# APPENDIX B HDD EXECUTION PLAN

BROTHERTON PIPELINE
WE DIG AMERICA

# *HDD Execution Plan*

BARNARD
People building for People.

PG&E Pacific Gas and Electric Company®

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**Petaluma, California**

***December 19, 2022***

**HDD Execution Plan for Crossings**

**Contents**

# 1 INTRODUCTION

## *1.1 Horizontal Directional Drill Procedure*

The trenchless method selected for the crossing(s) is a horizontal directional drill (HDD) crossing technique. The following is an overview of the steps that will be involved in the execution of the HDD of the Petaluma River Crossing in Petaluma, California. It will also outline some of the mitigated measures that will be taken to ensure the effective installation of the proposed crossings.

# 2 EXECUTION PLAN

## *2.1 Notifications and Permits*

Prior to access or construction activities associated with the crossings, all crossing approvals, permits, and/or notifications will be received or issued respectively. All conditions specified in approvals or permits will be discussed, understood, and adhered to by company personnel and all contractors. Any permits/approvals or notifications will be provided within the timing specified. Notifications will be completed as specified, documented, and maintained in the construction field office.

## *2.2 Identification of Buffer Zones*

All buffer zones or restricted areas will be identified and flagged prior to mobilization and site preparation. In addition, any restricted areas identified by permits/approvals will be flagged off.

## *2.3 Pre-Construction Survey*

A pre-construction survey will be completed to confirm the entry and exit points for the pilot hole as shown on the construction drawings and as staked in the field. Following the examination of the entry and exit points, the distances between the holes will be verified to the HDD design drawings using survey equipment such as a total station. Field stations and elevations surveyed along the proposed center line will be plotted for monitoring and recording three dimensional coordinates generated by the tracking software during drilling operations. This exercise ensures that the pre-engineered alignment and radius restrictions are maintained during the execution of the drill.

Following receipt of the survey results, a design profile will be developed. The design profile in turn is then verified to the HDD design drawings and presented to Owner and other concerned parties for review. Once the profile has been reviewed and approved the site preparation can commence.

## *2.4 Noise Control*

Brotherton Pipeline equipment noise levels will comply with all Applicable Laws and requirements of all authorities having jurisdiction, including meeting the requirements of all municipal by-laws and guidelines.

## *2.5 Equipment on Site*

All equipment used on site shall be cleaned and free of oils, fuel, grease, coolant and other hydrocarbons or otherwise toxic substances, or any vegetation, soil or other material prior to mobilization. Oil changes, refueling, and lubrication of mobile construction equipment will only be undertaken at a minimum of 100 ft from a water body (250' from vernal pools) and only at approved locations, so as to minimize the potential for water pollution. Fuel containers will be dual walled tanks or alternatively will be contained within containment berms constructed to a capacity of 125% of the fuel stored. Contingency plans will be in place in the event of fuel or hazardous waste spills.

**Drill Rig(s)**

***Vermeer D220x300***

- 415 HP
- Thrust/Pullback: 242,100 lbs.

    - Rotary Torque: 30,000 ft-lb
- 4 1/2" IF Drill Pipe
- TruTrack Guidance Systems
- (1) Mud Pump: American Auger P750
    - Rated Capacity: 750 U.S. Gallons
    - Maximum Pressure: 1,500 psi
- Reclaimer: Vermeer R9X12T
    - Maximum Capacity: 8,000 gal
    - Number of tanks: 3
    - 1000 GPM
- Mud Storage Tank: 20,000 Gallon Tank
- Water Storage: 20,000 Gallon Tank
- 48' Drill Steel Trailers
- Vacuum Truck
- Drill bits and reamers
- Kubota SVL75 Skid Steer
- Frac Containment Kit

### *2.6 Project Entry/Exit Points*

During site preparation, filter fence\straw bailed berm walls as well as the ingress and egress that will be required for the entry and exit points will be constructed as per the design HDD drawings. Two (2) work areas will be required for the installation of the large diameter pipe under the designated crossing(s).

A primary staging area (SOUTH) will be used to string, weld and coat the pipeline before pull through. The primary staging area will be located near the entry side of the crossing and will be contained within the existing right-of-way limits or temporary work space. Typically an area 150 feet by 100 feet (or approximately 15,000 square feet) is sufficient in size but may vary depending on the requirements of the selected drilling contractor. The drill rig location will initially setup at this location and complete the pilot drill and reaming process

The secondary staging area (NORTH), which is to be located on the exit side of the crossing will be utilized to set-up and install the drilling rig as per the drilling contractor's site plan. Typically an area 150 feet by 100 feet (or approximately 15,000 square feet) is sufficient in size but may vary depending on the requirements of the selected drilling contractor. The drilling rig is used to pull back the inspected and tested pipe pull section from the exit side of the crossing back to the entrance side.

### *2.7 Drilling Description Timeline -*

**CONSTRUCTION TIMELINE -**

**Based on Crew working 10 hours per shift - 6 Days a week.**

Brotherton does not anticipate working beyond 10 hours per day unless an emergency cleanup effort were to occur during construction activities. Work hours may need to be temporarily extended during pullback operations to ensure the product pipe is installed properly and safely.

**Petaluma River HDD (1500) - 17 Days**

(3 Days) Rig Up\Survey

(5 Days) Pilot

(3 Days) Reaming Pass

(1 Day) Clean\Swab Hole

(1 Day) Move Rig Around

(1 Day) Pull in Product Pipe

(3 Days) Rig Down\Cleanup

### *2.8 HDD Tracking*

A magnetic guidance system paired with the TruTrack system will be used to track and to monitor the drill path during the HDD. The tracking system is important to ensuring the proper installation of the HDD as designed. To set-up the tracking system the directional heading (or azimuth) is taken on the proposed alignment of the crossing using the magnetic guidance system. The tracking system verifies the exact azimuth location of the probe and this location is sent to a computer for monitoring. The tracking system allows the steering head to control the path the drill takes and helps calculate the horizontal and vertical coordinates relative to the initial entry point on the surface. The tracking system will be used to generate the As-Built profile of the drill path.

## DataTraX Steering Tool Specifications

| | |
|---|---|
| Inclination Range | 0° to 180° |
| Inclination Accuracy | ± 0.1° |
| Azimuth | ± 0.75° (Inc > 10°, Dip < 70°) |
| Tool Face (Gravity) | ± 1.0° (Inc > 10°, Dip < 70°) |
| Operating Temperature | -40° C to +150° C |
| Survival Temperature | -40° C to +165° C |
| Calibrated Op Range | 0° C to +150° C |
| Voltage Supply | +18 to 40 volts |
| Parameters Sampled | Gx Gy Gz Bx By Bz Temp |
| Shock Qualification | 500G 1ms on three axes 5000 impacts per axes |
| Vibration Qualification | 27.5G for 10 minutes on each of the three axes |
| Instrument Length | 635 mm |
| Instrument Diameter | 36.5 mm (to fit 1.5" case) |

### *2.9 Drill Fluid Pressure Report*

**High Annulus Pressure**

Sudden increase

1. Trip pipe back until pressure drops; a full trip back to entry may be required.
2. Reduce or stop pumping if pressure does not drop
3. Check mud parameters
4. Check for volume loss
5. With pressure stabilized slowly increase pump speed up to a maximum flow capacity

Gradual increase over expected

1. Check fluid parameters and modify if required

2. Compare actual drill path to planned
3. If pressure reaches the upper limit, trip back to lower pressures and condition the hole

**Low Annulus Pressure**

Sudden decrease below expected

1. Stop pumping
2. Check returning fluid and volume loss
3. Check for correct tool operation (if point 2 is okay)
4. Prepare a lost circulation mixture and pump down.
5. Monitor for fluid loss
6. Trip back to entry to clean hole and allow plugging agents to work
7. Recheck for correct pressure tool operation
8. Trip back while monitoring for fluid loss

Gradual decrease below expected

1. Check drilling fluid parameters
2. Compare drill path to planned
3. Check for reduce flow and fluid loss
4. Mix up lost circulation material and pump down
5. Continue to drill monitoring for reduced flow and volume
6. If losses exist additional plugging agents may be required
7. Monitor for fluid to surface

## *2.10 Pilot Hole*

The first stage of an HDD involves the drilling of a pilot hole using a 12 1/4" bit along the designated drill path.

A Horizontal Technology Inc. Recorder (HTIR) will be rigged up and activated before any down-hole activity commences. The "HTIR" records the following drilling parameters:

- Rate of penetration (R.O.P.)
- Measure depth
- Pull / Thrust Forces
- Rotary torque
- Rotary speed
- Stand pipe pressure
- Pump strokes (m3 per minute or total m3 pumped)
- Drilling fluid surface tank volume monitoring

**CONVENTIONAL METHOD PILOT HOLE -**

To initiate the pilot hole, the drill rig is positioned along the same alignment as the azimuth. Next, the bottom hole assembly (BHA) containing the steering probe is drilled in at the entrance point or run inside the casing if applicable. Non-magnetic drill collars are placed behind the BHA in order to create a non-magnetic buffer between steering tool and possible magnetized drill string. The pilot hole is then advanced along the pre-designed profile which has been designed to ensure that the bending radius is appropriate given the size of the pull section product pipe to be installed in this crossing.

The pilot hole is kept on course by using non-rotating drill string with an asymmetrical leading edge. A steering bias is created by the asymmetry of the leading edge. If a change in direction is required, the drill string is rolled so that the direction of the bias is the same as the desired change in direction. The drilling progress is achieved by hydraulic cutting action using nozzles configured at the apex of the drill head. The flow rate will be determined according to fluid make ups, returns, tank levels, pump strokes etc. which will be monitored from pressure gauges in the control trailer throughout the pilot hole drilling operation. Fluid pressure will be continuously monitored to ensure that the pre-determined maximum permissive annular pressure is not exceeded during the drilling of the pilot hole. The actual path of the pilot hole is monitored during drilling by taking periodic readings of the inclination and azimuth of the leading edge using the tracking system and used to calculate the horizontal and vertical coordinates relative to the initial entry point on the surface.

Drilling fluid is used to help drill the pilot holes and subsequent reamers. Drilling fluid for the drill will be composed of non-toxic compounds such as bentonite. A drilling fluid contingency plan is in place to deal with inadvertent fluid migrations (frac-outs). Fully trained and appropriately equipped personnel to deal with frac-outs will be utilized for the HDD operations. During the course of the drill, terrestrial monitoring will be conducted by the HDD Contractor to ensure that frac-outs are detected should they occur. Material Safety Data sheets for the drilling fluid will be on site during drilling operations. Drilling fluid is managed by the rig crew and is contained within a bermed area near the drilling rig to ensure proper containment of the fluid. The drilling rig used will be equipped with a drilling fluid reclaim system.

While drilling the pilot hole, the HDD contractor will mathematically model the drilling fluid in use and calculate the expected annular pressure for the length of the drilled hole. The expected annular pressure will be graphed with the maximum permissible annular pressure.

Brotherton Pipeline will measure the annular pressure while drilling the pilot hole using an electronic sensor package. The real-time pressure will be continuously recorded by the drilling instrumentation system. Off-bottom circulating pressure will be recorded manually at the completion of each drilled segment of drill pipe.

### *2.11 Reaming and Hole Opening*

After the drilling operations of the pilot hole have been completed to the exit point, the reaming phase of construction begins. The pilot hole is enlarged using a reaming process. Hole opening tools will travel through the hole from entry towards exit which is referred to as push reaming. The hole is opened by repeatedly introducing larger diameter reamers into the hole. The hole is opened to a size approximately 1 ½ times larger than the outside diameter of the product line to ensure that when the product pipe is pulled into the final bore hole there is sufficient free space to allow it to move easily. In reaming, sections of drill pipe are continuously added as progress is made, to ensure that there is always a string of pipe in the hole. The reaming tools consist of a circular set of cutters and drilling fluid jets. The pressurized drilling fluid serves three purposes: to cool the cutting tools, support the reamed hole, and lubricate the trailing drill pipe. The drilling fluid returns coming back to the drill rig side will be collected, cleaned and re-circulated.

| Nominal Diameter | Hole Size | Nominal Diameter | Hole Size |
|---|---|---|---|
| 4 | 7 | 24 | 36 |
| 6 | 10 | 30 | 42 |
| 8 | 13 | 32 | 44 |
| 10 | 16 | 34 | 46 |
| 12 | 18 | 36 | 48 |
| 16 | 24 | 40 | 53 |
| 20 | 30 | 42 | 55 |

### *2.12 Drill Continuance Plan*

In the event of a frac-out Brotherton Pipeline along with the consultant and designated contact will determine an appropriate drill continuance plan. A typical drill continuance plan includes the following:

1. Fracture Plugging (Bridging) Agents

In certain types of formations or conditions, fracture plugging agents (non-toxic) have been utilized with limited success. These agents include bentonite pellets, sealant or other commercially available products. These are pumped down the drill hole left undisturbed for a predetermined length of time where upon drilling is restarted. If positive circulation is restored, drilling is continued using the same principles and contingency plans; if not drilling is halted. Approval with an SDS will be required prior to using any plugging agents.

2. Down Hole Cementing

If the fracture zone is determined to be too large for the use of plugging agents, the drill string may be inserted to a predetermined depth to allow a quick setting cement or thermal resin (non-toxic) to be pumped down-hole in sufficient quantities to seal off the problem zone. If no further fracturing occurs, drilling is continued using the same principles and contingency plans; if, not drilling is halted. All thermal resins shall be submitted for approval to PG&E with an SDS

3. Contain and Control

If the inadvertent release is on land, determined not to be causing an adverse effect, and the surface migration of the drilling mud can be adequately contained and controlled, then drilling can continue with the following conditions:

- There are no impacts to the environment or other adverse effects (i.e. no potential to contaminate surface or ground water, third party property damage or safety risks to the landowner, public or animals.)
- The area affected by the inadvertent release is minor and limited to only one spot
- The surface migration of the drilling mud is adequately contained (bermed with subsoil and fiber roll);
- The contained free drilling mud is adequately controlled (any free drilling mud migrating to the surface is immediately and continually removed for the duration of the remaining drilling phase.
- The site is monitored at appropriate periods during the drilling cycle and the drilling contractor reduces pump/hole pressure accordingly in order to maintain control of the amount of mud being contained
- The affected landowner is notified and permission for continued drilling is granted.
- The plan is discussed with appropriate regulatory agencies and their approval is obtained; and
- The affected site is remediated and reclaimed to meet approved criteria.

4. Partial Hole Recovery

In the event that of the above procedures are unsuccessful, down-hole cementing could be used to seal off a substantial portion of the existing hole back to a point where a “kick-off” can take place. The drilling is then advanced along a different path usually at a lower elevation. Again, careful monitoring of drilling fluids and drill path will be carried out using the same principles and contingency plans; if not drilling is halted.

In the event that none of the above procedures are successful or considered feasible, the hole will be abandoned, and a re-drill will be considered at a second location if it can be determined that more favorable geotechnical conditions exist, using the same principles and contingency plans.

### *2.13 Design Fluid Program*

The HDD contractor will execute the mud program with certified mud technician. The drilling fluid will be tested for viscosity, plastic viscosity, sand content, and mud weight and solids control monitoring during drilling and reaming operations. It is expected that the drilling fluid will consist of mainly bentonite.

### *2.14 Buoyancy Control*

Buoyancy control will be used for the pullback operations. The objective of the buoyancy control is to suspend the pipe in the bore hole by creating downward forces that match the uplift forces produced

by the submerged pipe. Neutral buoyancy is achieved by adding weight to the pull section internally through controlled loading with water. This ensures that only the lowest portion of the profile is weighted during the pullback.

| Project | Buoyancy Water Required |
|---|---|
| 1) All crossings | not required |

### *2.15 Pull-Back Procedure*

After hole opening operations are completed, the pipe pull section (pull section) is ready to be pulled back into the opened hole from the exit side.The pull-back process is similar to the hole opening phase except that a reamer is pulled back with the pull section. A swivel connects the pull section to the reamer thus minimizing torsion forces transmitted to the pull section. The pull section will be supported by positioned pipe rollers as specified. Side booms with cradles elevated in such a manner as to reduce axial loads imposed on the pull section will support the pipe entering the bore hole. The lead side boom will position the leading edge of the pull section to be in the same alignment as the exit angle. The thrust gauging system will be used to monitor pipe pull forces. The rig manager in consultation with the Owner representative will determine an appropriate procedure regarding pipe pull forces.

### *2.16 Water Requirements*

Contractor will provide a water source. Brotherton Pipeline shall provide a storage tank for water.

### *2.17 Drilling Fluid & Drilling Solids Disposal*

Waste cuttings and drilling fluids shall be disposed at a Company approved disposal site. The construction area will be checked a minimum of twice daily for signs of unplanned leaks or seeps. A written record shall be maintained by the contractor of all inspections and submitted with his daily report to the Company Representative. **Waste generated will be disposed of at an approved disposal facility, after an initial sample and characterized by the Project EFS.**

### *2.18 Cleanup and Restoration*

Following the completion of the HDD, the pipeline right-of-way and associated temporary work space will be cleaned up and restored as specified in the contract documents.

## 3 ENVIRONMENTAL MANAGEMENT

### *3.1 Planning*

Brotherton Pipeline will adhere to all acts, regulations, Codes of Practice and best management practices that will guide the HDD process to ensure that there are no adverse environmental impacts as a result of the water crossings. The HDD management plan has been developed to avoid any harmful alteration, disruption, or destruction of fish and fish habitat due to drilling fluids and additives entering a water body. The following mitigation measures will be implemented during the HDD crossing.

**General**

- The HDD contractor will comply with the plan prepared for the works, except where measures must be taken to deal with an emergency.

**Deleterious Materials**

The prime contractor will:

- Be responsible for managing any dewatering procedures;

- Ensure that effective sediment and erosion control measures are in place along the HDD work-space access route, right-of-way and appurtenances and that they are functioning properly and are maintained and upgraded as required to prevent sediment from entering fish habitat.

- Limit use of hazardous materials.

- MSDS for fuel, lubricants, and mud products will be onsite.

**Equipment:**

- All HDD equipment arriving on location is free from engine oil, hydraulic oil, fuel, and coolant leaks; equipment shall be checked daily to prevent leaks of fuels, lubricants or other liquids.

- All HDD equipment arriving on location is free from dirt, mud, vegetative debris, and other substances that may impact the water quality or the fish or fish habitat values of the water or land productivity; Hazardous or toxic materials that could be deleterious to aquatic life shall be contained in watertight containers or stored in upland locations with proper BMPs.

- All equipment is maintained and serviced at least 100 feet from a water body. If it is not possible to conduct such activities greater than 100 feet from the watercourse, these activities will occur within a containment area that is capable of preventing the accidental release of a deleterious substance from entering a water body or contamination of soils or vegetation;

- Restrict all equipment to the cleared Right-of Way and work space;

- All portable equipment using fuels, hydrocarbon lubricants, coolants such as electrical generators and pumps used off of the bermed entry or exit work pad will be positioned inside of a sandbag berm (or equivalent) lined with leak free polyethylene or other containment structure that serves to prevent deleterious substances such as fuel from entering the soil or aquatic environment or contamination of soils or vegetation;

- All fuels, lubricants, coolant, and other substances are contained, controlled, and handled according to Occupational Health Safety regulations and Brotherton Pipeline's safety policy and procedures ;

**Work Areas**

- Drilling fluid mud and excess cutting material from construction activities will be stockpiled in containers\bins awaiting initial testing and characterization prior to being hauled off to an approved dump site. The containers\bins will be stockpiled in permitted work areas only.

**Aquatic Resources**

- Ensure generators and pumps used for water intake have secondary containment, when stationed, operated or refueled within 100 feet of a watercourse.

**Waste Management**

- The composition of the drilling fluid will be limited to fresh water and high yield bentonite conforming to or exceeding American Petroleum Institute specifications. Other additives or substitutions will be submitted for approval before being used in the drilling fluid.

- An MSDS sheet is maintained on the work location for all drilling fluid additives.

### *3.2 Monitoring*

- The HDD contractor will monitor, by visual and electronic means:

- The return flow of drilling fluid from the borehole. A reduction in return flow shall be taken as indicating a possible seepage of drilling fluid.
- The annular and / or standpipe pressure. An unplanned reduction in pressure shall be taken as indicating a possible seepage of drilling fluid.
- The tank and pit volumes.

Any unplanned losses or gains will be reported, and increased diligence of upland and in-stream monitoring will be conducted.

- The HDD contractor will inspect all HDD equipment once every 12 hour shift to prevent the deposition of hydrocarbons onto the ground, or into a water body.

- Water Quality Monitoring is not part of Brotherton's scope of work.

### *3.3 Response*

- The Rig Manager is the on-site authority for the HDD contractor. The Rig Manager has the authority to direct the rig crew, and the materials and equipment towards the protection of the environment.

### *3.4 Directional Drill Mud Release Contingency Plan*

**Objectives**

The contingency plan outlined below has been developed and will be employed to meet the following objectives:

- To ensure Contractor has specific measures in place in the event of a inadvertent mud release and that potential impacts are minimized; and

- To ensure corrective action processes are in place to properly manage inadvertent releases of drilling mud.

The Rig Manager is responsible for implementing and maintaining all mitigation measures unless otherwise specified.

**Specific Measures**

*Cleanup Plan*

1. Develop a cleanup plan, before drilling. The plan will be prepared with the drill contractor in consultation with Owners inspection staff. Acquire the appropriate approvals to access the release area if off right-of-way and for mud pump-off.

2. Ensure that supervisory personnel are aware of the contingency plan and cleanup plan before commencement of drilling activity.

*Surface Casing*

3. Install surface casing at the entry point to a depth that extends beyond the coarsest material, if warranted.

4. Install surface casing at the exit point, after completion of the pilot hole if coarse textured near-surface deposits could interfere with drilling mud circulation.

*Mud Composition*

5. The composition of drilling fluid will be limited to fresh water and high yield bentonite conforming to or exceeding American Petroleum Institute specifications. Other additives or substitutes will require Owner approval before being used in the drilling fluid.

*Drilling Sumps*

6. Construct subsoil berm(s) or sump(s) down slope from the entry point and proposed exit point with a capacity adequate to capture anticipated volumes of drilling mud that could be released during pullback and other drilling operations.

*Contingency Plan Equipment and Supplies*

7. Certain equipment will be required onsite in sufficient quantities during drilling operations to contain any inadvertent drilling mud releases. This equipment and supplies may include:

    - (25) Sandbags;
    - (100') filter cloth (e.g., silt fence);
    - (10) t-bar posts;
    - (50')straw waddles;
    - (6) shovels; (4) SqueeGees
    - (1) 55 Gallon Barrel;
    - (1 - 100' x 10' Roll) 6 mil polyethylene or equivalent; and
    - (1) 3" trash pump c/w sufficient lengths of leak free hose and suction heads.

    All of the HDD equipment on site is available to for use with emergency containment of seepage of drilling fluid, and will be directed by the Rig Manager

*Manpower*

8. All of the HDD contractor manpower are available to effect an emergency containment of seepage of drilling fluid, and will be directed by the Rig Manager.

*Monitoring*

9. Supervisory personnel will be onsite during drilling, reaming and pullback operations to ensure that contingency plan measures will be implemented immediately and effectively.

10. Monitor and record the amount of fluid return to the mud tank/pit and the amount of makeup drilling fluid required in the mixing tanks during drilling of the pilot hole and reaming.

*Water Quality Monitoring (by others)*

11. Ensure the water quality sampling program is in place before drilling and includes the following information:

    - Sample locations (both an upstream control site as well as appropriate downstream sites);
    - Frequency of sampling; and
    - Sampling procedures.

12. Increase the sampling frequency if monitoring of drilling mud returns indicate that a release may have occurred.

*Response*

13. Where seepage of drilling fluid into a water body or riparian area is detected as possibly occurring, all drilling operations must stop. Rig Manager will initiate emergency response plan if seepage of drilling fluid into a water body or riparian area is confirmed.

14. The observation of a reduction in flow of drilling fluid will constitute a detection of a possible occurrence of seepage, and thus, if a reduction in the return flow of drilling fluid should occur, the Rig Manager will;

    - Stop the advancement of the drilling assembly, pull the drive carriage to the top of the derrick, and shut off the drilling fluid pumps
    - Conduct a survey of the ground surface and water body for evidence of seepage of drilling fluid to surface.
    - Notify the Owners Representative.
    - Assemble measurement data such as annular and/or standpipe pressure, forward thrust pressure, and observations such as the behavior of the return flow. Evaluate the measurement data and observations with the Owners Representative.
    - Assist the Owners representative in developing a Drill Continuance Plan.

*Seepage*

15. If seepage of drilling fluid to surface does occur, the Rig Manager will:

    - Stop all drilling operations.
    - Contain the seepage by erecting a sandbag and polyethylene berm (or other fit- for-purpose material).
    - Notify the Owners Representative and the California State Land Commission's 24-hour emergency notification number (562) 590-5201 within 24 hours of the frac-out.
    - Develop and implement a recovery and clean up plan with the Owners Representative.
    - Assemble measurement data such as annular and/or standpipe pressure, forward thrust pressure, and observations such as the behavior of the return flow.
    - Evaluate the measurement data and observations with the Owner Representative.
    - Assist the Owners Representative in developing a Continuance Plan.
    - Document the incident according to company procedures.

*Pilot Hole Deviation*

16. If the pilot bore encounters conditions that interfere with steering accuracy, then the Rig Manager and Owners representative will need to take the appropriate action to complete the crossing. These actions could include:

    - Accepting the new drill path; and/or
    - Adjusting the depth of the borehole path so the drill can avoid the problematic stratum; or
    - Pulling out, moving over and drilling a new pilot hole

*Loss of Circulation*

17. If loss of circulation is encountered during the HDD, then the Rig Manager and Owners representative will need to assess the extent of fluid loss, determine its likely cause and take the best remedial action. These actions may include:

- Determining the fluid loss acceptable and continuing to drill/ream/pull; or
- Stopping the operation, re-establishing circulation and restarting the operation; or
- Abandoning the hole, moving over, and boring a new crossing path

Given that there are many factors to consider in determining if the HDD fails, a full evaluation of all relevant data will be made and all reasonable options will be considered prior to seeking approval to use the contingency plan.

*Waste Management*

18. The Contractor and the Rig Manager will put in place the following measures in place to maintain the cleanliness of the work site.

- Store deleterious substances used in the operation and maintenance of equipment in approved containers, and store containers in a location and in a manner that protects them from being punctured, crushed and leaked into the watercourse.
- Provide segregated waste disposal containers for all general waste, and dispose of such waste.
- Provide sanitary facilities for crew.
- Backfill and stabilize any pits excavated for anchoring or containment.
- Dispose of all waste drilling fluid and drilled solids according to and in conformance with regulatory requirements.

***Hole Abandonment***

19. *If the pilot\reamed hole must be abandoned, below are the steps necessary to be completed prior to starting a new bore.*

- Shut down horizontal directional drilling operations and leave the drill stem in the failed hole.
- Contact a grouting specialist and produce an approved downhole grout that can be pumped through the drill stem.
- Once the grouting material is approved by the owner, the grout will be pumped downhole while the drilling stem is removed back to the entry pit.
- After the entire drill stem is removed and the grout has had sufficient time to cure, drilling operations will resume with a new entry bore location.
- The abandoned bore hole shall be grouted as far as possible downhole.
- When a borehole is abandoned, immediate notification shall be made to the California State Lands Commission and other applicable agencies.
- The as-built alignment (plan and profile) of the abandoned borehole shall be documented and included in as-built drawings.
- Prior to drilling the second or new borehole, approval from the CSLC is required.

***Groundwater Intrusion Management -***

- Over-excavate entry pit to dimensions of 8'x 8' by 5' deep pit

- Collect groundwater flowing into bore pit and pump out into 20,000 gallon frac tank using 6" pump. The groundwater will be sampled and characterized by the Project EFS prior to haul off.
- Hauled off and dispose of excess groundwater at approved dump site with vacuum trucks.

***Drilling Fluid Flush Management Plan -***

- Over-excavate entry pit to dimensions of 8'x 8' by 5' deep pit
- Collect drilling fluid flowing into bore pit and pump out into 20,000 gallon frac tank using 6" pump.
- Hauled off and dispose of excess groundwater at approved dump site with vacuum trucks.