

Pembina Pipeline Corporation

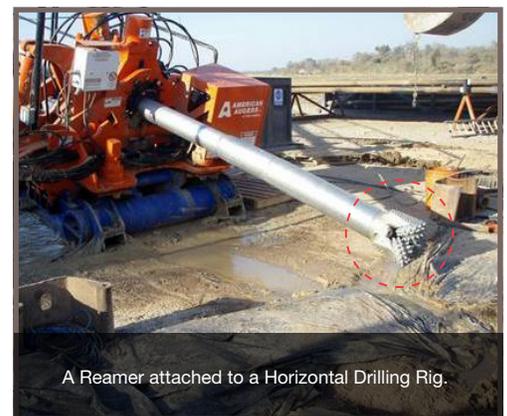
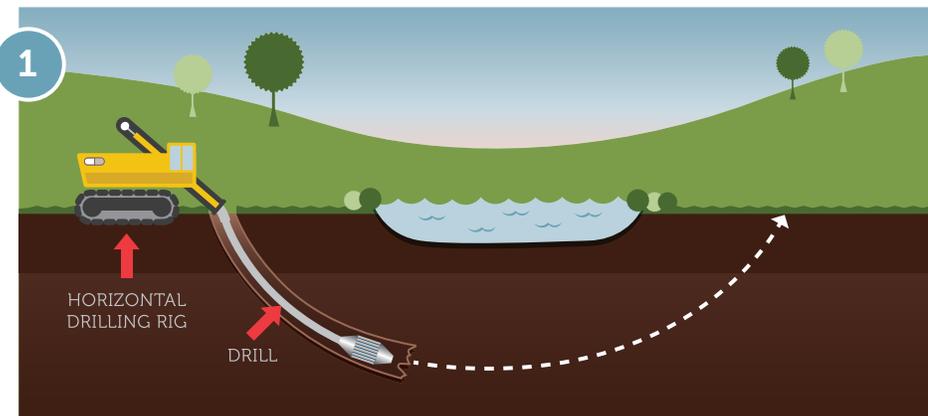
HORIZONTAL DIRECTIONAL DRILLING

PEMBINA PIPELINE CORPORATION (*Pembina*) is a leading transportation and midstream service provider that has been serving North America's energy industry for over 60 years. Pembina owns and operates an integrated system of pipelines that transport various hydrocarbon liquids including conventional and synthetic crude oil, heavy oil and oil sands products, condensate (diluent) and natural gas liquids (NGL) produced in western Canada and ethane produced in North Dakota. We also own and operate gas gathering and processing facilities and an oil and NGL infrastructure and logistics business. With facilities strategically located in western Canada and in NGL markets in eastern Canada and the U.S., Pembina also offers a full spectrum of midstream and marketing services that spans across its operations. Pembina's integrated assets and commercial operations enable it to offer services needed by the energy sector along the hydrocarbon value chain.

What is Horizontal Directional Drilling?

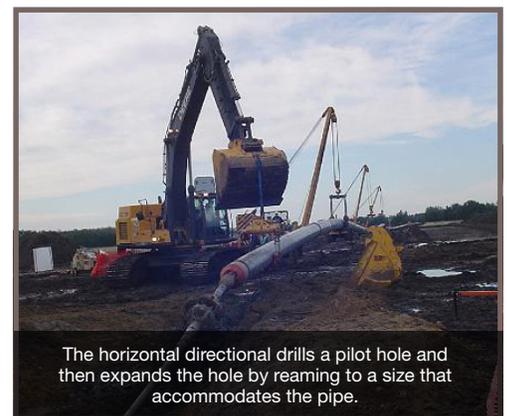
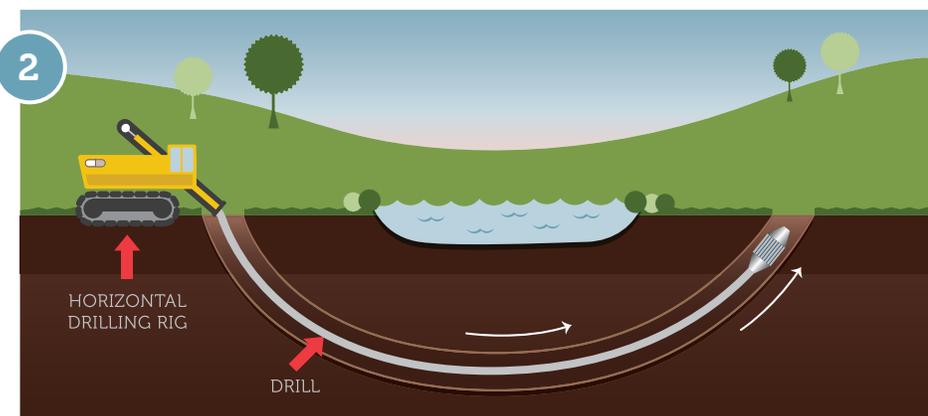
Horizontal Directional Drilling (HDD) is a trenchless construction method that involves drilling a path underneath an area such as a watercourse or road, etc. and pulling the pipeline through the underground path. HDD is a minimal impact pipeline installation that requires only above-ground workspaces at the entry and exit locations of the drill-path, creating a limited amount of disturbances to surface land. HDD is used to safely cross watercourse, rails, roads, steep/sliding slopes, community recreation areas, and pipelines.

Installation of a pipeline by HDD is generally completed in three stages:



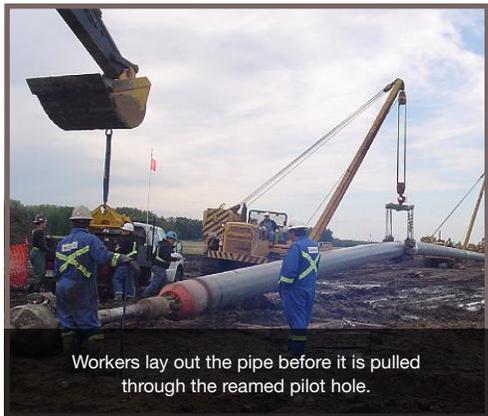
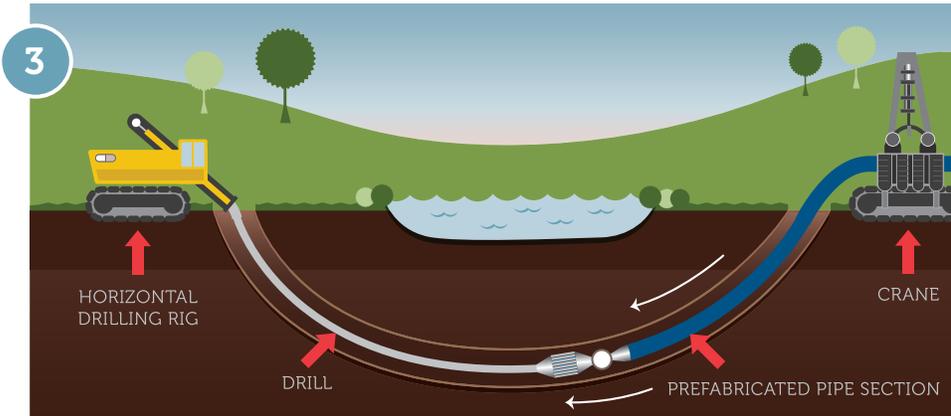
A Reamer attached to a Horizontal Drilling Rig.

The first stage consists of directionally drilling a small diameter pilot hole along a designed directional path. The path of the drilling string is tracked and directed using surface monitoring systems. The surface monitoring system determines the location of the drill bit in the hole by taking measurements from a grid or point on the surface.



The horizontal directional drills a pilot hole and then expands the hole by reaming to a size that accommodates the pipe.

The second stage involves enlarging the pilot hole to a diameter that will accommodate the pipeline. The enlargement process involves the use of a Reamer to cut harder soils. It can take several passes to enlarge the hole to the required diameter, which is normally one and a half times the size of the pipe being installed.



The third stage begins once the pilot hole is enlarged to the correct size. The section of pipe is lowered into the hole using a crane. The pipe is then pulled through the hole using the horizontal directional drilling rig.

Environmental Protection

Before beginning any new project, Pembina conducts environmental studies and assessments to understand the local environmental features and potential effects the project may have on the soil, land, air, plants, wildlife, watershed, archeology and historic sites. Environmental plans are created for the project and used in consultation with regulatory authorities, Aboriginal communities, landowners and other stakeholders.

When using the HDD method, there is limited surface disturbance during the construction and installation of the pipe. Disturbances only occur where the machinery is located at the entry and exit point where the pipe is joined. When crossing a water body, there is no physical activity inside the water, reducing and eliminating disturbances to fish and water life habitats.

In addition to eliminating water disturbances, riverbank stability is another benefit associated with the HDD construction method. There is little disturbance to the bank, subsequently minimizing the possibility of the bank sloping in or eroding into the water body.

Safety

The safety of our people and the public are part of Pembina's core values. Pembina is committed to ensuring our pipelines and facilities are designed, constructed and operated in a safe and environmentally responsible manner.

Safety is deeply embedded in our corporate culture and is the cornerstone of Pembina's success. This is achieved through the development of stringent standards and procedures, regular safety meetings, contractor screening, project inspection and review of potential hazards.

Engineering & Design Considerations

At Pembina, integrity management begins at the engineering and design phase of any pipeline project. Before HDD takes place a number of engineering and design considerations must be examined and tested.

- Some of these engineering and design considerations include:**
- Depth of Cover:** Annular Pressure Analysis is completed to ensure HDDs are drilled at a depth where any risk of drilling mud to the surface is minimized.
- Pipe Stress Analysis:** Detailed stress analysis is completed to determine the design of the drillpath radius to ensure that the pipe can withstand the product pressure during both installation and operation.
- Hydrological Analysis:** Modeling of future depth and extents of erosion are completed to ensure any crossings under waterbodies have sufficient cover for the life of the pipeline.
- Fluid Disposal:** Excess drilling mud and cuttings from the borehole must be tested and disposed of in adherence to regulatory guidelines.

Call or click before you dig

Personnel are required to call area One Call Centres for information prior to any ground disturbances along an occupied ROW or where underground facilities may be present.

For assets where Pembina is the owner and the operator of underground infrastructure, Pembina is a member of the One Call Centre applicable to those assets.



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| Alberta One Call Corporation
1-800-242-3447
www.alberta1call.com | Saskatchewan 1st Call
1-866-828-4888
www.sask1stcall.com | Ontario 1 Call
1-800-400-2255
www.on1call.com | North Dakota One Call
811 or 1-800-795-0555
www.ndonecall.com |
| British Columbia One Call
1-800-474-6886
www.bconecall.bc.ca | Manitoba
www.callb4udig.mb.ca | Texas 811
811 or 1-800-344-8377
www.texas811.org | Virginia 811
811 or 1-800-552-7001
www.va811.com |

Contact Information

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