



Horizontal Directional Drilling (HDD)

Horizontal directional drilling is a less impactful method to install underground pipes rather than digging an open trench to bury the pipe. The use of this method greatly reduces the environmental impact and disruption to roadways and other existing infrastructure during construction. HDD construction also improves the safety and protection of the pipeline from potential third-party damage once in operation due to the additional depth that can be achieved.

This method is used to install pipelines underneath waterways, wetlands, and congested neighborhoods and roads.

According to the Interstate Natural Gas Association of America, "HDD is less disruptive on the existing environment than any conventional open-trench operations."

Mitigation and Remediation Measures

During the drilling process, Rover has employed additional manpower and equipment to monitor for any potential inadvertent returns. If, at any time, during the drilling process an inadvertent return is suspected, the construction team will immediately contain the released material as quickly and efficiently as possible and contact the appropriate regulatory agencies involved. Rover would then refer to the HDD plan and the HDD supplemental plan on file with Federal Energy Regulatory Commission (FERC) for next steps to ensure complete remediation of the affected area.

HDDs are also used for:
Water and Sewer Pipes
Telecommunication/Fiber Optics
Electric Conduits
Environmental Remediation

Materials Used During HDD Process

"Drilling mud" is commonly used during HDD operations to lubricate and keep drilling tools cool, remove drilled material, support the borehole, and lubricate the carrier pipe during the final stage of pullback. This mixture consists predominantly of water that must adhere to safe drinking standards and naturally occurring clay called bentonite. At the request of the Federal Energy Regulatory Commission, a drilling fluid engineer will be employed to supervise the use of pre-approved, non-petroleum based additives to adjust the consistency of the drilling fluid to minimize circulation loss and to combat reactive clays and shale to minimize annular pressure. Approval for use of these additives is obtained from both the Federal Energy Regulatory Commission and the Ohio Environmental Protection Agency, prior to use.

During HDD, drilling mud can rise through preexisting cracks in the soil to the surface. This event is frequently referred to as an "inadvertent return." These discharges are a potential occurrence in the course of HDD activity, and do not typically result in long-term impacts to the environment.



In the case of the Rover Pipeline, the drilling mud ratio used ranges between **3% and 10% bentonite** and between **97% and 90% water**, depending on the specifics of the particular drill.

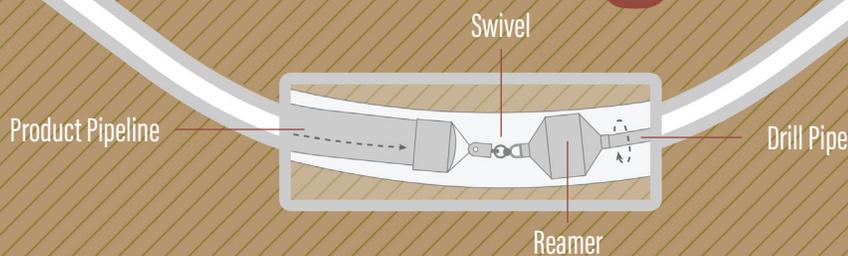
The same bentonite used in the HDD process can be found in everyday household products such as hand soaps and lotions, and is used in the clarifying process in winemaking and home brewing. Bentonite is also listed by the U.S. FDA as a 'Generally Recognized Safe Food Substance' when used as a processing aid, and serves a number of other practical uses such as adhesives, medicines and paint.

According to former federal regulator and pipeline expert Brigham McCown, "The bentonite that is used in the drilling mud is commonly used in many different applications such as water purifying or used as a base layer in makeup."

Rover HDD Fast Facts

- 49 HDD crossings along the pipeline route
- Retained GeoEngineers, an expert HDD engineering firm specializing in geotechnical and environmental issues to provide additional consultation and support
- Mobilized additional construction/environmental personnel at each HDD site
- Deployed aerial drones to help monitor each HDD site

Horizontal Directional Drilling



The Horizontal Directional Drilling method to install pipelines involves three stages:

1 Pilot Bore Drilling

A computer-controlled drilling bit is steered along the planned route.

2 Reaming

A reamer replaces the drill bit, enlarging the borehole diameter. During this stage, soil is removed hydraulically and mechanically. Water and bentonite are used during hydraulic excavation.

3 Installation

The prefabricated line is pulled back from the exit point into the cleaned borehole to the entry point to complete installation.

