APPENDIX I

HORIZONTAL DIRECTIONAL DRILL PLAN

Transwestern Pipeline Company, LLC
Horizontal Directional Drill (HDD) Plan

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PART A: HDD DRILLING MUD CONTINGENCY PLAN

1.0 DESCRIPTION OF HDD PROCESS

The HDD crossing technique is a trenchless installation process by which pipeline is installed beneath obstacles or sensitive areas by utilizing equipment and techniques derived from the oil well drilling industry. An HDD involves a multi-stage process that consists of establishing a small diameter pilot hole along a crossing profile, followed by enlargement of the pilot hole (reaming) to accommodate pull back of the proposed pipeline. The pilot hole is drilled using rotation cutting and/or jetting with a jetting assembly attached to drill pipe. The cutting action of the drill head is remotely operated to control its orientation and direction. Enlarging the pilot hole is an incremental process accomplished with multiple reaming passes, depending on the pipeline diameter and subsurface geology, to increase the hole diameter. Upon successful completion of the reaming operation, the pre-assembled, hydrostatically tested section of pipeline is then pulled into the completed hole. Bentonite drilling fluid is used to lubricate the drill bit, help stabilize the hole and remove cutting spoil as the drilling fluid is returned to the entry point.

2.0 PURPOSE OF PLAN

All stages of HDD operations involve circulating drilling fluid. Among other purposes, the drilling fluid is used in the HDD process to transport soil and rock cuttings to the surface and to stabilize the hole. The fluid also reduces drilling friction, cools and cleans the drill cutters, transmits hydraulic power to the drill bit, and performs the hydraulic excavation of the cuttings.

The primary component of the drilling fluid used in HDDs for pipeline installation is water. To enhance the fluid performance, a viscosifier (typically a naturally occurring bentonite clay) is added to the water to improve its properties. Specific soils and drilling conditions may require the addition of various constituents to vary the properties of the drilling fluid to meet the needs of the particular situation. Because the drilling mud consists mainly of a bentonite clay-water mixture, it is not considered to be hazardous or toxic.

The most likely occurrence of inadvertent mud releases developing during drilling operations is from "frac-outs." A frac-out is a condition in which the drilling mud is released through fractures in the soil and migrates toward the surface. Frac-outs usually occur when the down-hole pressures are too high and overcome the restraining forces of the surrounding formation. This most often occurs during the pilot hole drilling operations when the pressures are the highest. Escape of drilling mud from a frac-out is most common near the drill entry and exit locations, but can occur at any location along the drill path.

This plan identifies operational procedures and responsibilities for the prevention, containment, and clean-up of frac-outs associated with HDD operations.

3.0 LAYOUT AND DESIGN FOR HDD CROSSINGS

The HDD entry and exit locations will be sited to provide a minimum of a 50-foot setback from sensitive resources and a maximum design depth clearance to provide the greatest buffer between the sensitive resource and the drilling activity/installed pipe.

4.0 MONITORING OF HDD OPERATIONS

The Construction Inspector(s) and/or the Environmental Inspector(s) will continuously monitor operations during HDD activities. Monitoring activities during drilling operations will include:

- Visual inspection along the drill path, fluid return pit(s) and waterbody surface for evidence of a release;
- Observation and documentation of drilling fluid pressures using HDD instrumentation;
- Observation and documentation of drilling fluid recirculation volumes; and
- Documentation of all drilling fluid products used.

The Contractor will have readily available containment equipment to contain inadvertent releases of drilling mud to waterbodies including earth-moving equipment, portable pumps, containment booms, hand tools, hay bales, silt fence and sandbags. The Environmental Inspector(s) will ensure that adequate quantities of spill containment equipment and supplies are at the drilling location prior to allowing the contractor to begin drilling. Further, the Environmental Inspector(s) will ensure that each individual involved in drilling operations is familiar with the locations of all spill containment equipment and the specific procedures for handling potential drilling fluid releases.

5.0 LOSS OF CIRCULATION

Typically, lost circulation has the highest probability of occurring while the pilot hole is being drilled due to the smaller bore-hole annulus and the relatively large volume of solids being displaced and carried out in the drilling fluid. In the course of drilling the pilot hole, circulation will often be temporarily lost as the pilot bit is advanced through more permeable or less competent sections of the ground formation when fluid pressures are at a maximum. As the pilot bit advances beyond these sections of the bore-hole, fluid pressure will fall and circulation within the bore-hole will naturally be re-established. Much of the fluid lost to the formation under the greater pressures will return back to the bore-hole as the pressures fall, in which case the drilling fluid is not likely to migrate to the ground surface or the river.

Drill cuttings generated as a result of the drilling process often will naturally bridge and subsequently seal fractures or voids as drilling progresses, thus providing another means of re-establishing circulation. This is especially likely during the reaming process as higher volumes of larger cuttings are typically generated. Therefore it is usually beneficial to proceed with the pilot hole even if circulation has not been re-established, since it will likely be re-established at some point during the reaming process.

In the event a complete loss of circulation of drilling mud occurs during operation of a HDD, Transwestern Pipeline Company, LLC (Transwestern), will require the Contractor to cease pumping immediately, contain any drilling fluid which has surfaced, notify the Chief Inspector and Chief Environmental Inspector, and evaluate the data and circumstances leading to the loss of circulation to determine what method is to be utilized to seal the fracture. Most fractures can be sealed, if detected early, by pumping special materials to prevent loss of circulation down hole.

If a significant reduction of drilling fluid circulation is detected without total loss of circulation, the Contractor will reduce drilling fluid volumes and subsequent pressures and will increase the yield point of drilling fluid. Then, depending upon the progress of the drilling, the drill pipe may be tripped out until return flow is restored.

6.0 PROCEDURES FOR RELEASE OF DRILLING FLUID

Should an inadvertent release of drilling fluid (bentonite) occur in accessible areas, containment and subsequent clean-up will begin immediately upon detection. Field measures to contain inadvertent releases of drilling fluid will vary according to site-specific conditions (e.g. volume of fluid, topography, and environmental setting). The most commonly utilized system for containment of surface releases of bentonite would involve a perimeter earthen berm, hay bales, or silt fence. Where this system of containment cannot be employed, containment procedures will be directed by the Chief Inspector assisted by the Chief Environmental Inspector to minimize environmental impact.

After containment, clean-up and restoration will generally be accomplished utilizing one of the following:

- hand labor, hand tools and buckets;
- portable pumps and hand tools;
- rubber tired equipment and hand tools; and
- vacuum trucks and hand tools.

Isolation under certain field conditions is virtually impossible. In the unlikely event that a release occurs within an area that cannot be isolated or contained, such as along the bed of the waterbody or into the water, drilling operations will be stopped immediately. Upon evaluation by appropriate personnel, a decision will be made on how best to continue the crossing construction to minimizes impacts. The procedures listed below will be followed.

- Ensure that all reasonable measures within the limitations of the technology have been taken to re-establish drilling fluid circulation;

- Continue drilling with the minimum amount of drilling fluid required to penetrate the formation and successfully install the pipeline.

In the event of an inadvertent release of drilling fluid within a waterway, Transwestern will immediately contact the following agencies by telephone and/or facsimile detailing the location and nature of the release, the corrective actions being taken, and whether the release poses a threat to public health and safety.

- Federal Energy Regulatory Commission
  Doug Sipe, Project Manager
  (202) 502-8837

- US Fish & Wildlife Service
  Wally Murphy, Ecological Services Field Supervisor
  (505) 761-4781

- US Army Corps of Engineers
  Deanna Cummings, Project Manager
  (970) 375-9509

- New Mexico Department of Game and Fish
  Lisa Kirkpatrick, Chief, Conservation Services Division
  (505) 476-8008

- New Mexico Oil Conservation Division
  Wayne Price, Environmental Bureau Chief
  (505) 476-3490

- New Mexico Environment Department, Surface Water Bureau
  Neal Schaeffer
  (505) 476-3017

7.0 ABANDONMENT OF HDD

If a directional drill must be abandoned, the drill hole will be filled with drilling fluid and grout sealed for a distance of not less than thirty feet at each end.

PART B: HDD FAILURE CRITERIA

7.0 INTRODUCTION

The following is a description of events occurring during an attempted horizontal directional drill (HDD) crossing of the San Juan River with 36-inch natural gas pipeline that would ultimately lead to the abandonment of the HDD crossing method. While it is widely believed that installing river crossings by HDD construction is less environmentally damaging than open cut construction, there are many cases where HDD may not be the method best suited for a particular crossing location. Soil conditions, scheduling, and economics often play a major role in determining whether an HDD is feasible. Due to scheduling concerns it is necessary for the crossing permit for the San Juan River to allow for the timely transition from HDD construction to open cut construction if during the HDD process it is determined that a drilled crossing is not feasible, either economically or environmentally.

8.0 PILOT HOLE

If during the pilot hole phase of construction it is evident that directional control of the downhole steering assembly is lost, the HDD operations will be abandoned. This can occur as a result of gravel and cobble formations causing poor hole stability and the inability to move heavy cobble-type material away from the bit. In other words, if it is impossible to drill a hole within the design criteria set forth by the owner that will accommodate the eventual installation of the 36-inch pipeline, then an open-cut crossing will be accomplished.

If during the drilling of the pilot hole the drill string becomes stuck and two attempts to free the pipe and drilling assembly from the formation fail, then only one more attempt to drill a new pilot hole will be made. This is also the case for “twisted-off” drill pipe. Stuck or twisted–off pipe is usually a result of poor hole condition (cuttings or gravel surrounds the stem) and/or excessive sharp turns from a lack of directional control. Thus, if the drill stem is stuck and is either intentionally severed for recovery or inadvertently twisted apart, the crew will abandon the hole, move the drill rig, and begin a new hole.

If during the second attempt at a pilot hole the drill string or the drilling assembly becomes difficult to turn without the use of a large amount of torque from the drill rig, the contractor will make efforts to reduce the torque. If removal of drill stem and cutting head (referred to as tripping out) to clean the hole or the use of torque reducing additives in the drill fluid fails to remedy the high torque on the drill pipe, the HDD will be abandoned to avoid having another stuck or twisted-off pipe string. This will avoid the loss of another expensive tool and the waste of costly time of the drill spread.

9.0 PRE-REAMING

During the reaming process (pre-ream or swab pass) large amounts of drill fluid, possibly 400 GPM or more, will be pumped down hole. If drill fluid circulation is lost during any of the ream passes, the drill contractor will make two attempts at both trying to regain circulation and containing any fluid reaching the surface. Fluid circulation is critical to the success of any HDD crossing. The drill contractor may employ techniques such as “tripping out” to clean the hole, using a cleaning tool, or using fluid additives to aid in stabilizing the hole. In the event that full fluid circulation is not achieved and the fluid is reaching the ground surface or a waterbody in a location that cannot be accessed for containment, HDD construction will be abandoned for the open cut option so that no further environmental impact occurs.

If during the final ream pass the drill string or reamer/hole opener becomes stuck and numerous attempts to free the pipe and drilling assembly from the formation fail, then only one more attempt to drill a new pilot hole will be made. This is also the case for "twisted-off" drill pipe. Thus, if the reamer/hole opener or drill stem is stuck and is either intentionally severed for recovery or inadvertently twisted apart, the crew will abandon the hole, move the drill rig and begin a new hole.

If during the ream pass on the second pilot hole the drill string or the drilling assembly becomes difficult to turn without the use of a large amount of torque from the drill rig, the contractor will make efforts to reduce the torque. If "tripping out" to clean the hole or the use of torque reducing additives in the drill fluid fails to remedy the high torque on the drill pipe, HDD will be abandoned to avoid having another stuck or twisted-off pipe string. This will avoid the loss of an expensive downhole tool and the waste of costly time of the drill spread.

Finally, if during the reaming process the equipment is experiencing very slow penetration rates, a determination will be made whether or not to continue. The slow rate of reaming will have a large impact on scheduling and cost. After reviewing drill logs and geotechnical data the contractor and Transwestern Pipeline Company will decide whether a change in the penetration rates is likely. If it appears the current rate of reaming will continue throughout the crossing and that the rate is not economically feasible, the HDD operation will be abandoned.

10.0 PIPE PULLBACK

In this final stage of HDD construction the ultimate failure is if the pipe section being pulled in becomes stuck and is not able to be pulled further into the hole for completion. This occurs most often as a result of a poorly drilled pilot hole or poor hole stability due to the loose and granular formation or loss of circulation. Depending on where in the section the stuck pipe has occurred, the drilling contractor may use winches to move the pipe to completion or pull the pipe section out of the hole. If the section is pulled out of the hole the contractor will run a reamer through the hole again in order to clean any fallen debris. The contractor may opt to run a larger sized reamer if a dogleg is thought to be the problem. Once the hole is said to be suitable for pullback the pipe section is prepared for another attempt at installation. If a second attempt at pullback is not successful the HDD crossing will be abandoned.

If the contractor is not able to pull the stuck section out of the hole the pipe will be abandoned in-place in the ground. The section will be cut off below ground level and capped. At this point HDD construction will be determined not feasible.

11.0 DOCUMENTATION OF EVENTS LEADING TO AN HDD FAILURE

Records of the HDD activities will be maintained by the drilling contractor. A daily progress report will document the employees engaged in the operation, as well as operational information such as hole size, tool in use, footage each day and to date, and rate of penetration. The records will also document the bentonite used each day and to date, whether circulation had been lost, volume of fluid lost, and volumes of fluids and solids disposed of each day. Updates to the fluid system and/or drilling schedule will also be recorded. A daily drilling log and daily reaming log will also be maintained for HDD activities. These logs will record parameters such as joint number and length, time, total hours, location of the drilling tool, torque, pump pressure, start/stop times and other notes.

In the event that an attempted HDD of the San Juan River is determined to be unsuccessful, the following agencies will be provided with the documentation that describes the events leading up to the HDD failure:

- Federal Energy Regulatory Commission
  Doug Sipe, Project Manager
  (202) 502-8837

- US Fish & Wildlife Service
  Wally Murphy, Ecological Services Field Supervisor
  (505) 761-4781

- US Army Corps of Engineers
  Deanna Cummings, Project Manager
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- New Mexico Department of Game and Fish
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