

Date of Issuance: 3/3/2026	Effective Date: 2/29/2025
Owner: City of Bay St. Louis	Owner's Contract No.:
Contractor: Bottom 2 Top Construction LLC	Contractor's Project No.:
Engineer: Chiniche Engineering & Surveying	Engineer's Project No.: 15-007-008
Project: Ramoneda Street Sanitary Sewer Improvements	Contract Name: Ramoneda Street Sanitary Sewer Improvements

The Contract is modified as follows upon execution of this Change Order:

Description: Sewer forcemain to be bored, instead of open cut installation, to limit impacts to driveways and existing utilities.

Attachments: See attached breakdown of costs.

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES <i>[note changes in Milestones if applicable]</i>
Original Contract Price: \$ <u>409,738.13</u>	Original Contract Times: Substantial Completion: <u>120 days</u> Ready for Final Payment: <u>180 days</u>
Increase from previously approved Change Orders No. <u>0</u> to No. <u>0</u> : \$ <u>0</u>	Increase previously approved Change Orders No. <u>0</u> to No. <u>0</u> : Substantial Completion: <u>N/A</u> Ready for Final Payment: <u>N/A</u>
Contract Price prior to this Change Order: \$ <u>409,738.13</u>	Contract Times prior to this Change Order: Substantial Completion: <u>120 days</u> Ready for Final Payment: <u>180 days</u>
Increase of this Change Order: \$ <u>0</u>	Increase of this Change Order: Substantial Completion: <u>N/A</u> Ready for Final Payment: <u>N/A</u>
Contract Price incorporating this Change Order: \$ <u>409,738.13</u>	Contract Times with all approved Change Orders: Substantial Completion: <u>120 days</u> Ready for Final Payment: <u>180 days</u>

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____ Engineer (if required)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: <u>Principal Engineer</u>	Title <u>Mayor</u>	Title _____
Date: _____	Date _____	Date _____

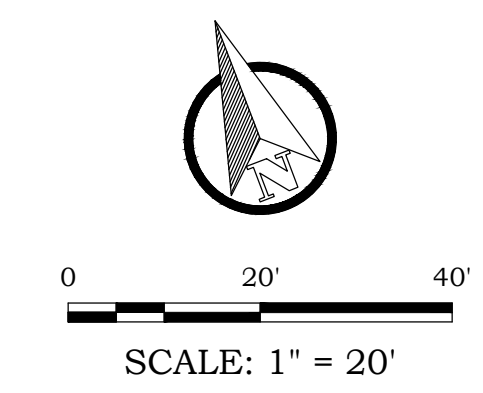
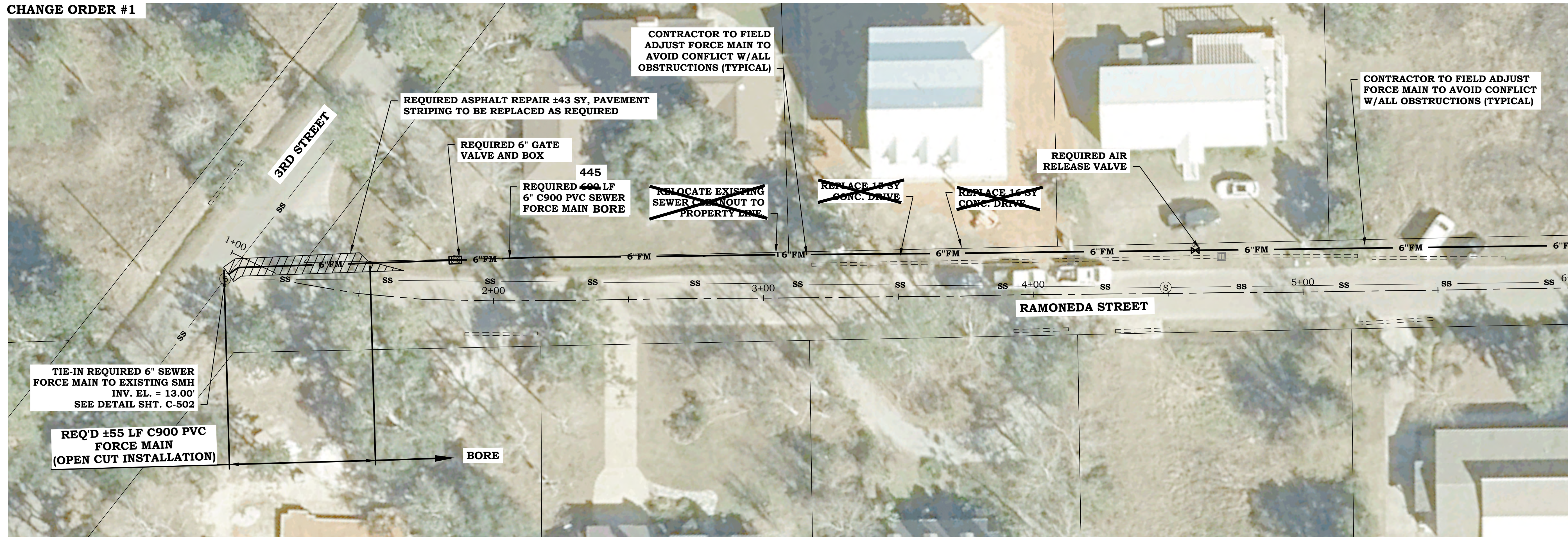
Approved by Funding Agency
(if applicable)

By: _____ Date: _____
Title: _____

CITY OF BAY ST. LOUIS
RAMONEDA STREET SANITARY SEWER IMPROVEMENTS
CHANGE ORDER #1 - BORE FORCEMAIN

Item No.	Item Description	Quantity	Unit	Unit Price	Total
02000 B	Removal of Driveway	-190	SY	\$21.60	-\$4,104.00
02405 A	6" PVC Sewer Force Main	-1200	LF	\$35.92	-\$43,104.00
02405 B	Force Main Fittings	-1	Ton	\$21,155.04	-\$21,155.04
02405 D	Relocation of Sewer Cleanout	-2	EA	\$528.88	-\$1,057.76
02405 E	Utility Adjustment	-2	EA	\$6,117.12	-\$12,234.24
02730 A	Concrete Driveway	-160	SY	\$178.42	-\$28,547.20
02730 B	Gravel Driveway	-30	SY	\$38.06	-\$1,141.80
02900 A	Topsoil, 4" Thick	-335	SY	\$15.29	-\$5,122.15
02900 B	Placement of Sod	-335	SY	\$11.47	-\$3,842.45
--	6" Sewer Forcemain Bore	1200	LF	\$97.50	\$117,000.00
--	Fittings and Sleeves	1	LS	\$3,300.00	\$3,300.00
TOTAL					\$0.00

CHANGE ORDER #1



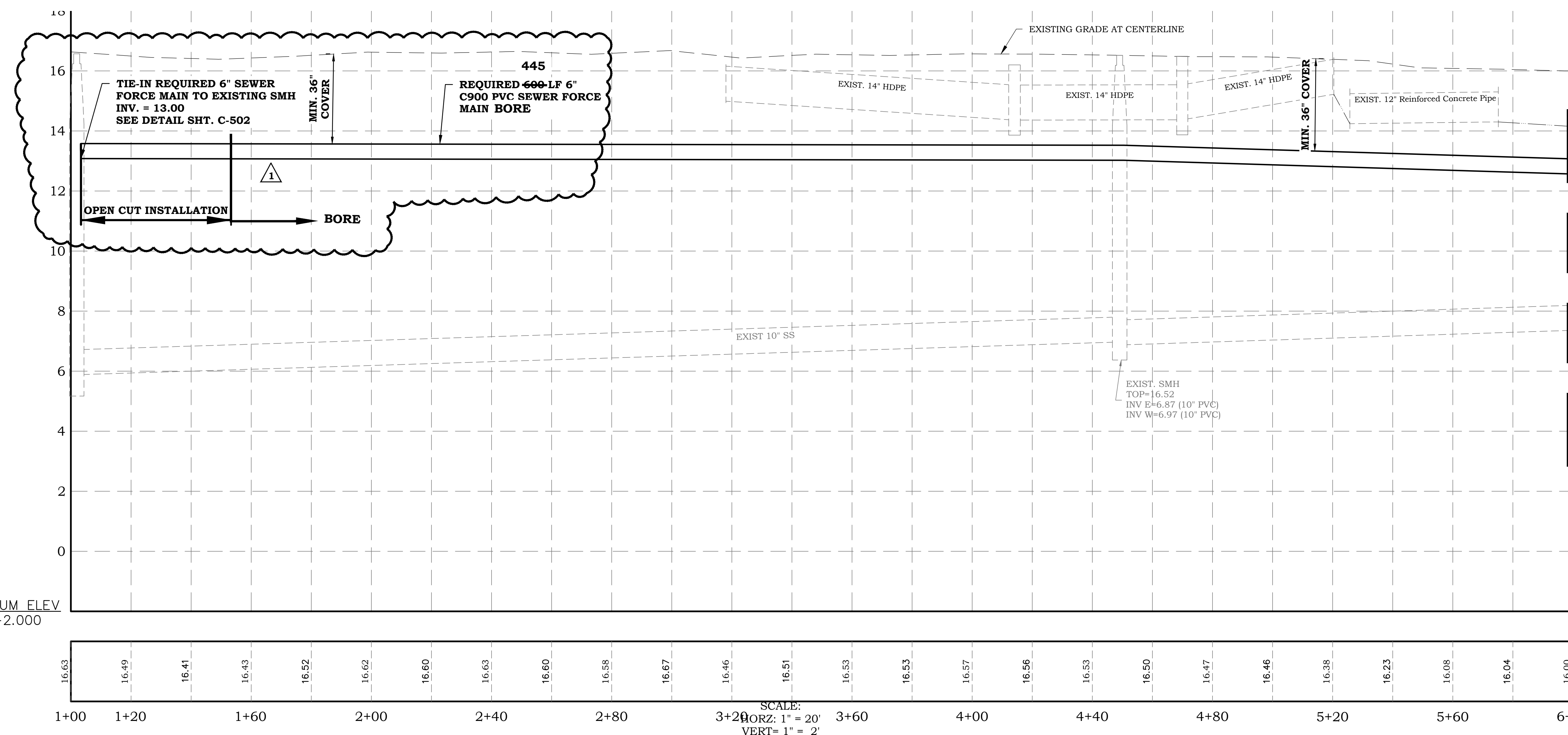
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OWNER INFORMATION

CITY OF BAY ST. LOUIS
688 HIGHWAY 90
BAY ST. LOUIS, MISSISSIPPI 39520

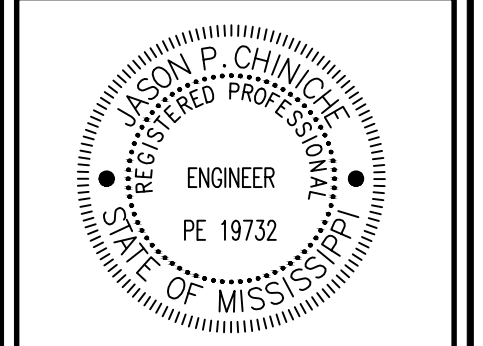


MATCH LINE - STA. 6+00
(SEE SHEET C-202)

MATCH LINE - STA. 6+00
(SEE SHEET C-202)

SHEET TITLE

RAMONEDA STREET
SANITARY SEWER IMPROVEMENTS
PLAN & PROFILE - STA. 0+00 - STA. 6+00



C.O.#1	2/25/26	
MARK	DATE	DESCRIPTION
ISSUE:	PROJECT NO:	15-007-008
DATE:	01/13/2025	
DRAWN BY:	TLL	
CHECKED BY:	JPC, CS	
SCALE:	20' / 2'	

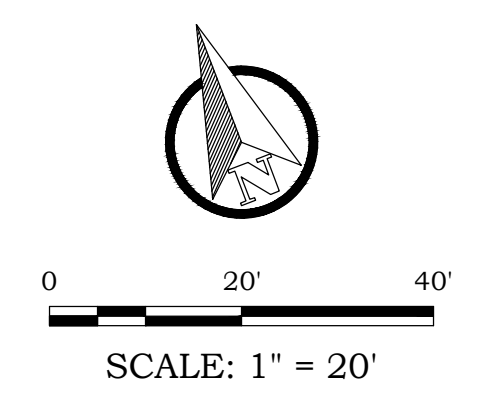
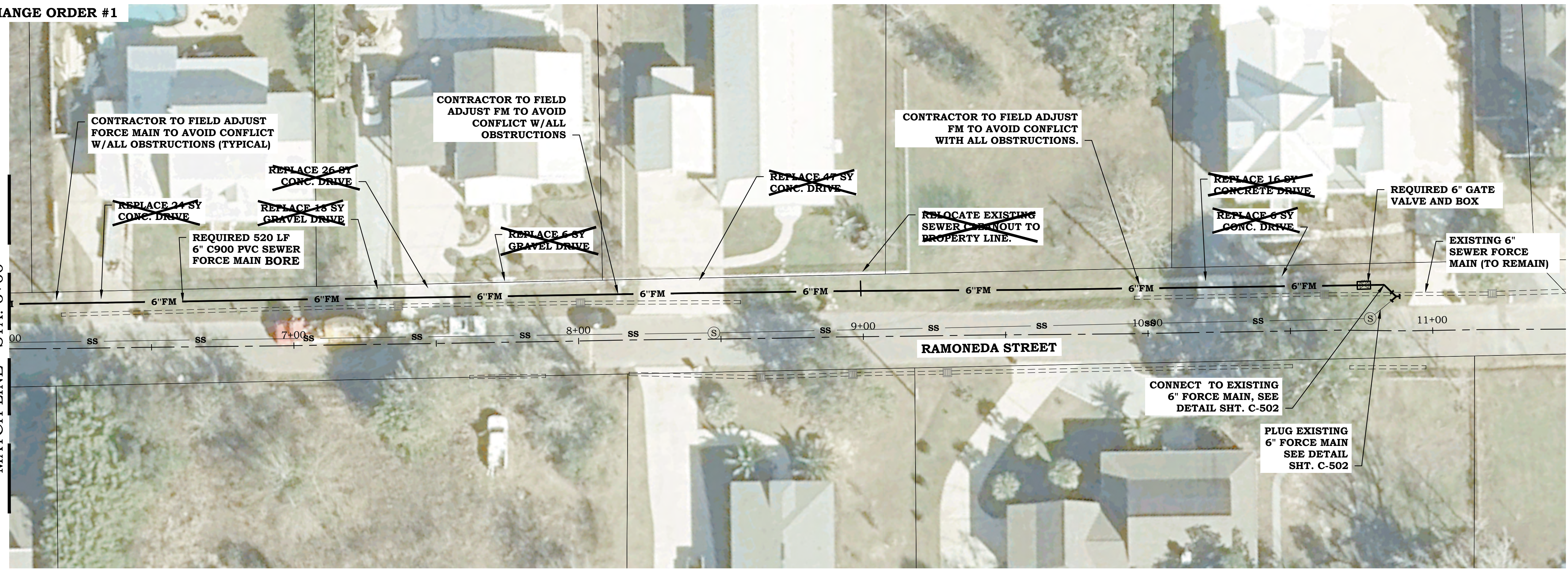
SHEET NUMBER
5

SHEET DESIGNATION
C-201

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CHANGE ORDER #1

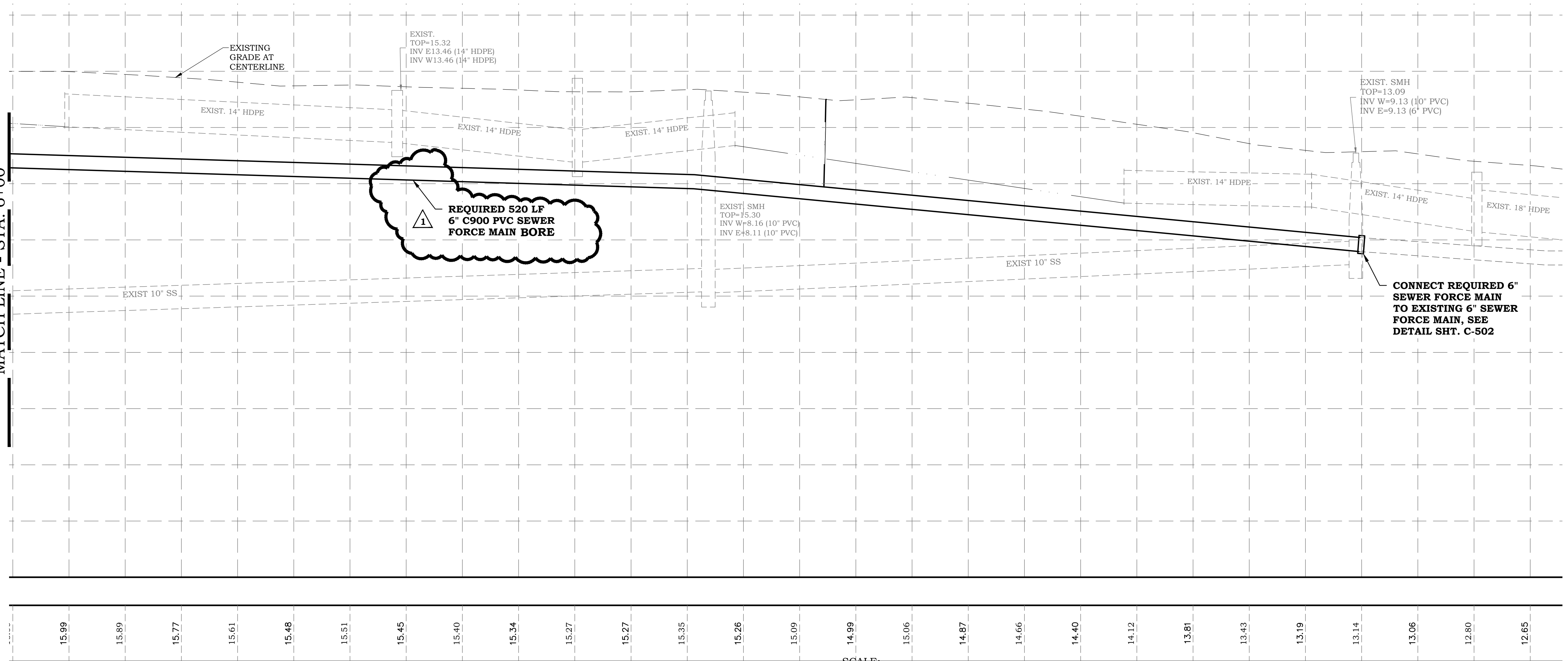
MATCH LINE - STA. 6+00



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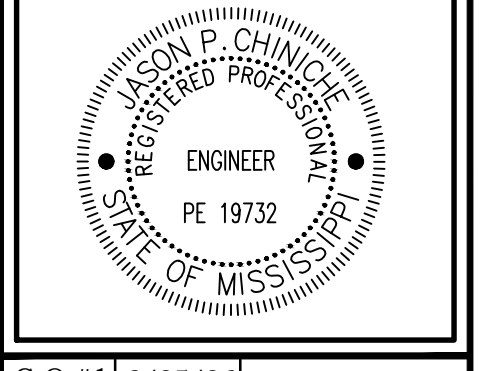
OWNER INFORMATION
CITY OF BAY ST. LOUIS
688 HIGHWAY 90
BAY ST. LOUIS, MISSISSIPPI 39520

MATCH LINE - STA. 6+00



SCALE:
HORIZ: 1" = 209+20
VERT: 1" = 2'

SHEET TITLE
RAMONEDA STREET
SANITARY SEWER IMPROVEMENTS
PLAN & PROFILE - STA. 6+00 - STA. 10+80



C.O.#1 2/25/26

MARK	DATE	DESCRIPTION

ISSUE:
PROJECT NO: 15-007-008
DATE: 01/13/2025
DRAWN BY: TLL
CHECKED BY: JPC, CS
SCALE: 20' / 2'

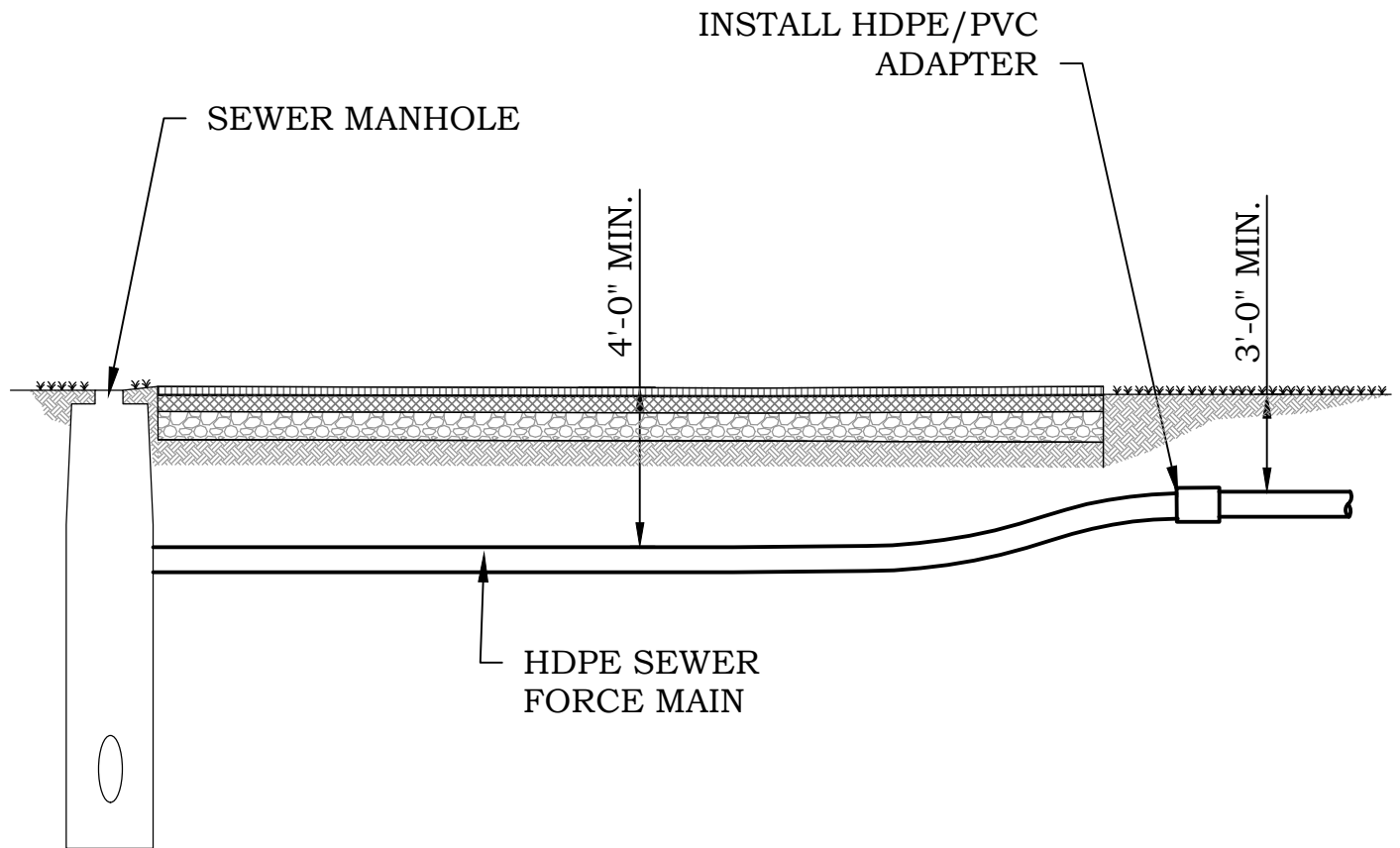
SHEET NUMBER
6

SHEET DESIGNATION
C-202

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RAMONEDA STREET SANITARY SEWER IMPROVEMENTS CHANGE ORDER #1



TYPICAL FORCE MAIN BORING DETAIL

N.T.S.



02330 HORIZONTAL DIRECTIONAL DRILLING

1.0 GENERAL

A. SCOPE OF WORK

The work specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration. For the supply of domestic water during construction, the contractor shall utilize an OWNER supplied meter assembly (meter & backflow device) and pay for all water consumed except in the case where the new water main is connected directly into the active water system for line filling and flushing operation. Un-metered reclaimed water may be utilized for flushing and testing of new reclaimed water mains. Un-accountable domestic water quantities shall be minimized, where possible.

B. QUALITY ASSURANCE

The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper horizontal directional drilling installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification or within any associated permit. Adherence to the specifications contained herein, or the OWNER Representative's approval on any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract. The HDD contractor shall be responsible for the repair of all damage to private and/or public property (at no expense to OWNER). Repair work shall meet all local and state rules and requirements.

C. PROJECT SCHEDULE AND COOPERATION

In addition to the schedule requirements contained in the General and Special Conditions, the following tasks shall be included in the Contractor's detailed schedule: utility locate requests, utility locate verification, rig mobilization, pilot bore drilling, pre-reaming and reaming, layout and fusion of pipe, final reaming, pipe pullback, pressure testing, pig testing of installed pipeline, and restoration.

D. WARRANTY

The contractor shall supply to OWNER a two (2) year unconditional warranty. The warranty shall include materials and installation and shall constitute complete replacement and delivery to the site of materials and installation of same to replace defective materials or defective workmanship with new materials/workmanship conforming to the specifications.

02330 HORIZONTAL DIRECTIONAL DRILLING

E. REFERENCED STANDARDS

The work shall conform to applicable provisions of the Owner Water and Sewer Standards, and the following standards, latest editions, except as modified herein.

1. American Water Works Association (AWWA) Standards:

- a. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch, for Water Distribution American Society for Testing and Materials (ASTM) Standards.
- b. ASTM D618 - Standard Methods of Conditioning Plastics and Electrical Insulating Materials for Testing.
- c. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- d. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer. ASTM D1248 - Standard Specifications for Polyethylene Plastics Molding and Extrusion Materials. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
- e. ASTM D1598 - Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
- f. ASTM D1599 - Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
- g. ASTM D1603 - Standard Test Method for Carbon Black in Olefin Plastics.
- h. ASTM D2122 Standard Method of Determining Dimensions of Thermoplastics Pipe and Fittings.
- i. ASTM D2290 - Standard Test Method for Apparent Tensile Strength or Tubular Plastics and Reinforced Plastics by Split Disk Method.
- j. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter- Controlled Polyethylene Pipe and Tubing.
- k. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
- l. ASTM D2839 - Standard Practice for Use of a Melt-Index Strand for Determining Density of Polyethylene.
- m. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
- n. ASTM E3261 - Standard Specification for Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- o. ASTM D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
- p. ASTM D4218 - Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
- q. ASTM F412 - Standard Terminology Relating to Plastic Piping Systems.

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F. PERMITS

Permits for all work within the MDOT, local municipality, and Submerged Land of the State rights-of-way shall be obtained by the Owner. The Contractor shall verify the existence of all permits before commencing any work on the project.

G. SUBMITTALS

1. Bid Submittal – The Contractor shall submit with their bid the following required information for all individual HDD segments greater than 600 LF. All calculations and responses shall be based on the geotechnical data and other information provided in the Bid Documents, generic assumptions will be acceptable only when site specific data is not available. Each of these minimum qualifications will be reviewed and each technical proposal will be evaluated as qualified or not qualified. All items (1.7.1.1. through 1.7.1.7.) will receive either a PASS or FAIL status after review. To be considered QUALIFIED for this project, all items must be considered PASSING.
 - a. Contractor shall provide an example of similar successful project experience. Minimum requirements are 8” outside diameter, HDPE pipe, and 600 LF single pull. Provide project contact name, title, telephone number, mailing address, email address, etc. for whom the successful project was performed.
 - b. Contractor shall provide calculations (in accordance with ASTM F 1962 or equal) for pull back force required and the resulting rig size proposed for this project.
 - c. Contractor shall provide calculations (in accordance with industry standards) predicting the expected annular pressure and identify areas subject to hydrofracture.
 - d. Contractor shall provide an example of a similar project where the specified guidance system was successfully used.
 - e. Contractor shall provide calculations demonstrating that the pipe will not be overstressed.
 - f. Contractor shall verify that the information and calculations presented herein will be fully incorporated into the work plan.
 - g. Contractor shall identify which, if any, items of the basis of design that the Contractor proposes to change (entry/exit angles, depth, radius, etc.). These changes shall be reflected in the calculations and information required in these evaluation criteria.

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2. Work Plan: Prior to beginning work, the Contractor must submit to the OWNER Representative 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 qualifications and experience (including back-up 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), traffic control plan (if applicable), an environmental protection plan and a contingency plan. The 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 complete the project. The HDD contractor shall submit and obtain OWNER's approval of a pre-construction bore-log depicting a plan and profile (horizontal and vertical alignment) of the proposed bore path. The bore-log shall show all utility crossings and existing structures. All deviations from the drawings included in the contract documents shall be clearly identified. The work plan shall specifically address the following potential problems:
 - a. A Frac-Out and Surface Spill Contingency Plan
 - b. Loss of returns
 - c. Obstructions along borepath during reaming or pullback
 - d. Drill pipe or product pipe cannot be advanced
 - e. Deviations from design line and grade exceed allowable tolerances
 - f. Drill pipe or product pipe broken off in borehole
 - g. Collapse or product pipe or excessive deformation
 - h. Damage to a utility
 - i. Excessive subsidence or heave
3. Calculations - The following calculations shall be submitted prior to beginning any HDD work:
 - a. Pullback load calculation
 - b. Pipe stress calculation
 - c. Maximum allowable drilling fluid pressure calculation

02330 HORIZONTAL DIRECTIONAL DRILLING

- d. Contractor shall confirm that the design parameters do not result in installation stresses that exceed allowable pipe stresses.
4. Existing Utilities - Provide a plan to locate and protect all adjacent utilities and infrastructure.
5. Record Drawing: Submit for the OWNER's approval the record drawings in duplicate to the OWNER's Representative within ten days after completing the pull back for review and approval. The drawings (24 x 36 (min.) and Auto CAD disk of the drawing, 20 horizontal max scale with 2 foot vertical max scale) shall include a plan, profile (data every 25 LF of main, at a minimum), and all information recorded during the progress of the work. The entry and exit points shall be located with GPS coordinates based on a locally available reference system (lat/long, state plane coordinates, etc.). The HDD contractor shall certify the accuracy of all record drawings. Final record drawing submittals shall meet the requirements of Section 01400 of these specifications.

H. NOTIFICATION

The OWNER's representative must be notified 48 hours (minimum) in advance of starting the drilling work. The HDD work shall not begin until the proper preparations (see work plan) for the operation have been completed and approved.

I. SITE PREPARATION

1. Prior to any alterations to work-site, Contractor shall photograph or video the entire work area. One copy of which shall be given to the OWNER's Representative and one copy to remain with Contractor for a period of two (2) years following the completion of the project.
2. Protection of Existing Utilities - Contractor shall coordinate utilities locates with Mississippi One Call. Once the locate service has field marked all utilities, the Contractor shall verify each utility (including any service laterals, i.e. water, sewer, cable, gas, electric, phone, etc.) and those within each paved area. Verification may be performed utilizing Ground Penetrating Radar, hand dig, or vacuum excavation. Prior to initiating drilling, the Contractor shall record on the drawings both the horizontal and vertical location of the utilities off of a predetermined baseline. The Contractor shall manage and control drilling practices to prevent damage to existing utilities. The Contractor shall be responsible for all losses and repairs as a result of damage to underground utilities resulting from drilling operations. The Contractor shall make a reasonable effort to locate evidence of any other potential subsurface obstructions such as piles or piers.
3. Work site shall be graded and filled to provide a level working area. No

02330 HORIZONTAL DIRECTIONAL DRILLING

alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

4. Following drilling operations, Contractor will de-mobilize equipment and restore the work-site to original condition. All excavations will be backfilled and compacted to 90% of original density (at a minimum), or as otherwise specified.

J. ENVIRONMENTAL PROTECTION

Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Contractor shall place hay bales, or approved protection, to limit intrusion upon project area. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations stated in local, state and federal permits.

K. SAFETY

Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner.

L. PERSONNEL QUALIFICATIONS CERTIFICATION

1. Directional Drilling:

All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. (Each person must have been fully trained for over 1,000 hours on all facets of directional drilling, including, but not limited to machine operations, mud mixing, locating, and material fusion.) A responsible representative who is thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual HDD operation. The Contractor shall have a sufficient number of competent workers on the job at all times to ensure the HDD work is made in a timely and satisfactory manner.

2. Pipe and Fitting Jointing

Joints between plain end pipes and pipe fittings shall be made by butt fusion when possible. The on-site welder making the joints shall have received specific training from the manufacturer of the fittings and/or pipe being welded and shall have written proof of proper training/certification from the associated manufacturers. Only certified welders who have written training certifications from the fitting and/or pipe manufacturer will be allowed to perform this work. That is, to weld a fitting in place, the on-site

02330 HORIZONTAL DIRECTIONAL DRILLING

welder (employee) must be trained and certified by the fitting manufacturer. To butt weld pipe, the on-site welder (employee) must be trained and certified by the pipe manufacturer. The fusion work shall be accomplished (welding and cool- down/closing times) in accordance with the fitting and pipe manufacturers' recommendations, at a minimum. External and internal beads shall not be removed unless approved by OWNER.

2.0 MATERIALS

A. HIGH DENSITY POLYETHYLENE (HDPE, PE) PIPE AND FITTINGS

1. Materials used for the manufacturer of polyethylene pipe and fittings shall be PE3408 high density polyethylene meeting cell classification 345464C per ASTM D3350; and meeting Type III, Class B or Class C, Category 5, Grade P34 per ASTM D1248; and shall be listed in the name of the pipe and fitting Manufacturer in PPI TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade rating of 1600 psi at 73°F per ASTM D-2837. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.
2. Polyethylene Pipe (4 inch and larger): HDPE Pipe shall conform to AWWA C906, DR-11, Ductile Iron Pipe (DIP) size and NSF 61 Standard. HDPE pipe for water or reclaimed water piping (not approved for sewer force mains) with pipe size 4 inch through 12 inch may be DR-17 conforming to AWWA C906 and NSF 61. For pipe sizes 24-inch and larger, the HDPE may be IPS size, DR 11. Polyethylene pipe shall be manufactured in accordance with ASTM F714,

Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter and shall be so marked. Each production lot of pipe shall be tested for (from material or pipe) melt index, density, % carbon, dimensions and either quick burst or ring tensile strength (equipment permitting).

3. Nominal pipe sizes only are indicated on the drawings and bid form. Outside diameter of pipe is generally 1 to 2-inches greater than the nominal pipe diameter.
4. Service Identification:

Permanent identification of piping service shall be provided by co-extruding multiple equally spaced color stripes into the pipe outside surface or by solid colored pipe shell. The striping material shall be the same material as the pipe material except for color. The following colors shall be used to identify piping service (pressure service):

Blue – potable water

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Green – wastewater or forcemain
Purple – reclaimed water
Black – raw water

5. Polyethylene Fittings and Custom Fabrication:

Polyethylene fittings and custom fabrications shall be molded or fabricated by the pipe manufacturer or trained personnel. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Fabricated fittings must have the same working pressure as the mating pipe.

6. Molded Fittings:

Molded fittings shall be manufactured in accordance with ASTM D3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, and shall be so marked. Each production lot of molded fittings shall be subjected to the test required under ASTM D3261.

7. Fabricated Fittings:

Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full service pressure rating of the mating pipe. Directional fittings 16" and larger such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets.

8. Polyethylene Flange Adapters:

Flange adapter shall be made with sufficient throughbore length to be clamped in a butt fusion joining machine without the use of a stubend holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooved to provide gasketless sealing, or to restrain the gasket against blow-out. Below ground flange adapters may only be utilized when specified and when MJ adapters are not commercially available in the required size. Adapters for 30 inch and smaller pipe shall utilize an MJ adapter (see below).

9. Back-up Rings and Flange Bolts:

Flange adapters shall be fitted with lap joint flanges pressure rated equal to or greater than the mating pipe. Convolute style backup rings preferred over the flat stock rings. The lap joint flange bore shall be chamfered to provide clearance to the flange adapter radius. Flange bolts and nuts shall

02330 HORIZONTAL DIRECTIONAL DRILLING

be Grade 2 or higher.

10. Manufacturer's Quality Control:

The pipe and fitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials. Incoming polyethylene materials shall be inspected for density, melt flow rated, and contamination. The cell classification properties of the material shall be certified by the supplier, and verified by Manufacturer's Quality Control.

11. Polyethylene Mechanical Joint (MJ) Adapters:

Mechanical connections of HDPE pipe (4" and larger) to Ductile Iron or PVC piping, mechanical joint fittings, or valves shall be through a self-restraining, fusible mechanical joint adapter with or without an integral, internal stainless steel insert. Mechanical joint adapter shall be of the same SDR rating as the pipe. A separate, loose stainless steel type insert will only be allowed for pipe sizes 4 inch through 8 inches. Provide the mechanical joint adapter, including but not limited to longer tee bolts or all thread rods with nuts at the mechanical joint bell. Note that PE flanged adapters may only be utilized for pipe sizes where MJ adapters are not commercially available.

12. Cast Transition Couplings:

HDPE to MJ cast transition coupling may only be utilized for 8 inch and smaller pipe size. A stainless steel stiffener is required sized at proper ID of HDPE pipe. The transition coupling must be epoxy lined (3 mils minimum for water use and 12 mils minimum for sewer use). Acceptable is a Power Seal model 3520 or approved equal.

13. Electro fusion Couplings and Fittings:

Electro fusion joining procedures shall not be used in any location or application on this project.

14. Polyethylene service line tubing shall conform to AWWA C901-latest.

15. Drilling Fluids shall be a bentonite slurry.

16. Locator Wire

Locator wire shall be twelve (12) gauge Extra High Strength Copper Clad Steel (EHS-CCS) insulated locator wire manufactured by Priority Wire or equal. The insulation shall be blue in color.

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17. Casing

Casing, where required, shall be as specified in Section 02334 of these specifications.

B. DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1. Inspect materials delivered to the site for damage. All materials found during inspection or during the progress of work to have cracks, flaws, cracked linings, or other defects shall be rejected and removed from the job site without delay.
2. Unload and store opposite or near the place where the work will proceed with minimum handling. Store material under cover out of direct sun light. Do not store directly on the ground. Keep all materials free of dirt and debris.
3. Contractor is responsible for obtaining, transporting and sorting any fluids, including water, to the work site.
4. Disposal of fluids is the responsibility of the Contractor. Disposal of fluids shall be done in a manner that is in compliance with all permits and applicable federal, state, or local environmental regulations. The bentonite drilling slurry may be recycled for reuse in the hole opening operation or shall be hauled by the Contractor to an approved location or landfill for proper disposal. Contractor shall thoroughly clean entire area of any fluid residue upon completion of installation, and replace any and all plants and sod damaged, discolored or stained by drilling fluids.
5. Locate Wire – Locate wire shall be as specified in Section 02500 of these specifications.

3.0 CONSTRUCTION

A. EQUIPMENT REQUIREMENTS

1. General:

The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the pilot hole, reaming, and pullback the pipe; a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the drill; a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be re-used; a guidance system to accurately guide boring operations; a vacuum truck of sufficient capacity to handle the drilling fluid volume; and trained, competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of

02330 HORIZONTAL DIRECTIONAL DRILLING

this project.

B. Drilling System:

1. Drilling Rig: The directional drilling machine shall consist of a power system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The power system shall be self contained with sufficient pressure and volume to power drilling operations. The hydraulic system shall be free of leaks. The rig shall have a system to monitor maximum pull-back force during pull-back operations. The rig shall be grounded during drilling and pull-back operations. There shall be a system to detect electrical current from the drilling string and an audible alarm which automatically sounds when an electrical current is detected.
2. Drill Head: The drillhead shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.
3. Mud Motors (if required): Mud motors shall be of adequate power to turn the required drilling tools.
4. Drill Pipe: Shall be constructed of high quality heat-treated, forged alloy steel.

C. Guidance System:

1. The position of the drill head shall be continuously tracked and recorded by a downhole wireline tracking locator system and shall be supplemented by a "TruTracker" or equivalent tracking system installed between the entry point and the exit point. The coordinates of the surface wire grid system shall be surveyed and recorded. The guidance system shall be capable of tracking at all depths up to eighty feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction) The guidance system shall be accurate to +/-2% of the vertical depth of the borehole at sensing position at depths up to one hundred feet and accurate within .5 meters horizontally.
2. The Guidance System shall be of a proven type and shall be operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies on the surface of the drill path and shall consider such influences in the operation of the guidance system if using a magnetic system.

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3. Bore Tracking and Monitoring: At all times during the pilot bore the Contractor shall provide and maintain a 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 these data at least once per drill pipe length or every twenty-five (25) feet, whichever is most frequent.
4. Downhole and Surface Grid Tracking System: Contractor shall monitor and record x, y, and z coordinates relative to an established surface survey bench mark. The data shall be continuously monitored and recorded at least once per drill pipe-length or at twenty-five (25) feet, whichever is more frequent.
5. Deviations between the recorded and design bore path shall be calculated and reported on the daily log. If the deviations exceed plus or minus 5 feet (horizontal or vertical deviation) from the design path, such occurrences shall be reported immediately to OWNER. The Contractor shall undertake all reasonable and necessary measures to correct deviations and return to design line and grade.

D. DRILLING FLUID (MUD) SYSTEM AND PRESSURE MONITORING SYSTEM

1. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid. Mixing system shall continually agitate the drilling fluid during operations.
2. 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. These measurements shall be made during pilot bore drilling, reaming, and pullback operations.
3. Downhole Annular Pressure Monitoring System: The Contractor shall use a downhole annular pressure monitoring system that will provide instantaneous and continuous operating pressures. This system shall incorporate a data recorder that will store the downhole annular pressure data for the entire drilling operation. This data shall be maintained and provided to the Engineer upon request or at the completion of the project. The data (x,y,z) shall be presented in a format easily referenced to the contract drawings. Pressure shall be indicated in psi at a specified datum.
4. Drilling Fluids: Drilling fluid shall be composed of clean water, appropriate additives and clay. Water shall be from an authorized source with a minimum pH of 6.0. Water of a lower pH or with

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excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No potentially hazardous material may be used in drilling fluid.

5. Delivery System: The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and conveyed to the drilling fluid recycling system. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and recycling facilities.
6. Drilling Fluid Recycling System: Control of Drilling Fluids: The drilling fluid recycling system shall separate sand, dirt and other solids from the drilling fluid to render the drilling fluid re-usable. Spoils separated from the drilling fluid will be stockpiled for later use or disposal. 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 fluid weights, drilling speeds, and any other operational factors required to avoid hydrofracture fluid losses to formations, and control drilling fluid spills. 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 maintain on-site mobile spoil removal equipment during all drilling, pre-reaming, reaming and pullback operations and shall be capable of quickly removing spoils. The Contractor shall immediately notify OWNER of any inadvertent returns or spills and immediately contain and clean up the return or spill.

E. OTHER EQUIPMENT

1. Pipe Rollers: Pipe rollers, if utilized, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.
2. Pipe Rammers: Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of the OWNER's Representative.
3. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those defined above in the preceding sections shall not be used unless approved by the OWNER Representative prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to

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approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the projects.

F. DRILLING PROCEDURES

1. Drill Path: Prior to drilling Contractor shall utilize all verified locate information to determine drill pathway. Marked up drawings (see Site Preparation paragraph) shall be on site at all times, and referred to during the drill operation.
2. Guidance System: Contractor shall provide and maintain a downhole wireline system to accurately locate the pilot hole (both horizontal and vertical position). A Tru-Tracker energized surface grid, or equivalent, shall be installed and used to supplement the wireline system. The OWNER Representative shall have access to instrumentation and readings at all times during operation.
3. Drilling fluid pressures and flow rates: Drilling fluid pressures and flow rates shall be continuously monitored and recorded.
4. Subsidence and Heave: Subsidence or heave of utilities, roads, or other features above the HDD centerlines and within the zone influenced by the HDD construction shall be limited to values that avoid damage. These values shall be determined by the utility or right-of-way owner. The Contractor shall repair any damage resulting from settlement or heave caused by HDD activities at no additional cost to OWNER. The Contractor shall grout any voids caused by or encountered during drilling.
5. Pilot Hole: The pilot hole shall be drilled along the path shown on the plans and profile drawings or as directed by the OWNER Representative in the field. Unless approved otherwise by OWNER, the pilot-hole tolerances shall be as follows:
 - a. Elevation: As shown on the plans.
 - b. Alignment: ± 5 feet and within 3 feet of right-of-way or easement boundary.
 - c. Curve Radius: The pilot hole radius shall be no less than 150% of the minimum bending radius as recommended by the pipe manufacturer of the pipe being installed.
 - d. Entry Point Location: The exact pilot hole entry point shall be within ± 5 feet of the location shown on the drawing or as directed by the OWNER

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Representative in the field.

- e. Exit Point Location: The exit point location shall be within ± 5 feet of the location shown on the drawing or as directed by the OWNER Representative in the field.
 - f. Water Main and Non-Water Main Separation Requirements: The minimum separation requirements between HDPE water main and a non-water main shall be as defined in 62- 555, F.A.C.
6. Pull Back: After successfully reaming bore hole to the required diameter, Contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel and reamer to compact bore hole walls. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations Contractor will not apply more than the maximum safe pipe pull pressure at any time. Maximum allowable tensile force imposed on the pull section shall be equal to 80% of the pipe manufacturer's safe pull (or tensile) strength.
- a. Torsional stress shall be minimized by using a swivel to connect a pull section to the reaming assembly.
 - b. The pullback section of the pipeline shall be supported during pullback operations so that it moves freely and the pipe is not damaged.
 - c. External pressure shall be minimized during installation of the pullback section in the reamed hole. Damaged pipe resulting from external pressure shall be replaced at no cost to the OWNER.
 - d. Locate wire shall be attached to the leading end of the pipe pulling head and shall extend the full length of the installed pipe.
 - e. Buoyancy modification shall be at the discretion of the Contractor and shall be approved by the OWNER's Representative. The Contractor shall be responsible for any damage to the pull section resulting from such modifications.
 - f. In the event that pipe becomes stuck, Contractor will implement the submitted and approved contingency plan. If pipe remains stuck, Contractor will notify OWNER Representative. The OWNER's Representative and Contractor will discuss options and then work will proceed accordingly.
 - g. The Contractor shall cease operations if the pipe is damaged and shall remove the pipe from the bore hole and repair the pipe using the manufacturer's recommended procedure or replace the damaged pipe

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before resuming installation.

G. PIPE ASSEMBLY

1. Pipe shall be welded/fused together in one length, if space permits. Pipe may be placed on pipe rollers before pulling into bore hole to minimize damage to the pipe. For pipe sizes larger than 12 inch, mechanical scrapers (per the fitting manufacturer's recommendation) shall be utilized during the fusion work. It is critical that all original oxidized pipe surface be removed in order for fusion to take place. The scraping process requires that approximately 0.10" of the outer "skin" be removed in order to penetrate the oxidation and contamination barrier.
2. Acceptability of Damaged Pipe: Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.
3. Fusion Testing: When requested by the OWNER's inspector, fusion testing will be performed. The test fusion shall be allowed to cool completely, and then fusion test straps shall be cut out. The test strap shall be 12" (min) or 30 times the wall thickness in length with the fusion in the center and 1" (min) or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new test fusion shall be made, cooled completely and tested. No more than one passing test will be required per pull section.
4. Mechanical Joining: Polyethylene pipe and fittings may be joined together or to the materials by means of flanged connections (flange adapters and back-up rings) or mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material. Mechanical couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer's recommendations, a longitudinal load applied to the mechanical coupling will cause the pipe to yield before the mechanical coupling disjoins. External joint restraints shall not be used in lieu of fully restrained mechanical couplings.
5. Mechanical Joint and Flange Installation: Mechanical joints and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. Flange faces shall be centered and aligned to each other before assembling and tightening bolts. In no case shall the flange bolts be used to draw the flanges into alignment. Bolt threads shall be lubricated, and flat washers shall be fitted under the flange nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be as recommended by the Manufacturer.

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H. TESTING

1. DISINFECTION TESTS (potable water mains only: All water pipe and fittings shall be thoroughly disinfected prior to being placed in service. Disinfection shall follow the applicable provisions of the procedure established for the disinfection of water mains as set forth in AWWA - Standard C651 entitled "AWWA Standard for Disinfecting Water Mains". Bacteriological testing of the water main shall be scheduled and completed by the OWNER. OWNER will collect the water samples and be responsible for completing the water analysis (lab testing).
2. Temporary blow-offs shall be installed for the purpose of cleaning the water main. Blow-offs installed on water mains up to and including 12" shall be the same diameter as the water main. Blow-offs installed on 16" water mains and larger may be the next smaller size, in diameter, than the water main being tested. Temporary blow-offs shall be removed and plugged after the main is cleared. The OWNER's Representative shall be present prior to and during the operation of blow-offs. The main shall be flushed prior to disinfection.
3. The new water main shall be connected to the existing water main at one point only for flushing purposes (no looping). The new main MUST have a blow off on the end as required previously. After the new main is thoroughly flushed, the open end shall be sealed and restrained and the main shall be thoroughly disinfected. Anytime the new line is reopened (to repair defective joints or pipe, defective fitting or valve) the complete disinfection process shall be repeated. Once bacteriological clearance has been received from the regulatory authority, the new main may be pressure tested.

I. PRESSURE AND LEAKAGE TESTS

1. Contractor shall test pipelines installed under this Contract in accordance with these specifications prior to acceptance of the pipeline by the OWNER. All field tests shall be made in the presence of the OWNER's Representative. Except as otherwise directed, all pipelines shall be tested. Unless approved otherwise by OWNER, all fusible or butt weld joints shall be tested, including MJ adapter fittings associated with the new construction. All piping to operate under liquid pressure shall be tested in sections of approved length. The pressure testing of an HDPE line section shall be tested separately from the PVC and DIP line sections. Where impractical, the HDPE test section shall include only a minimum amount of PVC and ductile iron pipe within the test section. If at all possible, the PVC and D.I.P. test sections shall be left exposed during the pressure test for visual leakage observation. For these tests, the Contractor shall furnish clean water, suitable temporary testing plugs or caps, and other necessary equipment, and all labor required. If the Contractor chooses to pressure test against an existing OWNER water main/valve, the new water main must be disinfected prior to connection to the OWNER's line. The

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OWNER will not be responsible for failure of the pressure test due to the existing valve leaking. The OWNER may elect to furnish suitable pressure gauges for these tests. If not, the contractor will furnish suitable pressure gauges, calibrated by an approved testing laboratory, with increments no greater than 2 psi. Gauges used shall be of such size that pressures tested will not register less than 10% or more than 90% of the gauge capacity. All valved sections shall be hydrostatic tested to insure sealing (leak allowance) of all line valves.

2. Unless it has already been done, the section to pipe to be tested shall be filled with potable water and air shall be expelled from the pipe. Reclaimed water may be utilized for filling new reclaimed water or sewer force main installations. If blow offs or other outlets are not available at high points for releasing air, the Contractor shall provide 1 inch (minimum taps and blow-off valves (at the 12:00 position), as necessary. The cost of constructing blow-off valves and plugging them, after a successful pressure test, shall be included in the unit price bid amount for the HDPE pipe.
3. For mains larger than 20" diameter, it is highly recommended that the contractor profile (line and grade) the main after installation and prior to pressure and leakage test to accurately locate all high points. Field survey instrument (Level equipment) shall be utilized for this task. Blow off valves shall be installed (at a minimum) at all high points which offset vertically more than two pipe diameters in length (at a minimum). The contractor shall consult the design engineer on any technical questions or concerns.
4. Hydrostatic testing shall consist of a 150 psig test pressures, based on the elevation of the highest point of the line or section under tests. Pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the OWNER's Representative. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor and shall be subject to the approval of the OWNER's Representative.
5. Maximum duration for pressure test, including initial and final phase of the test, shall not exceed eight (8) hours. If the test is not completed due to leakage, equipment failure, etc., depressurize the test section, and then allow it to "relax" for at least eight (8) hours before bringing the test section up to test pressure again.
6. Initial Phase of Pressure Testing: First, all air must be removed from the test section. The pressure test shall be completed after the line is backfilled. If possible, all flanged or mechanical joint valves and fittings shall be left exposed for visual leak inspection. If possible all PVC and D.I.P. test sections shall be left exposed for visual leak inspection. Initially, the pressure within the test section should be raised to approximately 160 psi and then allowed to be idle (no additional make- up water/pressure to be injected), for

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approximately 3 hours. During this 3 hour period, the test section shall be allowed to stabilize and come to an equilibrium stage. No additional make-up water/pressure shall be applied to the test section during this 3 hour stabilization period unless the line pressure drops below 140 psi. In this case, make-up water/pressure shall only be applied to the test section to maintain a minimum of 140 psi (during the 3 hour stabilization period).

7. Final Phase of Pressure Testing: The final phase of the pressure test shall involve applying make- up water/pressure to achieve an “initial test pressure” of 150 psi (minimum)/155 psi (maximum). The test section is then allowed to be idle (no make-up water/pressure is added) for a period of 2 hours. After this 2 hour period, make-up water/pressure is applied and measured to re-establish the “initial test pressure”. The quantity of water utilized to re-pump the line shall be measured and compared to the allowable quantities as determined by the table below. If the actual make- up water quantity is equal or less than the allowable amount, the pressure test passes. If the actual make-up water quantities are greater than the allowable amount, the pressure test fails (see enclosed OWNER test form).

Table 1: Allowable Make Up Amount
Make-up Water

Nominal Pipe Size (inches)	Allowance (Gallons/Linear feet of Pipe) 2-hour test
6	0.0030
8	0.0050
10	0.0065
12	0.0115
14	0.0140
16	0.0165
18	0.0215
20	0.0275
22	0.0350
24	0.0440
26	0.0500
28	0.0555
30	0.0635
32	0.0715
34	0.0810
36	0.0900
42	0.1155
48	0.1350
54	0.1570

8. In the event a section fails to pass the tests, the Contractor shall do everything

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necessary to locate, uncover (even to the extent of uncovering the entire section), and replace the defective pipe, valve, fitting or joint. Visible leaks shall be corrected regardless of total leakage. Lines which fail to meet these tests shall be retested as necessary until test requirements are complied with. All testing shall be performed at the Contractor's expense.

9. If, in the judgment of OWNER, it is impracticable to follow the foregoing procedures exactly for any reason, modifications in the procedure shall be made with approval; but, in any event, the Contractor shall be responsible for the ultimate tightness of the piping within the above requirement. Re-disinfection shall be required if the line is de-pressurized for repairs.

J. LOCATE WIRE

Locate wire shall be provided on all installations. Locate wire shall be 12 AWG copper-clad carbon steel with 30 mils (min) insulation. Locate wire shall be brought to grade within a valve box or locate station box at all "entry point locations" and all "exit point locations". There is no maximum length or interval between locate wire stations.

4.0 METHOD OF MEASUREMENT

- A. HDPE Bore, all sizes, shall be measured by the linear foot (LF) from submitted road profiles, and shall include all materials, equipment, tools, labor, and incidentals required to complete the bore in accordance with the Contract Documents. This shall also include sampling and testing.
- B. Fittings and Sleeve shall be measured by the lump sum (LS) and shall include all materials, equipment, tools, labor, and incidentals required to install the Harvey Adapters, mechanical joint fittings and sleeves required to complete and connect the bore to PVC forcemain or existing infrastructure.

5.0 PAYMENT

- A. Payment shall be made under Pay Item No.

02330 A	6" HDPE Bore	\$ _____ LF
02330 B	Fittings and Sleeves	\$ _____ LS

END OF SECTION