September 1, 2021 WDNR Data Request

Attachment B

Data Request Response #9

Comparison Table of Waterbody Crossing Methods

Data Request Question #9 Response
Pipeline Waterbody Installation Methods

Method	Description	Applicability	Advantages	Disadvantages
Trench: Open Cut (Non-Isolated)	Open-cut crossing technique that involves trenching through the dry or frozen waterbody with no perceptible flow, or while water continues to flow across the in-stream work area (refer to Figure 14 of the EPP).	Suitable for ephemeral and intermittent waterbodies where there is no perceptible flow (dry or frozen), such as agricultural ditches. This method may also be used in waterbodies that are part of a wetland complex where isolating the flow is not feasible. In Minnesota, these are primarily waterbodies located within large, saturated wetlands, and waterbodies impacted by beaver dams.	• Rapid construction / installation • No need for specialized equipment • Compatible with granular substrates and some rock • Minimizes period of in-stream activity • Maintains streamflow • No sediment release or relatively short duration of sediment release (<24 hours)	• May require implementation of erosion and sediment control BMPs to mitigate sediment release during excavation and backfilling • May interrupt streamflow
Trench: Dry Crossing (Isolated): Dam and Pump	Create a dry work area by damming the flow up- and downstream of the crossing and pumping water around. Dam materials may include but are not limited to: sand bags, aqua dams, sheet piling, or street plates (refer to Figure 15 of the EPP).	Suitable for streams with low flow and defined banks where fish passage is not of concern. Works best in non-permeable substrate and preferred for crossing meandering channels.	• Maintains streamflow • Minimal release and transport of sediment downstream that is not likely to result in effects on aquatic habitat • Relatively dry working conditions • May reduce trench sloughing and trench width	• Minor sediment release during dam construction, dam removal and as water flushes over area of construction • Fish salvage may be required from dried up reach within the workspace • Short-term barrier to fish movement • Specialized equipment and materials required • Seepage may occur in coarse, permeable substrate
Trench: Dry Crossing (Isolated): Flume	Create a dry work area by damming the flow up- and downstream of the crossing and installing flume to convey water. Dam materials may include but are not limited to: sand bags, aqua dams, sheet piling, or street plates (refer to Figure 16 from the EPP).	Suitable for crossing relatively narrow streams that have straight channels and are relatively free of large rocks and bedrock at the point of crossing where fish passage is of concern. The waterbody should have defined banks and channel with solid, fine-textured substrate.	• Maintains streamflow • May allow fish passage • Minimal release and transport of sediment downstream that is not likely to result in negative effects on aquatic habitat • Relatively dry or no flow working conditions • May reduce trench sloughing and trench width	• Minor sediment release during dam construction, removal and as water flushes over area of construction • Fish salvage may be required from dried up reach within the construction workspace • Short-term barrier fish passage if water velocity in culvert is too high

Method	Description	Applicability	Advantages	Disadvantages
				• Difficult to trench and lay pipe, especially large diameter pipe, under flume pipe • Work area may not stay dry in coarse, permeable substrate • Seepage may occur in coarse, permeable substrate
Trench: Modified Dry Crossing (Isolated): Dam and Pump	Dam the flow up- and downstream of the crossing and pumping water around; however, water is not pumped from the trench area. Dam materials may include but are not limited to: sand bags, aqua dams, sheet piling, or street plates. Buoyancy control used to sink the pipe.	Suitable for streams with stable banks where fish passage is not of concern and conditions are too saturated to effectively dewater from the construction workspace.	• Maintains streamflow • Minimal release and transport of sediment downstream that is not likely to result in effects on aquatic habitat • May reduce trench sloughing and trench width	• Minor sediment release during dam construction, dam removal and as water flushes over area of construction • Short-term barrier to fish movement • Specialized equipment and materials required
Trenchless: Bore (Non-Pressurized)	Bore under watercourse from bore pit on one side to bore pit on the other side with or without casing. Non-pressurized water or bentonite may be introduced if soil conditions dictate; any release will travel back along the path of the pipe and into the bore pit.	Suitable for fine-textured impermeable soils and deep water table. Used most commonly for highway, road, and railroad crossings and can include adjacent ditches. Requires a slightly incised watercourse with approach slopes that are absent or slight.	• Avoids surface ground disturbance in the waterbody or ditch adjacent to the feature crossed. • No sediment release • No potential for inadvertent release outside of the bore pits • No disturbance of streambed or banks • Maintains normal streamflow • Maintains fish passage	• Requires additional workspace for bore pits, spoil piles, and sump(s) • Large excavations required both sides of the crossing • Deep bore pits may require sump pump or well point dewatering system and/or sheet-piling • Slower than trench crossing techniques
Trenchless: HDD (Pressurized)	Place a rig on one side of the waterbody and drill a small-diameter pilot hole under the feature along a prescribed profile. Upon completion of the pilot hole, the use a combination of cutting and reaming tools to accommodate the desired pipeline diameter. Drilling mud is necessary to remove cuttings and maintain the integrity of the hole. Once the hole is reamed to the	Suitable to cross sensitive or particularly deep, wide, or high-flow waterbodies depending on site-specific topography and the local geologic substrate. Feasibility limitations in areas of glacial till or outwash interspersed with boulder and cobbles, fractured bedrock, or non-cohesive coarse sands and gravels. Geotechnical borings and hydrofracture risk analysis are performed to determine	• No sediment release unless an inadvertent return occurs • Avoids surface disturbance of the riparian area and stream bed and banks • Limits vegetation disturbance to within the permanently maintained easement • Maintains normal streamflow • Maintains fish passage • May enable construction during restricted activity windows for	• Potential for inadvertent release of drilling fluids • Requires ATWS on both sides of the crossings to stage construction, fabricate the pipeline, and store materials • Tree and brush clearing is necessary for operations • Requires obtaining water to formulate the drilling fluid, buoyancy control, as well as hydrostatic testing

Method	Description	Applicability	Advantages	Disadvantages
	appropriate size, the welded pipe section is then pulsed back through the hole.	HDD feasibility and potential for inadvertent returns.	sensitive fisheries with agency approval • Significantly reduces clean-up and restoration between entry and exit points	• Feasibility and success depends on substrate • Requires specialized equipment (limited availability) • Pull string area along the alignment for the same length of the crossing to allow continuous pullback • Requires a straight alignment for the length of the HDD • May require several weeks to complete the HDD
Sources: Canadian Association of Petroleum Producers, Canadian Energy Pipeline Association, and Canadian Gas Association, 2005. Canadian Energy Pipeline Association, Canadian Association of Petroleum Producers, Canadian Gas Association, 2018.				