



CITY OF PETALUMA

POST OFFICE BOX 61
PETALUMA, CA 94953-0061

Kevin McDonnell
Mayor

Brian Barnacle
Janice Cader-Thompson
Mike Healy
Karen Nau
Dennis Pocekay
John Shribbs
Councilmembers

ADDENDUM NO. 3

Adobe Road Recycled Water Pipeline Project C66501936

September 19, 2024

This Addendum No. 3 modifies the bidding documents for the Adobe Road Recycled Water Pipeline Extension Project C66501936. This Addendum shall become part of the Contract and all provisions of the Contract shall apply thereto. Bidders shall acknowledge all Addendums in the Bid Schedule.

CLARIFICATION TO CONTRACTORS – QUESTION AND RESPONSE

Public Works & Utilities

City Engineer
11 English Street
Petaluma, CA 94952
Phone (707) 778-4303

Environmental Services

Ellis Creek Water
Recycling Facility
3890 Cypress Drive
Petaluma, CA 94954
Phone (707) 776-3777
Fax: (707) 656-4067

Parks & Facility Maintenance

840 Hopper St. Ext.
Petaluma, CA 94952
Phone (707) 778-4303
Fax (707) 206-6065

Transit Division

555 N. McDowell Blvd.
Petaluma, CA 94954
Phone (707) 778-4421

Utilities & Field Operations

202 N. McDowell Blvd.
Petaluma, CA 94954
Phone (707) 778-4546
Fax (707) 206-6034

E-Mail: publicworks@cityofpetaluma.org

Question #1: An accuracy tolerance of 3.0% of depth is not a sufficient tolerance window for this design. At 30' deep, the tolerance window would be +/-0.9'. A minimum of +/-3' is to be expected. Additionally, the design radius between STA 42+80 and 43+45 results in a compound radius of 446'. This is going to greatly stress the (size of) drill pipe that is necessary for the torque and pull back requirements.

Response # 1: Please review Specification Section 33 06 23.13. The relevant information regarding the statement is in following paragraphs:

1.1 Requirements, subparagraph A.

1.4 Design Requirements

1.5 Performance Requirements

The guidance system tolerance specified in paragraph 1.5.B requires ± 3.0 percent accuracy both horizontally and vertically as measured from a depth of $30.0 \times 0.03 = \pm 0.9$ feet. Nowhere is the installation tolerance stated as 3.0 percent.

The contractor is free to redesign as stated in Specification Section 33 06 23.13 paragraph 1.7.E.14. Provide any proposed deviations from the design geometry as shown on the Contract Drawings. Proposed deviations are subject to acceptance by the Engineer.

Question #2: The specifications make mention of conductor casing in the contract drawings. Conductor casing is not mentioned anywhere in the drawings, and therefore the requirements (length and size) of the casing are unknown. Please clarify this. (My assumption is that the jack and bore method was confused into the HDD design).

Response #2: The relevant paragraphs regarding use of a conductor casing has been revised in Specification Section 33 05 23.13 and the section reissued with this addendum. The use of a conductor casing is at the Contractor's option.

Question #3: The specifications make mention of grout that is to fill the annular space of the conductor casing. Being that the details of the casing are unknown, the quantity of grout is unknown.

Response #3: The relevant paragraphs regarding use of a conductor casing and grouting the annular space has been revised in from Specification Section 33 05 23.13 and the section reissued with this addendum.

This Addendum No. 3 shall become part of the Contract and all provisions of the Contract shall apply thereto.

City of Petaluma,

A handwritten signature in black ink, appearing to read "Kristin Arnold". The signature is written in a cursive, flowing style.

Kristin Arnold, P.E.
Senior Civil Engineer
Public Works & Utilities Department

A signed copy of this Addendum and the attached acknowledgement form shall be attached to the bid proposal. Failure to do so may cause rejection of your bid as being non-responsive.

ADDENDUM NO. 3

**Adobe Road Recycled Water Pipeline
Project
C66501936**

September 19, 2024

ACKNOWLEDGEMENT

Receipt of Addendum No. 3 is hereby acknowledged by _____
(Contractor's Name)

on the _____ day of _____, 2024.

By: _____
Signature

Title

Company

SECTION 33 05 23.13

HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 REQUIREMENTS

- A. This section specifies minimum design and performance requirements for the construction of a potable water pipeline by the horizontal directional drilling (HDD) method.
- B. Furnish all designs, tools, equipment, materials, and supplies, and perform all labor required to complete the Work as indicated on the Contract Drawings and specified herein.
- C. Select, furnish, and maintain the drilling and ancillary equipment in proper and safe working order.
- D. Successfully complete final acceptance testing of the installed potable water pipeline as specified in Section 33 11 00.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Comply with the applicable reference Specifications:
 - 1. Section 01 11 00 - Summary of Work
 - 2. Section 01 30 00 - Administrative Requirements
 - 3. Section 01 33 00 - Submittals
 - 4. Section 01 70 00 - Project Closeout
 - 5. Section 01 74 19 - Construction Waste Management
 - 5-6. Section 02 01 10 - Existing Utilities and Underground Structures
 - 6-7. Section 31 09 13 - Geotechnical Instrumentation and Monitoring
 - 7-8. Section 31 00 00 - Earthwork
 - 8-9. Section 31 23 19 - Dewatering
 - 9-10. Section 33 11 00 - Recycled Water Utilities
 - 10-11. Section 33 11 13 - Fusible PVC Pipe
- B. Comply with the following industry standards effective at time of bid:
 - 1. NSF/ANSI Standard 060 – Drinking Water Treatment Chemicals – Health Effects

1.3 DEFINITIONS

- A. Bent Sub: A specially manufactured piece of drill steel behind the drilling tools that is inclined at an angle of one to three degrees from the axis of the bore in the desired direction of steering. The bent sub is used for steering of the drilling tools.

- B. Conductor/Surface Casing: A steel casing pipe installed at the entry and/or exit locations of the borehole to stabilize the borehole. Drilling Fluid/Mud: A mixture of water, bentonite, and/or polymers continuously pumped to the drilling tool or bit to facilitate the removal of soil cuttings and the stabilization of the bore. These fluids also cool the drilling tools, cool the drill steel, cool the guidance electronics, and lubricate the pipe string.
- C. Drill Steel: Specialty manufactured steel drill rod segments used to provide forward thrust and rotation to the drill tool. The drill rod is extended, as the excavation process advances, by joining the individual drill rod segments to become the drill string. The drill string also transports drilling fluids from the surface to the point of excavation. The drill string is pushed upon during pilot bore drilling and forward reaming and is pulled upon during back-reaming, swabbing, and pipe pullback.
- D. Drilling Mud: An engineered fluid mixture of water, with bentonite, and/or polymer additives, used in a closed loop system for transporting spoil and counterbalancing earth and groundwater pressures during the HDD process.
- D-E. Drilling Tool/Bit: Any rotating tool or system of tools on a common support which excavates and/or provides directional control.
- E-F. Entry Pit: Location where the pilot bore begins with the drill tool entering the ground.
- F-G. Exit Pit: Location where the pilot bore ends with the drill tool exiting the ground.
- G-H. Horizontal Directional Drilling (HDD): A guided, steerable drilling system used for the trenchless installation of pipes, conduits, and cables. A pilot bore path is excavated in a shallow arc from a surface-launched drill rig. Excavation takes place with fluid assisted cutting from a drilling tool on the drill string. The pilot bore is directed by the positioning of a bent sub. The bore is filled with drilling mud/fluid for stabilization. The bore path is enlarged with subsequent reaming passes until the desired diameter is achieved. As a final step, the carrier pipe, conduit, or cable is pulled into the fluid-stabilized bore.
- H-I. Hydrolock: A condition that occurs when the drilling fluid in the bore becomes trapped behind the reamer and/or casing and exerts counter pressure during pullback to the extent where it cannot be overcome by the pulling force and the pullback cannot be advanced.
- J. Inadvertent Returns: The loss of drilling fluid, including slurry and lubrication, from the slurry or lubrication system. A special form of inadvertent return, where the fluid exceeds the strength and confining pressure of the ground and reaches the surface or waterway, is called a hydrofracture or "frac-out."
- I-K. Mud Motor: Motor located on the drilling tool that uses pressurized drilling mud introduced through the drill steel to provide rotational power to the cutting drill tool.
- J-L. Pilot Bore: The action of creating the first guided pass of the HDD process which is then reamed in one or more passes to the size required to allow pullback of the carrier pipe.
- K-M. Pullback: That part of a horizontal directional drilling process in which the drill string and carrier pipe are pulled back through the bore to the entry.
- L-N. Pullback Loads: The tensile load (force) applied to a drill string and carrier pipe during the pullback process.
- O. Pre-Reaming/Reaming: The HDD operational sequence where the pilot bore is being enlarged. Back reaming has the operational forces exerted towards the HDD equipment in a "pulling" manner and forward reaming has the operational forces exerted away from

the HDD equipment in a “pushing” manner. Reaming can also be accomplished by two HDD rigs connected to the same drill steel pushing and pulling in unison.

P. Spoil: Earth, rock, and other materials excavated during the HDD process.

M-Q. Swab: An HDD operational sequence where the hole is stabilized and cleared by the passing of a special hole-sized tool. This step is typically performed just before the pullback. This operation typically has the operational forces exerted towards the HDD equipment.

1.4 DESIGN REQUIREMENTS

A. Provide HDD systems with the following:

1. Directional control to construct the carrier pipe within the design tolerances.
2. Down-hole surveying equipment with pitch, roll, depth, and azimuth information for real time monitoring, tracking, and surveying of the drill head. Provide guidance system with a minimum accuracy of ± 0.40 degree of azimuth and ± 0.10 degree of inclination.
3. Provide HDD rig with pulling capacity equal to or greater than 1.5 times the static weight of the entire assembled pipe string including ballast.
4. Provide HDD rig with torque capacity at least 20 percent greater than the maximum anticipated torque calculated for each pass.
5. Provide a spoil separation plant sized to accommodate 120 percent of the maximum allowable instantaneous excavation rate and solids tonnage based upon 120 percent of the maximum allowable instantaneous advance rate, and anticipated ground conditions for each drilling pass.

B. Locate the entry and exit points and drill the entrance and exit angles as indicated on the Contract Drawings, unless otherwise accepted by the Engineer.

C. Conductor casing, if used:

~~1. Construct conductor as shown on the Contract Drawings.~~

2.1. Construct the conductor casing until firmly embedded in the identified formation or intended depth.

3.2. Construct the conductor casing to the designed entry or exit angle as shown on the Contract Drawings.

4.3. The conductor casing shall remain in place during pilot bore drilling, reaming, and pullback operations.

5.4. Methods used to construct and remove the conductor casing shall prevent ground settlement and heave.

D. Size each reaming pass so as not to exceed 80 percent of the maximum torque of the drill rigs.

E. Calculate the maximum anticipated construction loads acting on the conductor casing and demonstrate that the anticipated loads are implemented in the manufacturer's design of the conductor casing, subject to the Engineer's review. Provide a minimum factor of safety of 2.0.

- F. Calculate the maximum anticipated construction loads acting on the casing and carrier pipe and show that the anticipated loads are implemented in the manufacturer's design of the casing and carrier pipe, subject to the Engineer's review. Provide a minimum factor of safety of 2.0.
- G. State as built to plan or prepare and provide HDD calculations using industry accepted methods such as ASTM or API, or other standard acceptable to the Engineer. Use conservative assumptions.
- H. All process water shall be removed and legally disposed.

1.5 PERFORMANCE REQUIREMENTS

- A. Directional tolerances of the pilot bore:
 - 1. Provide a minimum of 6.0 feet separation from existing utilities and other obstacles [including property, right-of-way and easement boundaries](#).
- B. Guidance System Tolerance:
 - 1. Vertical Tolerance shall not exceed ± 3.0 percent of depth.
 - 2. Horizontal Tolerance shall not exceed ± 3.0 percent of depth.
- C. At no location shall the pilot bore create a path that locates the carrier pipe or excavates in violation of any permit or easement.
- D. The carrier pipe shall be capable of meeting the design flow.
- E. Drill a radius of curvature no less than that shown on the Contract Drawings, unless otherwise accepted by the Engineer. The minimum drill radius shall be calculated over three continuous drill steel segments or 30 feet, whichever is less.
- F. Ground movements above the alignment shall not exceed those specified in Sections 31 09 13.

1.6 QUALITY CONTROL

- A. Requirements outlined below shall be met at the time of bid and remain in force through completion of the project. Subcontracted work does not qualify as experience.
 - 1. The Contractor shall have demonstrated experience in constructing pipelines with similar pipe diameters, installation lengths, and depths using HDD. At least four (4) years of recent experience constructing HDD projects is required in similar ground conditions, as measured by soil type, N value and hydrostatic head, as anticipated for this project. The Contractor shall have demonstrated experience using similar HDD equipment proposed for use on this project.
 - 2. The Contractor shall employ skilled, experienced superintendent(s), drill rig operator and drilling fluid and separation plant specialist. The project superintendent shall have completed at least five (5) projects of 18-inch diameter (or greater) with pull lengths of 1,000 feet (or greater) in similar soil conditions, as measured by soil type, N value and hydrostatic head, as anticipated on this project, in the last five (5) years. The drill rig operator must have completed at least three (3) projects of 18-inch diameter (or greater) with pull lengths of 1,000 feet (or greater) in similar ground conditions, as measured by soil type, N value and hydrostatic head, as anticipated on this project, in the last five (5) years. The drilling fluid and separation plant specialist must have at least five (5) years of

experience in the design of drilling fluid mixes and separation plants based on anticipated ground conditions. The drilling fluid and separation plant specialist must have completed at least three (3) projects of 18-inch diameter (or greater) with pull lengths of 1,000 feet (or greater) in similar ground conditions, as measured by soil type, N value and hydrostatic head, as anticipated on this project, in the last five (5) years.

3. Contractor's HDD engineer, if required by HDD design, shall be a Professional Engineer registered in the State of California. Experience shall include HDD design calculations on five (5) HDD projects with reaches over 1,000 feet long within the last five (5) years.
 4. Contractor's surveyor shall be a Professional Land Surveyor registered in the State of California.
 5. Experience records shall list the five (5) most recent HDD projects, including all HDD projects completed for the City, and all projects demonstrating the specified experience. The experience record shall include name of project; owner of the project; names of contacts including all contact information; pilot bore diameter, carrier pipe diameter, ground conditions as measured by soil type, N value, and hydrostatic head; longest reach planned and completed; and total footage planned and completed.
 6. The Engineer will be the sole judge in determining if the prospective contractor, HDD project superintendent, HDD operator and surveyor meet the work and project experience requirements.
- B. If an automated data acquisition system is provided with the system operate the automated data acquisition system for the duration of the project.
- C. Surveying:
1. Establish survey control points sufficiently far from the HDD excavation so as not to be affected by ground movement or damaged by any Work on the project.
 2. The position of the drill head shall be continuously tracked capable of maintaining the design tolerances specified herein.
 3. All surveying equipment shall be inspected and calibrated by the equipment manufacturer prior to use on the Project.

1.7 CONTRACTOR SUBMITTALS

- A. Submittals shall be made in accordance with Section 01 33 00 and as specified herein.
- B. HDD submittals shall be coordinated with all relevant submittals, assembled, and submitted as a single, comprehensive submittal.
- C. Where calculations are required to be submitted, they shall be signed and sealed by a Professional Civil Engineer registered in the State of California. Calculations shall clearly identify all parameters used, state all assumptions made in the calculation, and identify all sources of information.
- D. All shop drawings shall be legible with dimensions accurately shown and clearly marked in English.
- E. Pre-Construction Submittals:

1. Submit qualifications and experience records for the following:
 - a. HDD contractor performing the Work.
 - b. HDD project superintendent.
 - c. HDD and guidance operator.
 - d. Drilling fluid and separation plant specialist.
 - e. Contractor's Engineer.
 - f. Contractor's Surveyor.
2. Provide HDD Work Plan including set-up of equipment, guidance set-up, number of passes, size and type of tooling for each pass etc.
3. Provide detailed method of conductor casing installation, [if used](#).
4. At least 15 workdays prior to mobilization, provide detailed schedule for the HDD installation showing all major construction activities and durations, with starting and completion dates shown. The schedule shall be updated weekly, or as directed by the Engineer, and shall include:
 - a. "One call" utility locate requests and visual confirmation of all crossing utilities and all parallel utilities within 20 feet laterally of the bore centerline.
 - b. Site preparation.
 - c. Rig mobilization and setup.
 - d. Installation of conductor casing, [if used](#).
 - e. Pilot bore drilling.
 - f. Pre-reaming and reaming.
 - g. Layout and thermal butt fusing of carrier pipe.
 - h. Pressure testing of pipe prior to pullback.
 - i. Filling the pipe with water during pullback.
 - j. Final reaming and pullback of pipe.
 - k. Pressure testing of pipe after installation.
 - l. Cutting of conductor casing stick-out into drill rig pit, [if used](#).
 - m. Annulus grouting of conductor casing, [if used](#).
 - n. Mandrel/pig test.
 - o. Cleanup, surface restoration, and demobilization.
5. Provide plan of entry and exit sites including pit, set-up of all HDD and ancillary equipment, spoils handling, carrier pipe and conductor casing staging area, and methods of maintaining and protecting the jobsite.
6. Provide a profile shop drawing showing the lift height for the carrier pipe during pullback including any overhead conflicts and safe separation at a scale acceptable to the Engineer.
7. Provide any proposed deviations from the design geometry as shown on the Contract Drawings, Proposed deviations are subject to acceptance by the Engineer.
8. HDD equipment manufacturer's preprinted specifications and data sheets or letter from manufacturer demonstrating that HDD rig meets minimum pullback and torque requirements as specified herein.
9. Provide HDD Work Plan including set-up of equipment, guidance set-up, number of passes, size, and type of tooling for each pass etc.
10. Provide detailed method of conductor casing installation, [if used](#).

- ~~11. At least 15 workdays prior to mobilization, provide detailed schedule for the HDD installation showing all major construction activities and durations, with starting and completion dates shown. The schedule shall be updated weekly, or as directed by the Engineer, and shall include:~~
 - ~~a. "One call" utility locate requests and visual confirmation of all crossing utilities and all parallel utilities within 20 feet laterally of the bore centerline.~~
 - ~~b. Site preparation.~~
 - ~~c. Rig mobilization and setup.~~
 - ~~d. Installation of conductor casing.~~
 - ~~e. Pilot bore drilling.~~
 - ~~f. Pre-reaming and reaming.~~
 - ~~g. Layout and thermal butt fusing of carrier pipe.~~
 - ~~h. Pressure testing of pipe prior to pullback.~~
 - ~~i. Filling the pipe with water during pullback.~~
 - ~~j. Final reaming and pullback of pipe.~~
 - ~~k. Pressure testing of pipe after installation.~~
 - ~~l. Cutting of conductor casing stick-out into drill rig pit.~~
 - ~~m. Annulus grouting of conductor casing.~~
 - ~~n. Mandrel/pig test.~~
 - ~~o. Cleanup, surface restoration, and demobilization.~~
- ~~12. Provide plan of entry and exit sites including pit, set-up of all HDD and ancillary equipment, spoils handling, carrier pipe and conductor casing staging area, and methods of maintaining and protecting the jobsite.~~
- ~~13. Provide a profile shop drawing showing the lift height for the carrier pipe during pullback including any overhead conflicts and safe separation at a scale acceptable to the Engineer.~~
- ~~14. Provide any proposed deviations from the design geometry as shown on the Contract Drawings. Proposed deviations are subject to acceptance by the Engineer.~~
- ~~15. HDD equipment manufacturer's preprinted specifications and data sheets or letter from manufacturer demonstrating that HDD rig meets minimum pullback and torque requirements as specified herein~~
- 16.11. A complete list of all drilling fluid additives that will be on site with material safety data sheets (MSDS) and manufacturer's description and warranties.
- 17.12. Provide drilling fluid mixture and content of additives including mixing instructions for each ground type to be encounter along the HDD profile.
- 18.13. Plan for monitoring alignment control to design.
- 19.14. Plan for monitoring for inadvertent returns.
- 20.15. Provide a sample of daily HDD report and HDD operator's manual log.
- 21.16. Provide a sample of driller fluid mixing and batching report.
- 22.17. Provide a sample of surveyor's location and alignment report.
- 23.18. Provide a sample of the automated data acquisition record, in English, with information available for recording, variations in data acquisition frequency, and

available formats for Engineer to select operating parameters for automated recording.

24.19. Method statement for filling the carrier pipe with potable water prior to pullback. Identify the source of potable water.

25.20. Provide electrical system, lighting system, and onsite power generation details.

26.21. Contingency Plans addressing the following:

- a. Spoils do not settle/separate with the spoils separation equipment on site.
- b. Drill steel or carrier pipe cannot be advanced or retrieved with the drill rig onsite.
- c. Drill tool becomes lost in the hole.
- d. Guidance control system fails to provide accurate information.
- e. Loss of steering or inability to steer.
- f. Installation forces start to increase rapidly, raising concerns about completing the pipe pull back installation.
- g. Swivel breaks during carrier pipe installation.
- h. Frac-Out and Surface Spill Contingency Plan: Describe procedures for preventing drilling fluid losses or spills and/or fluid returns to the surface. The plan shall address roles and responsibilities of involved parties, monitoring, prevention, containment, cleanup, and documentation procedures, and observations to be made and plans for containment and cleanup, if spills or hydrofracture occur. The plan will address changes that will be made to Contractor's operations to avoid recurrences. Containment and cleanup equipment shall be provided at both entry and exit locations and shall include at a minimum:
 - 1) Heavy weight plastic gravel filled and sealed bags.
 - 2) Geotek filter bags.
 - 3) Splash board.
 - 4) Several 5-gallon hard plastic pails.
 - 5) Heavy duty push brooms and several flat blade shovels.
 - 6) Silt fence and T-post or straw bales.
 - 7) Straw logs.
 - 8) Portable pumps.
 - 9) Hose.
 - 10) Vacuum truck available for response within one (1) hour of a frac-out event.
- i. Obstructions encountered.
- j. Utility strike.
- k. Loss of drill fluid circulation.
- l. Deviation from design bore path exceeds tolerances.
- m. Pipe collapses or pipe deformations exceed maximum allowable tolerances.
- n. Hydrolock

F. Construction Submittals to be submitted as construction progresses:

1. Notifications:

- a. All notifications are to be provided in writing and within one workday unless otherwise specified herein.

- b. Immediately notify the Engineer when the HDD pilot bore is out of design tolerance by 75 percent of the maximum allowed. Include written description of the operational changes being made to avoid attaining the maximum allowed.
 - c. Immediately stop drilling and notify the Engineer when the HDD pilot bore is out of design tolerance by 100 percent of the maximum allowed. Include written description of the operational changes being made and acceptable to the Engineer before the resumption of drilling.
 - d. Immediately notify the Engineer upon encountering an object that impedes advancement during HDD operations. Notify the Engineer of proposed measures to attempt to advance past the object, prior to initiating the attempt.
 - e. Immediately notify the Engineer upon implementation of any contingency plan.
2. Provide daily HDD reports with the following information for each shift:
 - a. Date;
 - b. Project name;
 - c. Printed name and signature of operator.
 - d. Start and finish times for each crew each workday.
 - e. Start time of each activity;
3. Provide HDD operator's manual log:
 - a. One recorded measurement for every drill rod or every 30-foot advance, whichever is more frequent. For each of the recording points, record the following measurements along with the unit of measure:
 - 1) Time of measurement
 - 2) Surface station
 - 3) Drilling length
 - 4) Drill rod lengths
 - 5) Drilling time required for each drilling rod
 - 6) Advance rate
 - 7) Maximum force and direction of force, push or pull
 - 8) Maximum torque
 - 9) Drilling fluid pressures and flow rates
 - 10) Drilling fluid losses
 - 11) Pitch
 - 12) Inclination
 - 13) Roll
 - 14) Azimuth
 - 15) Any instances of retraction and re-drilling
4. Provide drilling fluid mixing and batching report: Measure and record drilling fluid viscosity and density (mud weight) with no more than 2 hours between readings, using calibrated Marsh funnel and mud balance, also include types and quantities of additives used.
5. For automated data recording, provide the operating parameters selected by the Engineer for recording. At a minimum, include the operating parameters specified for manual recording.
6. Perform and record results of 360-degree test roll of the guidance system in the drill string before initiation of drilling operations.

7. Surveying:
 - a. Record the position of the drill bit every drill rod or every 30-foot advance or every 30 minutes, whichever is more frequent.
 - b. Submit plot of the actual location of the bore path at the end of the shift by 9 AM the following workday, or as directed by the Engineer.
 - c. Submit as-built location of the pilot bore within 24 hours of completion of the pilot bore at a scale acceptable to the Engineer.
 - d. Submit survey reports in both hard copy and electronic format acceptable to the Engineer.

8. Provide hydrostatic pre-test record of carrier pipe performed prior to pullback.

G. Post-Construction Submittals:

1. Provide as-built survey of the installed pipe in both tabular format and AutoCAD format acceptable to the Engineer. Scale to be acceptable to the Engineer.
2. Provide final acceptance test records.

1.8 PROJECT CONDITIONS

- A. Refer to: Final Geotechnical Investigation Report, Proposed Recycled Water Pipeline Project, Adobe Road, Petaluma, California
Date: February 24, 2020
Author: Kleinfelder.

PART 2 PRODUCTS

2.1 MATERIALS

A. Carrier pipe:

1. Provide Fusible PVC pipe in accordance with Section 33 11 13.
2. Pipe thickness and strength shall conform to the conservative design with respect to anticipated construction and operational loads.

B. Conductor casing, if used:

1. Provide steel pipe confirming to ASTM A-139, Grade B with minimum yield strength of 35,000 psi and shall not be spiral wound steel pipe.
2. Provide Permalok™ mechanical joining system or welded beveled ends prepared for full penetration butt-welds.
3. Provide conductor casing to the following dimensional criteria:
 - a. Circumference < 0.5%
 - b. Exterior Roundness < 0.5%
 - c. End Squareness +/- 1.5 mm
 - d. Straightness < 3 mm

C. Drilling fluid:

1. High yield sodium bentonite.

2. Water furnished from a potable water source.
3. Test all water for pH and treat with soda ash, or accepted equal, to adjust the pH of the water as required in the accepted mix design(s).
4. Bentonite, polymers, and additives, other than soda ash, shall be NSF/ANSI Standard 060 compliant.

D. Cementitious backfill grout for conductor casing, if used:

1. Provide Type V Portland cement conforming to ASTM C150.
2. Provide sand that conforms to ASTM C144, except for the following grading requirements:

Sieve Sizes	Percentage Passing by Weight
No. 8	100
No. 16	95 - 100
No. 30	60 - 85
No. 50	20 - 50
No. 100	10 - 30
No. 200	0 - 5

3. Provide potable water.

2.2 EQUIPMENT

A. HDD equipment:

1. Provide directional drilling rig with all ancillary equipment, including drill pipe, drilling fluid, drilling tools, reaming bits, swivels, expanders, motors, generator, pumps, hoses, mixing equipment, drilling fluid processing equipment (cuttings separation equipment), fluid pressure and flow rate monitoring equipment, spare parts, pipe handling equipment, crane, backhoe, roller, side boom tractors, control cabin, control equipment, and office equipment.

B. Spoil Separation Equipment:

1. Adequately separate the spoil from drilling fluid so that drilling fluid within the operating parameters can be returned to the drilling tool and hole for reuse. Use a mechanical separation plant, including scalping screens, shaker screens, de-sanding cones, de-silting cones, and centrifuge as deemed necessary by the operating parameters.
2. Monitor the composition of the drilling fluid to maintain the drilling fluid weight, gel strength, and viscosity limits defined by the operating parameters.

C. Guidance Control System:

1. Provide active steering information to the operator showing the three dimensional position of the drill tool in relation to the designed alignment.
2. Maintain alignment to the tolerances specified herein.

D. Provide and maintain a bore tracking system that locates the position of the drill head in the x, y, and z axis during the pilot bore.

- E. Provide a common grounding system to the HDD rig to prevent electrical shock in the event of high voltage underground cable strike. The grounding system shall connect all pieces of interconnecting machinery to a common ground. The drill rig shall be equipped with an "electrical strike" audible and visual warning system that notifies the system operators of an electrical strike.
- F. Provide all temporary fittings and pressure testing heads and work necessary to complete pressure testing of the pipe string as assembled for pullback and post installation. All tests shall be 100 percent passing for all required inspections before commencing pullback.

PART 3 EXECUTION

3.1 GENERAL

- A. Perform all work in accordance with accepted submittals.
- B. Do not commence any HDD operation until all submittals, including submittals for all related work specified elsewhere, are reviewed and accepted by the Engineer.
- C. Maintain a copy of the Contract Documents on site.
- D. Provide the Engineer and City with full access during HDD operations.
- E. Locate all utilities in accordance with Section 02 01 10 before commencing with HDD required excavation.
- F. No excavation deeper than four (4.0) feet shall be permitted within 100 feet of the HDD alignment until after the HDD work is completed, except:
 - 1. Entry and exit pits required for HDD;
 - 2. Potholing to locate utilities or other subsurface features;
 - 3. Construct instrumentation as specified in Section 31 09 13.
- G. Protect in-place or relocate existing utility. Remove and replace in-kind any damaged utility.

3.2 WORK AREA PREPARATION AND MAINTENANCE

- A. Limit staging and work operations to the staging areas shown on the Contract Drawings.
- B. Organize work area to always enable safe and proper operation and minimize impacts to property owners.
- C. Contain separated spoils and drilling fluid for removal from the site.
- D. Combustible materials (fuel, oil, lubricants, etc.) shall be stored off-site or in a well-ventilated storage facility removed from the immediate vicinity of the drilling area by at least 20 feet.
- E. Provide a suitable containment basin made of plastic lining and sandbags for any equipment operating with fuel, hydraulic, or lubrication oils.
- F. Maintain and keep all equipment in working order. All oil, hydraulic, or fuel leaks shall be repaired upon discovery. Any leaking equipment shall not be used until repaired. Any fluid shall be contained and cleaned up upon discovery.

- G. The exit area shall have a drilling fluid pit lined to prevent fluid seepage into the ground and for containing drilling fluids and cuttings
- H. Provide temporary drainage facilities during construction.
- I. Treat and dispose of all water in accordance with the requirements specified in Section 31 23 19.

3.3 INSTALLATION

- A. Alignment Establishment:
 - 1. Perform surveying in accordance with Section 01 30 00 and as specified herein.
 - 2. Contractor's surveyor shall check line and grade shown on the Contract Drawings before commencing HDD operations and immediately report any errors or discrepancies to the Engineer.
 - 3. Use the line and grade shown on the Contract Drawings to furnish and maintain reference control lines and grades for the potable water pipe construction.
 - a. Line and grade are shown as center line based upon the pilot pass.
- B. Establish and maintain constant communication between the entry and exit locations once pilot bore drilling has commenced and until the carrier pipe is completely pulled into place.
- C. Complete a full proof ream/swab pass prior to pullback.
- D. Perform hydrostatic water pressure test prior to pullback in accordance with Section 33 11 00.
- E. Isolate pipe from excessive torsional and axial stresses by a swivel device with a pre-established breakaway tensile capacity that is lower than the allowable tensile strength of the pipe.
- F. Fill pipe with potable water as it enters the bore during pullback.
- G. Provide adequate supports and rollers along the lay-down and carrier pipe build-up space to support the pipe during assembly and installation to prevent damage.
- H. Handle the carrier pipe in accordance with accepted submittals and as specified herein. Lift all piping using fabric slings with sufficient strength and width to safely pick up the pipe without strap failure and without causing scrapes or cuts to damage the pipe. Lifting with cable or chain shall not be permitted. Lifting one end of the pipe and dragging the pipe into position shall not be permitted. Protect the carrier pipe from impact and abrasion.
- I. Cease pullback operations if the pipe is damaged and remove pipe from the bore. Repair pipe using the manufacturer's recommended procedure or replace the damaged pipe before resuming installation.
- J. Remove the top portion of the conductor casing ~~as shown on the Contract Drawings~~ following carrier pipe installation.
- K. Backfill grout, as a minimum, the remaining top 5.0 feet of the conductor casing with cementitious material as specified herein.

- L. Do not cut the ends of the installed carrier pipe for at least 24 hours following completion of the pullback and relaxation of the tensile load.
- M. Perform final acceptance testing of the completed pipeline in accordance with Sections 33 11 00.
- N. If an object is encountered that impedes the advancement of HDD operations, make all diligent and reasonable efforts to advance past the object by drilling slowly through the object, pulling back, and drilling along a new bore path that avoids the object, or excavating and exposing and removing the object, and all other reasonable attempts to continue the bore. If attempt is made to pullback and re-drill, adhere to line and grade tolerances, unless the Engineer accepts the variance in writing, prior to the attempt. The Contractor and Engineer shall investigate the cause and together determine an appropriate response. Appropriate response to address, at a minimum, the following subject matter; revisions to equipment and methods, retraction and re-drilling of a portion of the bore, and abandonment of the hole. If abandonment is deemed necessary, the Contractor shall recover, to the extent practicable, any drill pipe, product pipe, and tools in the bore, and properly abandon the bore, unless otherwise directed in writing by the Engineer. If the bore is abandoned, pressure-grout the abandoned bore with a lean cement-sand grout mixture, or other accepted material. If the bore is abandoned, begin a second attempt to install the pipeline at an alternate location subject to acceptance, in writing, by the Engineer. Take all reasonable actions to complete the installation with minimal delays. The extra costs and payments associated with encountering a confirmed obstruction will be negotiated between the Owner and Contractor, based on reasonable time and materials.
- ~~O. For the removal and disposal of spoils, drilling fluids, all excavated material, unused soil, aggregate and other materials subcontract through Lee Graham or other Graham Equipment representative in accordance with Section 01 11 00.~~

3.4 DISPOSAL

- A. Spoils and waste drilling fluids are to be disposed of legally with weight tickets and commercial receipts.
 - 1. Provide City with the location and owner contact information of the disposal site
 - 2. Provide City -with a complete list of drilling fluid additives contained in the spoils and waste drilling fluids to be disposed of.
- ~~Drilling fluid is to be disposed of legally with weight or volume tickets and commercial receipts.~~
- ~~Provide disposal site with a complete list of additives.~~
- B. All other materials are to be disposed in accordance with 01 74 19 Construction Waste Management. Provide copy of disposal site approval letter prior to disposal of spoils or drilling fluid.

3.43.5 SITE RESTORATION

- A. Remove all equipment, materials, drilling fluids, muck, waste, and debris from the site and restore the site to its original condition upon completion of the installation. Restoration shall be completed by the Contractor as specified within Section 31 00 00. Restore disturbed areas in accordance with Section 01 70 00.

END OF SECTION