

Appendix D
Work Execution Plan
Monterey Bay Aquarium Research Institute
Moss Landing Ocean Bore

Moss Landing, California

Estimated Bore Length: 4700 L.F.
Estimated Bore Depth: 90' to 100' below sea level
Casing: 5-inch, E-Grade Yellow Band Drill Steel (5.00" OD, 3.75" ID milled)
Rig Size: 210,000 lb. to 330,000 lb.
Estimated solids removed from hole: 93 cu. yd.

The proposed Moss Landing Inlet directional drill is considered to be a typical "jettable beach installation" except for the special environmental concerns and specific site requirements. The following paragraphs will describe the procedures most likely to be employed to complete the HDD crossing:

Award of Bid:

Initially, once Monterey Bay Aquarium Research Institute (MBARI) awards the contract a pre-construction meeting will be scheduled with the drilling superintendent, MBARI personnel and any local and environmental agencies with interest in this HDD project. This meeting will serve several purposes; to go over all the specific requirements of the site, review the proposed drill path, and familiarize everyone with the project. Once this has been done, a mobilization schedule for getting equipment and personnel to the site will be set up.

Arrival of Superintendent on site:

When the Drilling Superintendent arrives on site, he will familiarize himself with the area. He will then go to the appropriate city offices and make notifications of the project start, while acquiring all the appropriate local licenses, if required. The Superintendent will make all appropriate notifications to the California ONE CALL system as well as to other utilities that may not be part of the ONE CALL system. Local vendors for sanitary, hauling, and supplies will be notified and rental equipment arrangements will be made.

Land Survey and Drill Design:

The drill crew, consisting of 6 to 7 people, will review the proposed drill site taking into account any existing utilities in the area. The entry and exit points will be established, and relative elevations and drill distances surveyed in and verified. During this operation, any existing sub-surface obstructions in the area will be

identified and staked. A profile of the ocean floor will be done to verify the depths provided are correct so as to establish a true running line and elevation for the drill path. The marine support crew will set a buoy at the exit coordinate provided by the client, and this distance will also be measured and verified. The drill path might need to be adjusted slightly should any conflict with an existing utility be encountered. MBARI has supplied geotech reports dating back to 1992 taken while their current research center was being built. These soil bores, gathered within a mile of the drill location, show a silty sand formation down to depths of a –120 feet where the soil bores were terminated. A recommended depth of the drill path is a –90' to a –100' below sea level. This depth should be deep enough to hinder the release of drilling mud to the surface and stay above the unknown formations below the soil bore information. Where possible a locating grid will be surveyed in along the entry portion of the drill path and a thin 8 ga. wire laid out on the perimeter. While drilling, a small DC current will be induced into the wire to create a magnetic field with known corner points that can be picked up by the sensor in the steering tool. This grid is used to verify the locational readings transmitted to the control cab continuously through a wire in the drill stem. The steering tool, located behind the drill bit, keeps track of the azimuth and the inclination, giving the surveyor an accurate location of the bit at all times.

Drill Site preparation and set-up:

The staging area for the directional drill project is on the South side of the entry channel on MBARI property. A site 100' x 150' should be large enough to set up the equipment; drill rig, mud system, extra drill pipe, support vehicles, and enclose the entry pit. The configuration of the drill rig, mud system, and support equipment will be done in such a way as to conform to existing and temporary rights-of-way. The work area will require some special preparations including a small trench approximately 10' x 6' x 4', filled with concrete. The concrete pad will be used as a dead man, anchoring the drill rig while drilling to ensure the stability of the equipment with the forces required during the drilling procedure. Placing plastic barriers under the drilling equipment and oil absorbent blankets around hydraulic components will add protection between the rig and ground surface, if a catastrophic failure occurs, the spill will be immediately contained avoiding a costly and untimely clean up. A small sump pit will be excavated at the bore entry, this sump pit allows for the recovery of the drilling fluid coming from the borehole back to the surface. The fluid is picked up by a sump pump and transferred to the solids control unit where the solids contained in the drilling fluid are mechanically separated allowing the mud to be recirculated downhole and used again. Once all the equipment is in place, silt fence and hay bales will be put in place around the work perimeter, in addition to those being placed around the sump pit and mud system. Most of the erosion control will be installed after all equipment is in place so any necessary movement during the set up process will not be impeded.

Drilling Procedures:

When the drilling rig is in place and all the environmental measures have been implemented, drilling will begin. The non-magnetic bottom hole assembly with the steering probe inside is placed on the drill rig and the jet assembly is installed on the lead end of this piece. The non-magnetic drill collar will serve as a buffer between the possibly magnetized drill string, the possibly magnetized jet assembly and the steering tool ensuring greater accuracy. The drill string is advanced along the pre-determined drill path while drilling fluid is pumped down the inside of the bore pipe and exits through the drill head. The fluid then returns to the entry pit through the annulus between the outside of the drill pipe and the formation being bored. The drilling fluid is composed of naturally occurring bentonite clay and water. The clay is insoluble and made up of small particles that function as a lubricant for the drill head and pipe, a transport for the cuttings being removed from the hole, and as a sealant that fills the annulus space surrounding the drill hole. During the drill, as each joint of pipe is set onto the drill rig, a visual inspection is done to make sure no debris is sent down the pipe that could cause a problem during cable installation. Directional information is accumulated while drilling and survey shots are taken on every joint of drill pipe. This data is calculated and plotted on a work profile and plan drawing so the true vertical depth and horizontal distance as well as right and left bearing drift are always known throughout the entire drilling operation. During the drilling procedure, the drill path will be constantly monitored for surface releases and constant communication between the monitoring vessel and the control cab will be kept at all times. The monitors will always know the distance we are out so as to be able to concentrate their search for any surface anomalies.

Drill Exit:

As the drill stem approaches the exit point on the ocean floor, the drilling conditions are carefully monitored. These conditions determine the time or distance from exit when a shift from the bentonite to fresh water drilling is done. By flushing the drill string with fresh water, the drilling mud is circulated out of the system and a mud free exit is achieved. The soil conditions near exit will dictate this time. If the drill penetration is moving at a fairly fast rate, a water shift will be sooner than usual allowing time to circulate fresh water to the drill head prior to exiting the sea floor, ensuring a clean exit. It must be reiterated that drilling conditions, not a pre-determined distance will be the factor as to what point the change to water will occur. As a rule of thumb, 150 feet is the average distance at which a change to fresh water happens. The driller and surveyor will know when the bottom hole assembly exits the sea floor, not by a loss in pressure, but by watching the console inside the drill cab. When the bottom hole assembly is no longer supported by the soil, the angle of inclination will fall off dramatically thus signaling the bore exit. A marine support crew will be dispatched to dive on

the exit and verify the exit point. Once the exit has been verified, the on-site inspector will be given the true offshore exit coordinate to approve. This approval must not be delayed if the crossing is not acceptable for any reason, as the drill string will need to be withdrawn as quickly as possible to avoid getting stuck in the hole. Due to exiting on fresh water, this timely approval is very important.

Remove bottom hole assembly:

Once the exit has been approved, divers will jet down to a point approximately 2 feet below the sea floor and using underwater cutting equipment, cut off the drill steel at the desired depth. Once the pipe is cut and the end of the pipe has been de-burred to remove any sharp edges, the guidance wire will be removed and a pipe pig will be installed at entry with a 1/4" aircraft cable attached. This will be hydraulically pushed through the drill pipe with fresh water and the 1/4" cable trails the pig. This proves the pipe as well as verifies a clean I.D. Flanges and a surface buoy will be attached to seal the drill steel for future re-location.

Site Cleanup and Restoration:

Once the drill is complete, the temporary pull-line installed, and the pipe is capped and back-filled, the drill site will be de-mobilized. All excess drilling fluid will be removed from the collection pit and disposed of at an appropriate site. All plastic barriers and oil absorbent cloth will be removed and disposed of. Silt fence and hay bales will be removed. The concrete dead man will be broken up and removed from the site and back-filled. Marine support will return the bottom hole assembly to the nearest port to be loaded on a trailer for shipment. The work area will be returned to its original condition or better to the satisfaction of all permitting agencies, public works inspectors and supervising engineer.