile strength, allowable make-up water, and duration of test pressure shall be
- E. Pipeline shall be tested end to end. 3.12 DISINFECTION OF THE PIPELINE FOR POTABLE WATER PIPING

After installation, the pipeline, having passed all required testing, shall be disinfected prior to being put into service. Unless otherwise directed by the owner or engineer, the pipeline will be disinfected per AWWA C651. See specification Section 15371 for disinfection requirements. 3.13 PARTIAL TESTING

- Segments of the pipe, may be tested separately in accordance with standard testing procedure, as approved by the owner and engineer. Testing of each HDD installation prior to connection to the system or other piping is preferred.
- 3.12 RECORD KEEPING AND AS-BUILTS A. CONTRACTOR shall maintain a daily project log of drilling operations and a guidance system log with a copy given to the ENGINEER at completion of project.
- B. The drilling data shall be recorded every 25-feet during the actual drilling operation. The CONTRACTOR shall furnish "as-built" plan a profile drawing based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation. The data shall be certified accurate by the ACTOR to the capability of the drilling system.
- C. "As-built" drawings shall be completed and certified by an Indiana registered professional surveyor or engineer at Contractors expense.

END OF SECTION 02350-16

> CONTRACTOR SHALL ADHERE AND REFERENCE THE CURRENT FAL CREEK REGIONAL WASTE DISTRICT STANDARDS FOR DESIGN AND CONSTRUCTION OF SANITARY SEWERS.