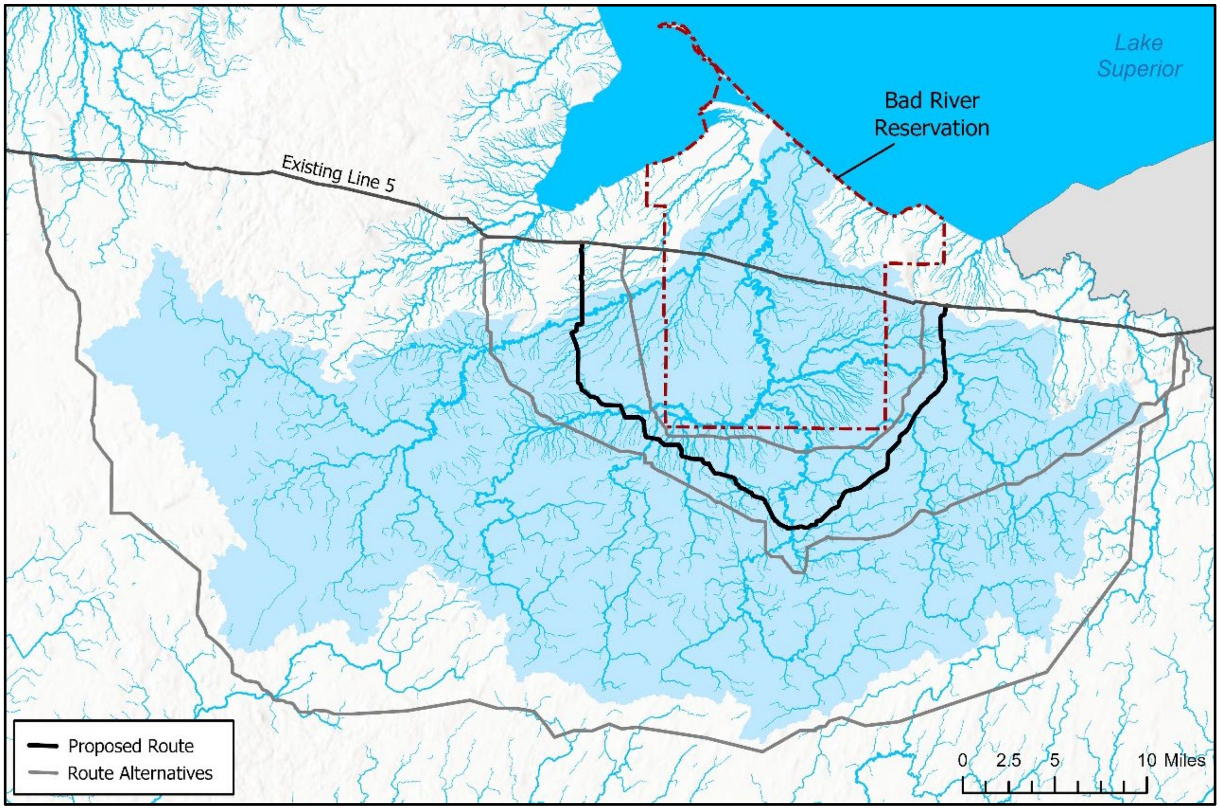
Final Environmental Impact Statement:
Proposed Enbridge Line 5 Relocation Project

Ashland, Bayfield, Douglas, and Iron Counties, Wisconsin



September 2024

WISCONSIN
DEPT. OF NATURAL RESOURCES

Enbridge Proposed Line 5 Relocation Project
Final Environmental Impact Statement

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To the Reader

Enbridge Energy (hereafter, Enbridge) has applied to the Wisconsin Department of Natural Resources (DNR) for waterway and wetland crossing permits and for coverage under the Wisconsin Pollutant Discharge Elimination System (WPDES) Storm Water Associated with Land Disturbing Construction Activity General Permit (Construction Site General Permit) for the company's proposed Line 5 Wisconsin Segment Relocation Project. In compliance with the Wisconsin Environmental Policy Act (WEPA), codified in s. 1.11, Wis. Stat., the DNR followed the Environmental Impact Statement (EIS) process for the proposed project, as established under ch. NR 150, Wis. Adm. Code. The DNR has prepared this Final EIS to inform decision-makers, agencies, tribes, local governments, and the public about the environmental, socioeconomic, and cultural effects of the proposed project, including measures to minimize those effects, and the effects of alternatives to the proposed project. An EIS is an informational tool, not a decision document.

This Final EIS describes Enbridge's proposal to construct approximately 41.1 miles of a new 30-inch-diameter crude oil and natural gas liquids (NGLs) pipeline, to install cathodic protection, AC voltage mitigation facilities, and ten new mainline block valves, to make a minor modification to the company's Ino Pumping Station, and to abandon approximately 20 miles of the existing 30-inch-diameter Line 5 pipeline, a portion of which currently crosses the Bad River Reservation in Ashland and Iron counties.

While no state agency has authority to identify the need for or site petroleum pipelines, the construction of the proposed reroute would require various permits and approvals. The construction of the proposed pipeline reroute would affect the "human environment," defined as the natural or physical environment, including the components, structures, and functioning of ecosystems, and the relationship of people with that environment, including aesthetic, historic, cultural, economic, social, and human health-related components (s. NR 150.03(12), Wis. Adm. Code). The DNR is responsible for analyzing, considering, and disclosing such effects for Enbridge's proposed relocation and route alternatives. This Final EIS discloses the anticipated direct, indirect, temporary, long-term, and cumulative effects of the construction and operation of the proposed pipeline, decommissioning of the existing segment, and the alternatives to the proposed project.

Organization of this Final EIS

Information within the Final EIS is structured topically. If you do not at first see what you are looking for, check the table of contents, as the material may be covered in a different section.

Chapter 1 provides a brief overview of Enbridge's proposed Line 5 pipeline relocation project ("proposed project"), outlines relevant legal background, and presents the "purpose and need" for the proposed project as described by Enbridge. Construction of the proposed relocation would require various environmental and construction reviews, permits, and approvals. Chapter 1 briefly describes federal, tribal, state, and local policies, regulatory authorities, and procedures relevant to Enbridge's proposed pipeline relocation.

Chapter 2 describes Enbridge's proposed relocation route, construction right-of-way (ROW) requirements, off-ROW requirements, pipe design and installation procedures, and construction phasing and sequencing. Chapter 2 describes the waterway crossing methods Enbridge proposes to employ. This chapter also describes construction practices that may be required as permit conditions or implemented as best management practices to reduce effects on wetlands and waterbodies, manage storm water and control erosion, prevent construction-related spills, address invasive species and fugitive dust concerns, and guide site restoration and revegetation.

Chapter 3 describes the EIS process and the scope of the DNR's analysis of anticipated effects. It discusses the geographic extent of the analyses as well as the types of effects analyzed. This includes a description of the three route alternatives considered by Enbridge, as well as the DNR's "No Action" alternative. Finally, this chapter also briefly notes alternatives that were not considered by the DNR in its analyses and provides the rationale for their exclusion.

Chapter 4 describes the Native American nations present in Wisconsin and summarizes the nature and scope of their inherent sovereignty and treaty rights. It overviews Ojibwe cultural perspectives, discusses cultural resources in the project area, and outlines tribal concerns for these resources. Finally, the chapter discloses the DNR's analysis of effects on tribes and their cultural and treaty resources, the exercise of treaty rights, and the environmental justice implications of Enbridge's proposed pipeline relocation and route alternatives.

Chapter 5 summarizes the extensive information used by the DNR, describes the DNR's analyses to identify anticipated effects, and reports the DNR's conclusions regarding anticipated direct, indirect, and cumulative effects on the geophysical, biological, and socioeconomic resources of Wisconsin. Following each description of current conditions, a summary of anticipated effects from construction of the proposed route and route alternatives on the environment is provided. Measures to limit effects, as well as their likely efficacy, are also discussed in this chapter.

Chapter 6 describes the likelihood and anticipated effects of accidental spills of crude oil or NGLs from Enbridge's proposed Line 5 relocation, as well as each of the three route alternatives and that portion of the existing Line 5 pipeline that would be replaced by Enbridge's proposed relocation. The chapter begins with an overview of various pipeline safety regulations, plans, and procedures, followed by a discussion of historical trends and probability of spills of different sizes, and concludes with a description of the impacts of such spills occurring in different locations under different conditions. This includes the DNR's evaluation of the comparative risks and impacts from spills occurring along the different routes under different conditions.

Chapter 7 overviews recent trends and future projections for greenhouse gas (GHG) emissions and Wisconsin's climate. It also discusses effects resulting from Wisconsin's changing climate. Treatment of these topics responds to public comments and provides context, using global, national, state, and regional data, for the discussions of cumulative effects in Chapters 4 and 5 and the emissions analysis estimates for the material carried by Enbridge's Line 5 pipeline that are presented in Chapter 8.

Chapter 8 considers the effects that would be anticipated if the DNR did not approve sufficient permits for Enbridge's proposed Line 5 relocation (the DNR's No Action alternative) and the outcome of the No Action alternative resulted in a shutdown of the Line 5 pipeline. The effects of this No Action alternative depend, in part, on potential substitute modes of crude oil and NGL transportation and alternative energy sources. This chapter considers risks of oil spills, implications for GHG emissions and climate change, as well as socioeconomic effects in the region including the social costs of carbon.

Anticipated Effects to the Human Environment from Pipeline Construction

Activities during construction of Enbridge's proposed Line 5 relocation would include land clearing for the ROW and temporary workspaces, construction of access roads, construction of the pipeline trench, installation of the pipeline, and post-construction restoration. Effects to the human environment from these activities would be temporary, long-term, direct, indirect, or cumulative. Direct effects would mostly be confined to the pipeline ROW and temporary workspaces. Indirect effects on some types of resources could occur downstream or within a larger geographic area. The greatest likelihood for anticipated effects during pipeline construction would be associated with large-scale habitat alteration, erosion and sedimentation from precipitation events that cause erosion, inadvertent releases of HDD drilling fluids (frac outs), and aquifer breaches. More complete and detailed analyses of how construction of Enbridge's proposed Line 5 pipeline segment relocation would be anticipated to affect the human environment is provided within this document.

Anticipated Effects to the Human Environment from Pipeline Operations

Activities during pipeline operation can include aerial and ground inspection patrols, maintenance, vegetation management, integrity digs, and responses to inadvertent petroleum spills. Effects to the human environment caused by these activities or by a petroleum release would be temporary, long-term, direct, indirect, or cumulative. Short-term direct effects from maintenance activities would mostly be confined to the pipeline ROW. An unanticipated release of petroleum products during the operation of the pipeline would likely result in long-term direct, indirect, and cumulative effects on the human environment, which could occur downstream or within a larger geographic area. More complete and detailed analyses of how operation of Enbridge's proposed Line 5 pipeline segment relocation would be anticipated to affect the human environment is provided within this document.

Anticipated Effects to the Human Environment from Decommissioning the Existing Pipeline

The shutdown or rerouting of a segment of Line 5 would require decommissioning all or part of the existing pipeline. The decommissioned pipeline or pipeline segment could remain in place, or all or portions of the pipeline or pipeline segment could be removed from the ground. If not removed from service properly, decommissioned pipeline can pose direct safety and environmental effects including spills, emissions, or explosions. Effects to the human environment caused by these activities or by a petroleum release would be temporary, long-term, direct, indirect or cumulative. Abandoning the pipeline in-place in the construction trench could lead to future direct effects, including long-term structural deterioration of the pipeline, which could in turn lead to some measure of ground subsidence. Exposure of the buried pipe at waterbody or wetland crossings could occur from either erosion of soils overlying the existing pipeline, stream degradation, or from flotation of an empty pipeline within a waterway. Release of contaminants, including substances produced in the hydrocarbon stream and deposited on the walls of the pipeline, treatment chemicals, and pipeline coatings and their degradation products, could occur after a pipeline is abandoned in place or during pipeline removal. Removing the pipeline could lead to direct effects such as damage to existing bank stabilization structures, destabilization of previously stable banks, erosion and slope stability effects, and disruption to facility and traffic operations at utility, road, and railway crossings during removal. Additional direct and indirect effects similar to those associated with construction would occur along the existing Line 5 segment if the pipeline were removed. Any combination of anticipated direct effects from decommissioning the pipeline would be expected to lead to indirect and cumulative effects to the human environment. More complete and detailed analyses of how decommissioning of Enbridge's Line 5 pipeline would be anticipated to affect the human environment is provided within this document.

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1 PROJECT OVERVIEW & PERMITTING AUTHORITIES

This chapter provides a brief overview of Enbridge's proposed Line 5 pipeline relocation project (the "proposed project"), outlines relevant legal background, presents the "purpose and need" for the proposed project as described by Enbridge, and describes the government authorities and approvals required to carry-out the project. Pipeline companies determine the routes for their pipelines; acquire the rights-of-way (ROWs) to build, operate, and maintain them; engineer the actual system designs; and construct the lines. The U.S. Department of Transportation (USDOT)'s Petroleum Hazardous Material Safety Administration (PHMSA) regulates pipeline operations and safety. No federal or state agency has general authority for identifying the need for or siting of petroleum pipelines in Wisconsin. Construction of the proposed relocation would, however, require various environmental and construction reviews, permits, and approvals. This chapter concludes by briefly describing federal, tribal, state, and local policies, regulatory authorities, and procedures relevant to Enbridge's proposed pipeline relocation.

1.1 Overview of Proposed Project

Enbridge owns and operates the 645-mile-long Line 5 pipeline. On average, Line 5 transports more than 500,000 barrels a day of unconventional crude oil and/or natural gas liquids (NGLs) from Enbridge's terminal in Superior, Wisconsin. Line 5 traverses northern Wisconsin and the Upper and Lower Peninsulas of Michigan before reaching its terminus at Sarnia, Ontario in Canada. Line 5 is part of Enbridge's Mainline System (Figure 1.1-1). The Mainline System is comprised of the Canadian Mainline, including several pipelines running from Edmonton, Alberta to the Canada-United States border at Gretna, Manitoba, and the Lakehead System in the United States, which carries products to Clearbrook, Minnesota and Superior, Wisconsin, and delivers crude oil to markets in Minnesota, northern Illinois, Indiana, Ohio, Michigan, and southern Ontario. Other Enbridge pipelines serve markets in the U.S. Gulf Coast, Oklahoma, southern Illinois, and Quebec.

Enbridge proposes to replace approximately 20 miles of existing Line 5 pipeline in Ashland and Iron counties–including approximately 12 miles of pipeline that crosses the Bad River (Mashkiiziibii) Reservation of the Bad River Band of Lake Superior Chippewa (Bad River Band)–with 41.2 miles of pipeline relocated around the reservation to the south. Enbridge would decommission the 12 miles of existing pipeline within the reservation plus another approximately 8 miles of pipeline outside the reservation. The decommissioned pipeline segment would be replaced with 41 miles of new 30-inch pipeline and 10 new mainline block valves. Enbridge would also make minor modifications to its existing Ino Pump Station. The proposed relocation segment would begin near the intersection of State Highway 137 and State Highway 112 in Ashland County and extend to approximately the intersection of U.S. Highway 2 and State Highway 169 in Iron County. An interconnection between the existing Line 5 pipeline and the new replacement segment pipeline would be constructed at the start and end points of the proposed relocation route (Figure 1.1-2). Chapter 2 provides additional details on Enbridge's proposed pipeline relocation route. Table 2.1-1 lists the township, range, and section locations intersected by the proposed pipeline relocation route.

The proposed project would be constructed using typical industry-accepted pipeline construction methods, following a sequential process that includes surveying and staking, clearing and site preparation, pipe stringing, bending, welding, coating, trenching, lowering-in, backfilling, hydrostatic testing, cleanup, and site restoration. In most areas, these construction processes would proceed in an assembly line fashion with construction crews moving along the construction ROW. Chapter 2 includes detailed information on the construction right-of-way (ROW) and off-ROW requirements, as well as construction phasing and sequencing.

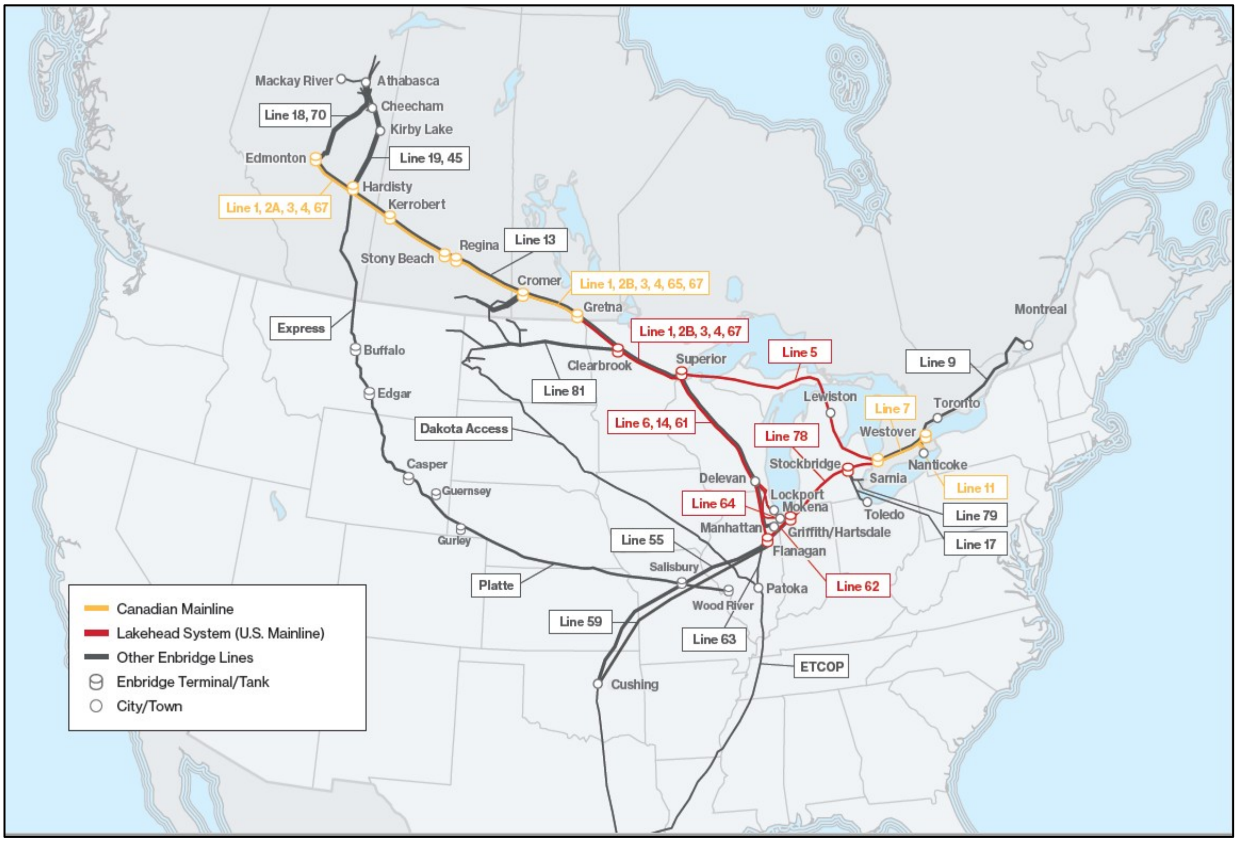

Figure 1.1-1 Enbridge's Mainline System.
Source: Enbridge

As currently proposed, installation of the relocated pipeline would include approximately 35.1 miles of pipe installation via trenched construction and approximately 6 miles of trenchless construction. Trenchless construction would be completed primarily by horizontal directional drilling (HDD) with a limited amount of direct bore installation. Pipeline depth of cover would vary by land use and subsurface conditions from 18 inches minimum in rock blasting areas to greater than 100 feet where HDD is used for waterway crossings (Table 2.6-1). Most of the pipeline would be installed with 30 to 48 inches of cover. Chapter 2 provides more detailed descriptions of Enbridge's proposed pipeline design and installation procedures, phasing, and sequencing.

Construction of the rerouted pipeline would require crossing 186 waterbodies. Appendix B includes a table of proposed waterway and wetland crossings. Figure 2.1-7 and Appendix A include maps of Enbridge's proposed relocation route and the associated waterway and wetland crossings. On February 11, 2020, Enbridge (2020a) submitted a Water Resources Application for Project Permits to the Wisconsin Department of Natural Resources (DNR) and U.S. Army Corps of Engineers (USACE) for the proposed Line 5 relocation. The application is a request for permits from the DNR and USACE to disturb wetlands and waterbodies to carry out Enbridge's proposed pipeline relocation. Chapter 2 describes Enbridge's proposed waterway crossing methods, as well as construction mitigation practices to reduce impacts to wetlands and waterbodies, manage storm water and control erosion, prevent construction-related spills, address invasive species concerns, and guide site restoration and revegetation.

Prior to Enbridge's permit applications, on December 12, 2019, the DNR notified Enbridge that it would prepare an environmental impact statement (EIS) following the procedures under § NR 150.30, Wis. Adm. Code in accordance with § 1.11(2)(c), Wis. Stat. and the Wisconsin Environmental Policy Act

(WEPA). The DNR released a Draft EIS in December 2021. The DNR held a public hearing on the Draft EIS in February 2022, and received more than 32,000 written comments during the associated public comment period. The DNR reviewed and considered the public comments, completed additional analyses, and prepared this Final EIS.

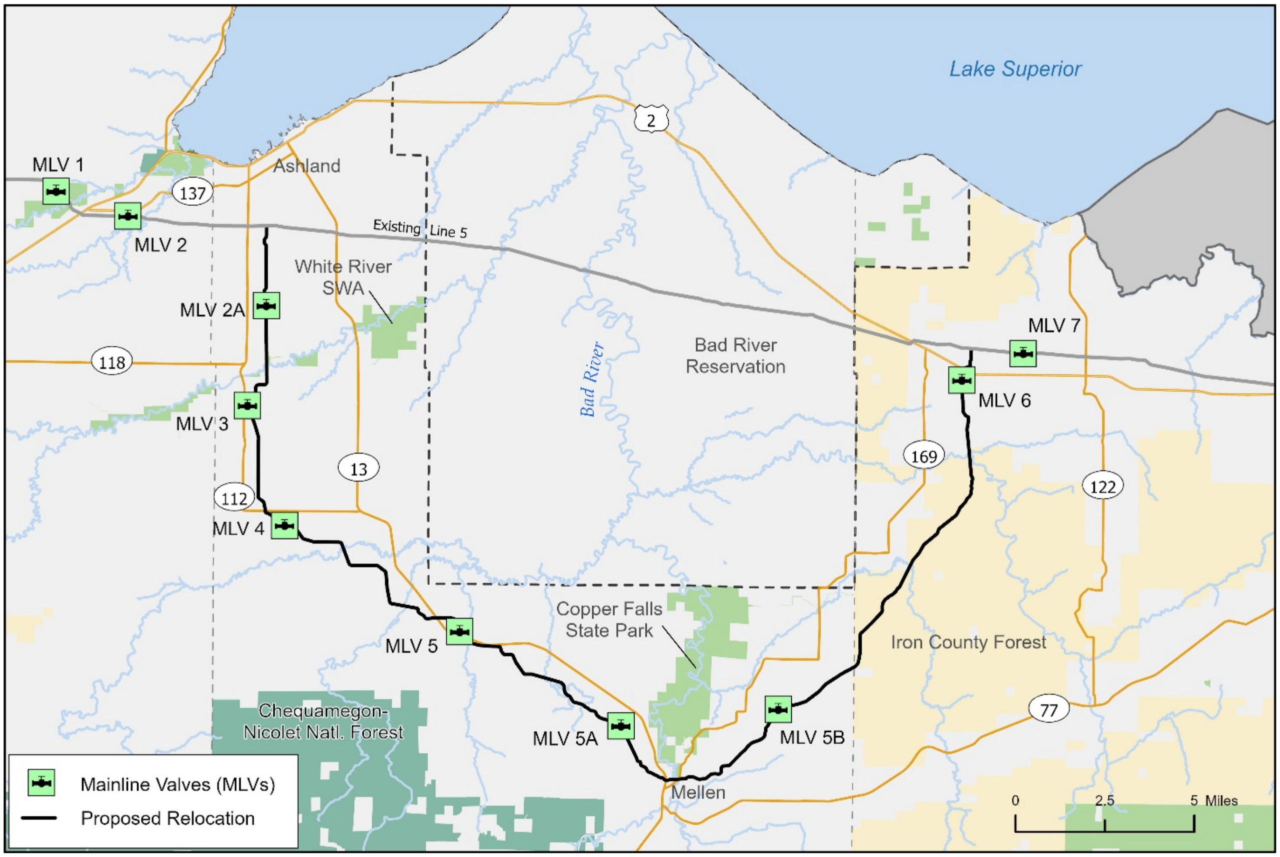

Figure 1.1-2 Enbridge's proposed relocation route and location overview.

1.1.1 Project Cost & Funding

Enbridge would privately fund the Line 5 relocation project. Multiple factors would impact the total cost. These factors include timing of project commencement, construction schedule, construction methods used, environmental mitigation measures employed, and potential fluctuations in the overall industry demand during procurement and construction and the resulting changes in the cost of contract labor and material costs. Currently, Enbridge estimates project costs to be approximately $450 million, with approximately $360 million to be spent in Wisconsin. Of the expenditures in Wisconsin, $110 million would be spent in Ashland, Bayfield, and Iron counties where land acquisition and construction would take place. Of the $450 million total, approximately 10 percent would be for design and engineering, 40 percent for administrative labor, 20 percent for materials, and 30 percent for construction labor.

1.1.2 Project Schedule & Workforce

Enbridge proposes to begin construction of the relocated pipeline once all necessary permits and approvals have been obtained. Enbridge estimates it will take 12 to 14 months to complete construction. Site restoration efforts would continue to be undertaken by Enbridge until the affected areas have been restored in accordance with state and federal permit conditions and any landowner agreements.

Enbridge projects construction labor expenses to exceed $148 million. Based on the scope of the relocation project (mainline length, construction activities, above ground facilities), Enbridge anticipates needing approximately 700 workers throughout the construction period. According to Enbridge, approximately half of these jobs would be provided by Enbridge's contractor(s) and the remaining personnel would come from the local area, subject to availability. Depending on availability, members of several trade unions would be expected to be involved in construction, including:

- Laborers' International Union of North America (LIUNA) Local 1091
- International Union of Operating Engineers Local 139
- International Brotherhood of Teamsters
- Pipeliners Union Local 798

Any non-local workers would likely relocate to the three-county area for the duration of the construction activity. Non-local workers would need temporary residence in hotels/motels for the duration of the construction activities. In addition, contractors and subcontractors may lease land to establish temporary field offices and lease equipment for material storage areas. Additional information on the expected workforce and the associated economic impact of the proposed project is provided in Sections 5.13 and 5.14.

1.2 Legal Background

1.2.1 Historic Land Easements

In 1953, the Bureau of Indian Affairs (BIA) granted Enbridge a 20-year easement allowing Line 5 to pass through the reservation of the federally recognized Bad River Band of Lake Superior Chippewa Indians (Enbridge, 2020b; Bad River Band of Lake Superior Chippewa, 2019a; Arnold, 2020). The easement was renewed in 1970 for an additional 20 years. In 1993, Enbridge sought a 50-year easement, which was granted by the Bad River Band and only applied to parcels that were owned wholly by the Bad River Band. The parcels subject to BIA control–15 parcels total–were issued 20-year easements. During this 20-year period, the Bad River Band acquired ownership interest in 12 of the 15 parcels.

In 2013, Enbridge and the Bad River Band discussed potential renewal of the easements but could not reach an agreement. In January 2017, the Bad River Tribal Council enacted a resolution to deny renewal of Enbridge's easements (Bad River Band of Lake Superior Chippewa, 2017). The Tribal Council resolution restated their position that tribal life "is rooted in a connection to the natural world, the source of our health and wellness for the past, present, and future generations making our relationship with the natural world sacred." The resolution went on to say that the White River (Waabishkaa-ziibi) and the Bad River (Mashkiigon-ziibi) provide food, medicine, and drinking water, and are necessary for the Bad River people's health and well-being. The resolution pointed out that petroleum pipelines have failed in similar settings causing extensive environmental damages and that oil released to the White or Bad rivers would be catastrophic to the health and economy of the downstream Odanah, Wisconsin community, Lake Superior coastal wetlands, wild rice beds, and lake fisheries. The resolution stated that "a pipeline break at these places will nullify our long years of effort to preserve our health, subsistence, culture and ecosystems, and sacrifices members have made instead of pursuing the possibility of short-term economic gain" (Bad River Band of Lake Superior Chippewa, 2017). The Tribal Council reaffirmed its opposition to the pipeline in another resolution in 2019 (Bad River Band of Lake Superior Chippewa, 2019b).

1.2.2 Federal Lawsuit to Remove Line 5 from Tribal Lands

In July 2019, the Bad River Band filed a lawsuit in the U.S. District Court for the Western District of Wisconsin (Case no. 19-cv-602-wmc), alleging trespass and unjust enrichment for Enbridge's continued operation across the Bad River Reservation without valid easements, public nuisance, ejectment, and a violation of Bad River Band's regulatory authority. In its opinions and orders from September 7, 2022, and June 16, 2023, the court held that the 20-year easements had expired, Enbridge's continued use of Line 5 on those parcels constituted trespass, a rupture on Line 5 would constitute a public nuisance, and that Enbridge was unjustly enriched by the continued operation of Line 5. The court ordered Enbridge to adopt a more protective pipeline monitoring and shutdown plan and to pay a monetary award to the Bad River Band. The court also issued an injunction prohibiting Enbridge from operating Line 5 beginning three years after the date of the order (June 16, 2026).

Both Enbridge and the Bad River Band have appealed the District Court ruling to the 7th Circuit Court of Appeals (Case no. 23-2309). Enbridge challenged the District Court's holding on trespass, unjust enrichment, and the issuance of the injunction. The Bad River Band asked the appellate court to affirm the holdings, but challenged the amount of the monetary award and the three-year period in which Enbridge could continue to operate before the injunction goes into effect. Oral arguments in the 7th Circuit were held on February 8, 2024. Following oral arguments, one of the three judges reviewing the case noted the court was seeking an opinion from the U.S. government. Later that month, more than 30 Native American Nations requested the U.S. government weigh in on the case. The U.S. government filed a brief in the case in April 2024 that argued that the District Court correctly held Enbridge in trespass but recommended that the case be remanded to reweigh the equities and public interest considered when granting relief for the trespass. The brief also recommended that the court "fully consider the possible consequences of an order requiring the shutdown of the pipeline, including its effect on the United States' obligations under the Transit Pipeline Treaty and the United States' diplomatic and commercial relationship with Canada." As of the date of this document, the Court of Appeals has not yet issued an opinion.

1.2.3 1977 Transit Pipelines Treaty

The 1977 Agreement Concerning Transit Pipelines between the United States and Canada provides certain assurances of continued transmission of oil and natural gas products though pipelines that originate in and are delivered to one country but travel through the other. This treaty includes allowances for just and reasonable governmental regulations by the governmental authorities with jurisdiction over the transit pipeline. On August 29, 2022, the Government of Canada invoked the dispute resolution provision in Article IX of the treaty with respect to Line 5 in Wisconsin, citing concerns about the impacts that a shutdown would have on Canadian jobs and the energy supply chain. The treaty's terms require binding arbitration between the two nations if negotiations are not successful.

1.3 Project Purpose & Need

Enbridge's stated purpose for the proposed project is to continue transporting crude oil and NGLs through its Line 5 pipeline, while decommissioning that portion of line that crosses the Bad River Reservation. According to Enbridge's application for DNR permits for its proposal (Enbridge, 2020c):

> *The Project will allow Enbridge to continue uninterrupted deliveries of propane to the Upper Peninsula of Michigan, as well as to maintain reliable, economic, and secure committed transportation services for its shipping customers. The propane extracted at Rapid River provides propane to both Wisconsin and Michigan residents. After the Project is in service, the pipeline would*

> *no longer operate within the Reservation.*

As discussed in Section 1.3.1.3.3, propane is produced by fractionating natural gas liquids (NGLs) into component products. Combined, NGLs constitute approximately 15% of the liquid petroleum products transported by Line 5. Propane constitutes roughly 70% of these NGLs (Earnest, 2022a). The extent to which propane transported via Line 5 serves Wisconsin households is discussed in Section 8.2.3.1.

In its comments on the Draft EIS, Enbridge (2022a) added that:

> *[T]he cessation of operation of Line 5 will remove 540,000 barrels per day of petroleum from the upper Midwest and eastern Canadian markets (80,000 barrels per day of NGLs and 460,000 barrels per day of crude oil), resulting in a material reduction in crude oil supply to those regions used for production of fuel and other petroleum-based products.*

Chapter 8 (Effects of No Action Alternative) discusses the anticipated economic and environmental effects of the cessation of operation of Line 5.

1.3.1 Current Line 5 Use

On average, Line 5 transports more than 500,000 barrels per day of unconventional crude oil and NGLs from Enbridge's terminal at Superior, Wisconsin. At Rapid River, in Michigan's Upper Peninsula, some of the NGLs are removed and fractionated to produce propane. In Michigan's Lower Peninsula, at the Lewiston Crude Oil Terminal, a small amount of locally produced crude oil is added. Further south, at Marysville, Michigan, some of the crude oil transported to that point leaves Line 5 via other pipelines that ship the product to refineries in Michigan and Ohio. Line 5 terminates at Sarnia, Ontario. Line 5 supplies crude oil to ten refineries in Quebec (2), Ontario (4), Pennsylvania (1), Ohio (2) and Michigan (1) and contributes about 37 percent of the crude oil used by these refineries (ESAI Energy LLC, 2022a). No refinery entirely depends upon Line 5 for the supply of crude oil.

1.3.1.1 Products Transported via Line 5

Table 1.3-1 lists the annual average daily volumes, between 2017 and 2022, of the different petroleum products transported via Line 5. Not including 2020 (the height of the COVID-19 pandemic), the average daily volume of products transported was 504,800 barrels per day. Synthetic light crude accounts for roughly 70 percent of the total liquids transported via Line 5, while Bakken Light Crude and Natural Gas Liquids (NGLs) each account for roughly 15 percent.

Table 1.3-1 Average daily volumes (barrels per day) of Line 5 products, 2017-2022.

Years	All products combined	Synthetic light crude	Bakken crude	Natural gas liquids
2017	484,000	304,000	106,000	74,000
2018	498,000	347,000	74,000	77,000
2019	526,000	340,000	108,000	78,000
2020	448,000	316,000	58,000	74,000
2021	489,000	352,000	70,000	67,000
2022	527,000	382,000	71,000	74,000
6-year Average	495,333	340,167 (72%)	81,167 (13%)	74,000 (14%)
5-year Average (without 2020)	504,800	345,000 (68%)	85,800 (17%)	74,000 (15%)

Source: (Enbridge, 2024a)

Synthetic light crude, NGLs, and Bakken crude are transported from their respective sources in Alberta and North Dakota to the Enbridge Superior terminal in Superior via other pipelines on Enbridge's Mainline System (Figure 1.1-1). Enbridge's Mainline is a "batched system," through which different types and grades of petroleum products are shipped in separate batches. Line 5 operates under "turbulent flow" conditions (i.e., high velocity/low viscosity) enabling the three different products to be transported back-to-back without a mechanized divider (or "batch pig"). Line 5 valves are operated at specific times to ensure product delivery without mixing.

1.3.1.2 Synthetic Light Crude

On average, Line 5 carries approximately 345,000 barrels per day (bpd) of synthetic light crude, extracted and processed from the tar sands of Alberta, Canada. "Light crude" refers to liquid petroleum that has a comparatively low density and flows freely at room temperature (CAPP, 2021). Alberta synthetic light crude is produced by "upgrading" the bitumen mined from tar sands. Bitumen is a semisolid to solid form of petroleum defined as a "naturally occurring viscous mixture, mainly of hydrocarbons heavier than pentane, that may contain sulfur compounds" (U.S. EIA, 2021). Synthetic light crude is generated through a multistep process to produce a petroleum comparable to conventional light crude oil. The processing involves upgrading the ratio of hydrogen to carbon in the oil compounds, conversion of long-chain, heavy hydrocarbons to shorter-chain, lighter hydrocarbons, removal of impurities, such as sulfur and nitrogen, and finally blending (Oil Sands Magazine, 2020).

1.3.1.2.1 Bakken Crude

On average, Line 5 carries roughly 85,000 bpd of Bakken Crude, which is an unconventional light crude oil extracted from the Bakken Formation of shale rock spanning portions of North Dakota and Montana in the United States and Manitoba and Saskatchewan in Canada. Bakken crude is extracted from shale by hydraulic fracturing (or "fracking") in which a pressurized mixture of water, sand, and chemicals is injected into wells to create and expand cracks in the shale, through which natural gas and petroleum will flow. The USGS estimates 4.3 billion barrels of unconventional crude and 4.9 trillion cubic feet of unconventional natural gas are available in the U.S. Bakken Formations (USGS, 2021a).

1.3.1.2.2 Natural Gas Liquids

On average, Line 5 carries approximately 74,000 bpd of NGLs. NGLs are heavier components of natural gas. They are separated from the gas state through absorption, condensation, or other methods. The liquids are first extracted from natural gas and later separated into different components. Processed NGLs include ethane, propane, butanes, isobutanes, and pentanes. In 2019, the composition of NGLs transported via Line 5 was: propane (70.2%), butane (26.1%), ethane (3.1%), natural gasoline (0.6%) (Earnest, 2022a).

1.3.1.3 Refined End Products

Refineries in Michigan, Ohio, and Ontario refine the raw petroleum feedstocks transported by Line 5 into propane, diesel fuel, jet fuel, and other products. NGLs are processed at the Rapid River fractionator in the Upper Peninsula of Michigan to produce propane. The remaining NGLs are reintroduced into Line 5 for transport to Sarnia, Ontario. The following sections briefly describe the principal end products that are refined from the materials conveyed through Line 5.

1.3.1.3.1 Diesel Fuel

Diesel fuels are refined from crude oil for use as liquid fuel for compression injection (diesel) engines. Most freight and delivery trucks as well as trains, buses, boats, and farm, construction, and military vehicles have diesel engines. Diesel fuel is also used in diesel-engine generators that produce electricity, such as for backup and emergency power supplies. Ordinarily diesel fuels are blends of hydrocarbon compounds obtained from the fractions of crude oil that are less volatile and less flammable than the fractions used in gasoline production.

1.3.1.3.2 Jet Fuel

Jet fuels are refined from crude oil for use in aircraft powered by gas-turbine engines. Jet fuels are blends of hydrocarbon compounds generally classified as either kerosene-type fuels or naphtha-type fuels. Kerosene-type jet fuels are used for commercial and military turbo jet and turbo prop aircraft engines. Naphtha-type jet fuels are used primarily for military turbojet and turboprop aircraft engines because these fuels have a lower freeze point than other aviation fuels and meet engine requirements at high altitudes and speeds.

1.3.1.3.3 Propane

A byproduct of natural gas processing and crude oil refining, propane is a colorless, odorless NGL that if not diluted into heavier petroleum compounds remains a gas at room temperature. Propane is used in combustion for residential and commercial heating, as a cooking fuel, and as a petrochemical feedstock (e.g., for plastics manufacturing). Propane can also be used to power light-, medium-, and heavy-duty propane vehicles. The Rapid River depropanization plant in the Upper Peninsula of Michigan extracts propane from the Line 5 NGLs for cooking and heating fuel, most of which is distributed in Michigan.

1.3.2 Current & Projected Demand for Products Transported by Line 5

U.S. consumption of oil and gas products has increased considerably since 1950 (Figure 1.3-1). Between 2010 and 2022, U.S. consumption of natural gas increased by 36 percent. During the same period, however, U.S. consumption of liquid petroleum, including crude oil, natural gas liquids, and refined petroleum products (e.g., motor gasoline, diesel, and jet fuel) increased by only 1.5 percent (U.S. EIA, 2023a).

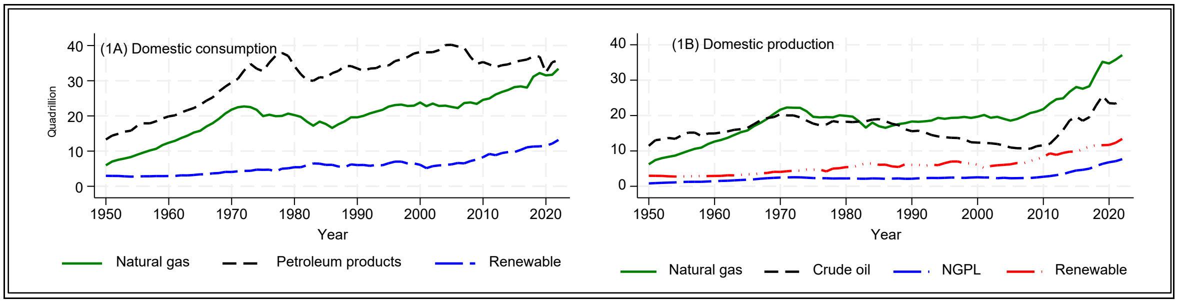

Figure 1.3-1 Production and consumption of oil and gas products in the United States, 1950-2022.
Source: DNR, adapted from data from the U.S. EIA

U.S. energy demand shrank in 2020 due to the COVID pandemic but rebounded in 2021. International demand for U.S. oil and gas products is forecasted to increase, while domestic consumption is projected to stay stable through 2050 under the “Reference” (base case) scenario (Figure 1.3-2). Similarly, Canadian crude oil production is projected to stay stable under the “Current Measures” (base case) scenario (Figure 1.3-3).

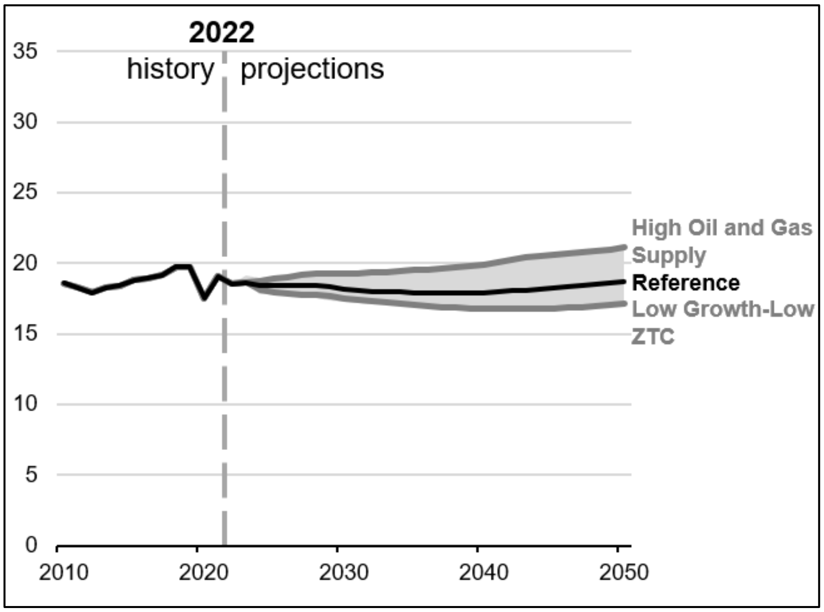

Figure 1.3-2 U.S. consumption of petroleum products, 2010-2050 (million barrels per day).
Source: (U.S. EIA, 2023b)

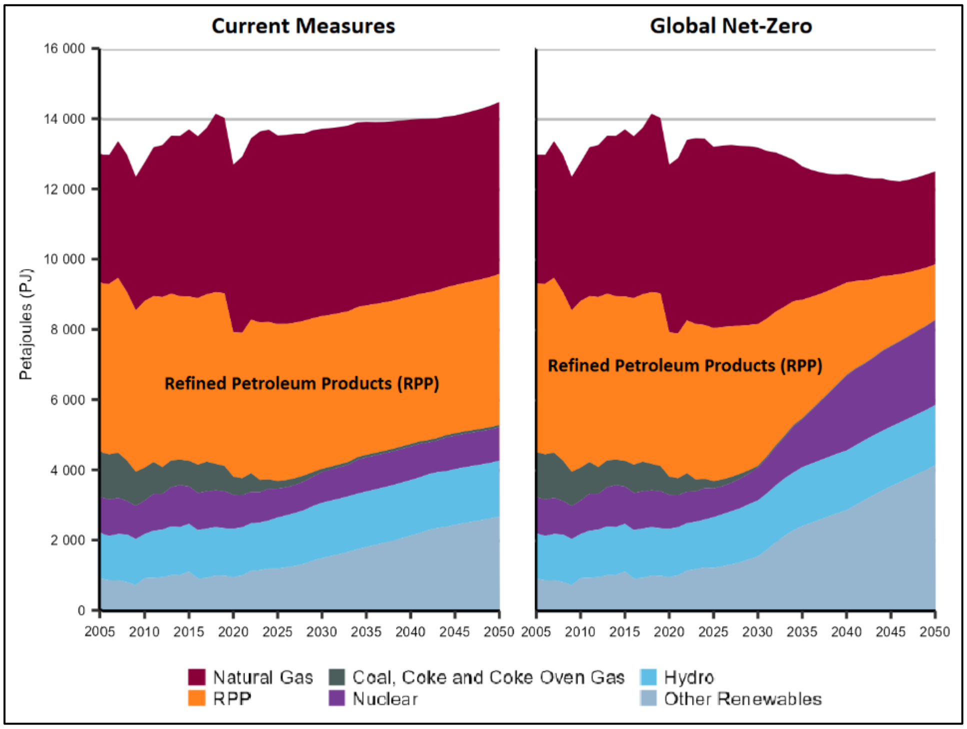

Figure 1.3-3 Canadian energy demand by fuel type, 2005-2050 (petajoules).
Source: (Canada Energy Regulator, 2023)

According to the U.S. EIA Annual Energy Outlook (AEO) for 2023, U.S. consumption of petroleum and natural gas either grows slowly or decreases over time. Due to growing income and population, jet fuel consumption is also projected to grow. The AEO projects a 32% increase in commercial jet fuel consumption from 3.2 quads in 2019 to 4.2 quads in 2050 (U.S. EIA, 2022). Nevertheless, these projections are inherently uncertain given the occurrence of various factors (technology, demographics, resources, policy developments) that shape energy markets.

Renewable energy is projected to be the fastest growing source of energy in the United States, although petroleum and natural gas remain the most consumed sources of energy (U.S. EIA, 2022). Solar and wind energy are considered the cheapest available sources of new electricity generation and account for the increased reliance on renewables, largely because of continuing declines in the capital costs. Until 2030, energy demand growth of almost one percent per year is expected to be largely met by renewables (IEA, 2022). Electrification is projected to displace combustion fuels in the demand sectors. Domestic natural gas consumption for electricity generation is predicted to decrease by 2050 relative to 2022 as electricity generation shifts to using more renewable and battery sources. The United Nations 2030 Agenda for Sustainable Development adopted in 2015 aims to double the global rate of improvement in energy efficiency by 2030. In addition, Wisconsin's Clean Energy Plan (Section 1.4.3.5) seeks to have all electricity consumed within the state be 100 percent carbon-free by 2050. Enbridge has indicated that the company is committed to achieving net-zero greenhouse gas (GHG) emissions from its operations by 2050 and suggested its "existing energy transmission and distribution assets will be a critical platform to achieve societal climate ambitions," noting that "existing assets are also critical to allow Enbridge to fund renewable projects" (Enbridge, 2020d).

1.4 Authorities, Policies, & Required Approvals

As noted previously, private pipeline companies determine possible routes for new or relocated pipelines; acquire the ROWs to build, operate and maintain the lines; engineer the actual system designs; and construct the lines. These steps are subject to various regulatory reviews and approvals. As noted above, construction of Enbridge's proposed pipeline relocation would require several environmental and construction reviews, permits, and approvals. This section briefly describes federal, tribal, state, and local policies, regulatory authorities, and procedures relevant to Enbridge's proposed pipeline relocation.

1.4.1 United States Government Authorities & Policies

Federal review and approval authorities applicable to the siting, construction, and operation of petroleum pipelines include:

- Oversight for siting pipelines on federal properties
- Pipeline safety regulations
- National Environmental Policy Act (NEPA)
- Clean Water Act (CWA)
- Rivers and Harbors Act
- National Historic Preservation Act (NHPA)
- Endangered Species Act
- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- Coastal Zone Management Act
- Workplace and Blasting Safety Standards

In addition, the U.S. Forest Service and National Park Service own and manage properties in the vicinity of Enbridge's proposed Line 5 pipeline relocation.

1.4.1.1 Petroleum Pipeline Need & Siting

No federal agency has approval authority over the need for or siting of liquid petroleum pipelines, with the exception of pipelines crossing federal lands. Under the Natural Gas Act, proposed interstate natural gas pipelines require a “certificate of public necessity and convenience” from the Federal Energy Regulatory Commission (FERC). No such certificate is required from the federal government for liquid petroleum pipelines.

1.4.1.2 Pipelines on U.S. Forest Service Properties

The U.S. Forest Service (USFS) manages the National Forest System, including the Chequamegon-Nicolet National Forest in Northern Wisconsin. The proposed relocation route does not cross this property. One of the alternative routes considered for this EIS, Route Alternative 3 (RA-03; Section 3.5.1.3), includes 28 miles of pipeline through the Chequamegon-Nicolet National Forest. That alternative would require a USFS Special Use Permit, along with agency reviews of anticipated environmental and cultural/historic impacts under NEPA (Section 1.4.1.12) and NHPA (Section 1.4.1.7).

1.4.1.3 National Park Service Properties

The National Park Service (NPS) manages the National Park System, including the Apostle Islands National Lakeshore and the St. Croix National Scenic Riverway in Northern Wisconsin. The proposed relocation route does not cross these properties. The proposed relocation route would cross the North Country National Scenic Trail at three locations (Figure 5.12-4). The Wisconsin DNR, NPS, and North Country Trail Association maintain the National Scenic Trail in Wisconsin. Additionally, Route Alternative 3 (RA-03) would cross the Namekagon River, part of the St. Croix National Scenic Riverway. Assuming the proposed crossing would be on NPS-owned property, congressional action would be required for a Namekagon River crossing. Appendix AE includes Enbridge’s North Country National Scenic Trail Coordination Plan.

1.4.1.4 Petroleum Pipeline Safety

The U.S. Department of Transportation (USDOT) regulates pipeline safety under 49 USC Chapter 601. The Pipeline and Hazardous Materials Safety Administration (PHMSA), housed within USDOT, is responsible for ensuring the safe and secure movement of hazardous materials (e.g., crude oil) to industry and consumers by all transportation modes, including by interstate pipeline. The regulations governing pipeline safety are included in 49 CFR Parts 190-199. The regulations at 49 CFR Part 195 (Transportation of Hazardous Liquids by Pipeline) include the design, construction, operation, and maintenance safety standards and reporting requirements for pipelines that transport hazardous liquids, including crude oil. The regulations at 49 CFR Part 196 include requirements for oil spill response plans to reduce the environmental impact of oil discharged from onshore oil pipelines.

For an interstate pipeline like Enbridge’s Line 5 pipeline, PHMSA has primary responsibility for pipeline safety regulations (PHMSA, 2014a). Operator compliance with state and federal pipeline safety regulations is monitored through PHMSA’s inspection and enforcement program (PHMSA, 2014b). The program consists of field inspections of operations, maintenance, and construction activities; programmatic inspections of operator procedures, processes, and records; and incident investigations and corrective actions (PHMSA, 2014b).

Enbridge’s proposed Line 5 pipeline relocation would need to comply with pertinent industry standards incorporated by reference in 49 CFR § 195.3, which have the full force of law (49 CFR § 195.3(a)). The industry standards are developed by the Pipeline Research Council International, Inc., American Petroleum Institute (API), ASME International, American Society for Nondestructive Testing, Manufacturers Standardization Society of the Valve and Fittings Industry, Inc., American Society for Testing and Materials, National Fire Protection Association, and NACE International. PHMSA continually reviews industry recommendations and adopts updated versions of industry-recommended standards.

Federal regulations require pipeline operators to submit emergency response plans that cover a geographic area along the pipeline "for which the operator must plan for the deployment of, and provide, spill response capabilities" (49 CFR § 194.5 "Response zone"). Federal regulations outline the requirements for these response plans, including the information that must be included (49 CFR § 194.107). Various other statutes and regulations, administered by several federal agencies, include additional requirements for emergency response planning. The federal government's National Response Team offers a mechanism for consolidating the multiple plans that facilities may have to prepare into a single integrated contingency plan (ICP). Section 6.3.2 describes Enbridge's emergency response plans.

1.4.1.5 Clean Water Act

The principal law governing pollution of the nation's surface waters is the Federal Water Pollution Control Act, or Clean Water Act (33 USC § 1251 et seq.). The Clean Water Act (CWA) establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands (CWA § 404; 33 USC § 1344). The USACE administers the Section 404 permitting program. Activities regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure developments (such as highways and airports), and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from regulation (e.g., certain farming and forestry activities).

Enbridge applied for a Section 404 permit from the USACE in February 2020. Appendix A includes maps of proposed waterway and wetland crossings. Appendix B includes a table of proposed waterway and wetland crossings. The USACE and DNR use a joint application process for projects involving impacts to waterways and wetlands, and coordinate impact assessments and project reviews (see Sections 1.4.3.9 and 1.4.3.10). The USACE published its Draft Section 404(b)(1) Guidelines Evaluation along with a Draft Environmental Assessment and Draft Public Interest Review (referred to as a Draft Combined Decision Document) in May 2024. The USACE held a public hearing to solicit comments on the Draft Combined Decision Document in early June 2024 and held a 45-day public comment period, which was extended by 30 days to August 4, 2024. DNR staff reviewed the Draft Combined Decision Document and public hearing testimony and considered them when developing this Final EIS.

In addition to Section 404, the CWA's National Pollution Discharge Elimination System (NPDES) permit program (33 USC § 1342) helps address water pollution by regulating point sources that discharge pollutants to waters of the United States. The NPDES storm water program regulates storm water discharges from certain construction and industrial activities. Permits include technology-based limits and water quality-based limits (if technology-based limits are not sufficient to provide protection of the receiving water). Under the CWA, EPA can delegate permitting, administrative, and enforcement aspects of the NPDES program to state, tribal, and territorial governments, while retaining oversight responsibilities. The DNR is the primary permitting authority of the NPDES program in Wisconsin, except for discharges to waters of the United States within "Indian Country," as defined under 18 USC § 1151. EPA retains permitting authority over these discharges (see Section 1.4.3.11). Work on Enbridge's existing Line 5 pipeline that would require more than 1 acre of land disturbing construction activities within the Bad River Reservation would require coverage under an NPDES construction site storm water permit issued by the EPA and subject to CWA Section 401 certification by the Bad River Band of Lake Superior Chippewa.

Section 311 of the CWA (33 USC § 1321) provides specific regulations for the discharge of oil or hazardous substances, because of the potentially catastrophic effects of such events on public health and welfare or the environment. Section 311 prohibits the discharge of oil or hazardous substances into Waters of the United States. It also requires higher standards of care in the management and movement of oil, including a requirement for spill prevention plans; it enables the government to recover the costs of cleaning up oil and hazardous substance discharges; and it provides for penalties for such discharges. In 1990, Congress enacted the Oil Pollution Act, which amended CWA § 311 and established a comprehensive system for the cleanup of oil spills, adding a mechanism to impose liability for such spills (33 USC Chapter 40).

1.4.1.6 Rivers & Harbors Act

The Rivers and Harbors Act prohibits the construction of any bridge, dam, dike, or causeway over or in navigable waters of the United States, including rivers, without Congressional approval (33 USC § 401 et seq.). The Act makes it illegal to excavate, fill, or alter the course, condition, or capacity of any port, harbor, channel, or other areas within the reach of the Act without a permit (33 USC § 403). The intent of the act is to protect navigation. The USACE regulates any work or structures in, over, or under navigable waters of the United States that is subject to the Rivers and Harbors Act. Although many activities covered by the Act are also regulated under the CWA, the Rivers and Harbors Act retains independent vitality.

Enbridge's proposed Line 5 pipeline relocation project would cross the White River, which is a navigable water of the United States. The USACE is evaluating portions of Enbridge's proposed pipeline replacement project to comply with the Rivers and Harbors Act. This evaluation includes compliance with other federal laws and executive orders. The USACE published its Draft Environmental Assessment along with a Draft Section 404(b)(1) Guidelines Evaluation and Draft Public Interest Review (referred to as a Draft Combined Decision Document) in May 2024. The USACE held a public hearing to solicit comments on the Draft Combined Decision Document in early June 2024 and held a 75-day public comment period. DNR staff reviewed the Draft Combined Decision Document and public hearing comments and considered them when developing this Final EIS.

1.4.1.7 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA), as amended (54 USC § 300101, et seq.), requires the lead federal agency with jurisdiction over a federal undertaking (i.e., a federally funded project or activity that requires a federal permit, license, or approval) to consider effects on historic properties before undertaking the project or activity (36 CFR Part 800). The intent of Section 106 is for federal agencies to consider the effects of a proposed undertaking on any historic properties situated within an area of potential effect (APE) and to consult with the Advisory Council on Historic Preservation (ACHP), State Historic Preservation Office (SHPO), federally recognized Native American tribes, and other interested parties regarding the proposed undertaking and its potential effects on historic properties. The USACE is the lead federal agency for permitting Enbridge's proposed Line 5 relocation project. Chapter 4 discusses cultural and historical resources in the three-county area of the proposed project and documents review and compliance with Section 106 and related state historic preservation laws.

1.4.1.8 Endangered Species Act

The Endangered Species Act (16 USC ch. 35) "establishes protections for fish, wildlife, and plants that are listed as threatened or endangered; provides for adding species to and removing them from the list of threatened and endangered species, and for preparing and implementing plans for their recovery; provides for interagency cooperation to avoid take of listed species and for issuing permits for otherwise prohibited activities; provides for cooperation with states, including authorization of financial assistance; and implements the provisions of the Convention on International Trade in Endangered Species of Wild Flora and Fauna." The Endangered Species Act prohibits the take (defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct") of endangered species, except as otherwise authorized by certain permits. The USFWS is responsible for ensuring compliance with the Endangered Species Act for terrestrial, freshwater, and catadromous species. Section 7 of the Endangered Species Act, as amended, states that each federal agency must ensure any project authorized, funded, or conducted by any federal agencies "… is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined…to be critical…" Enbridge has coordinated with the USFWS to identify federally endangered, threatened, and candidate species that may occur within its proposed pipeline relocation project area and determine any federal permitting needs.

1.4.1.9 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 USC §§ 703-712) implements four international conservation treaties that the United States entered into with Canada, Mexico, Japan, and Russia. The Migratory Bird Treaty Act prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the USFWS (16 USC § 703). Enbridge has asked the USFWS to provide planning recommendations under the Migratory Bird Treaty Act for its proposed pipeline relocation project.

1.4.1.10 Bald & Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 USC §§ 668-668d) prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald or golden eagles, including their parts, nests, or eggs. The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." (16 USC § 668c). Regulations define "disturb" to mean "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (50 CFR § 22.6 "Disturb"). In addition to immediate impacts, this definition also covers effects that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment (Department of Interior, 2007). Enbridge has asked the USFWS to provide planning recommendations under the Bald and Golden Eagle Protection Act for its proposed pipeline relocation project.

1.4.1.11 Coastal Zone Management Act

The Coastal Zone Management Act (16 USC § 1451 et seq.) defines coastal zones as coastal waters (including the lands therein and thereunder) and the adjacent shorelands, strongly influenced by each other and in proximity of the shorelines of the coastal states, including the Great Lakes states (16 USC § 1453(1)). Designated coastal zones include islands, transitional and intertidal areas, wetlands, salt marshes, and beaches. The Coastal Zone Management Act requires a Consistency Determination when federal agencies propose any activity inside or outside the coastal zone that would have a reasonably foreseeable effect on any coastal resources or uses within the coastal zone. The Wisconsin Coastal Management Program of the Wisconsin Department of Administration, through its federal consistency review authority, ensures compliance with the Coastal Zone Management Act. The review process relies on and seeks to improve existing state programs. Federal regulations (15 CFR Part 930) establish the basic policies and procedures for coastal states, federal agencies, and other affected parties pertaining to the federal consistency review process. The USACE requested a Consistency Determination from the Wisconsin Coastal Management Program for its permitting activities associated with the construction of Enbridge's proposed pipeline relocation. The Wisconsin Coastal Management Program solicited public comments in

May and June 2024. DNR staff reviewed the public comments and considered them when developing this Final EIS.

1.4.1.12 National Environmental Policy Act

The National Environmental Policy Act (NEPA) (42 USC 4321 et seq.) requires federal agencies to assess and consider the environmental and related social and economic effects of their proposed actions prior to making decisions. NEPA covers a broad range of actions including decisions on permit applications, federal land management actions, and construction of highways and other publicly owned facilities. The NEPA process requires agencies to consider reasonable alternatives and provide opportunities for public review and comment on its environmental evaluations. The Council on Environmental Quality (CEQ) oversees and guides NEPA implementation across the federal government. CEQ regulations (40 CFR Parts 1500-1508) provide direction to federal agencies to determine what actions are subject to NEPA's procedural requirements and the level of NEPA review where applicable.

An environmental review under NEPA can involve three different levels of analysis:

1. Categorical Exclusion – when the proposed federal action would normally not have a significant effect on the human environment (40 CFR § 1501.4).
2. Environmental Assessment – when a proposed federal agency action is not likely to have significant effects on the quality of the human environment or the significance of the effects is unknown (40 CFR § 1501.5).
3. Environmental Impact Statement (EIS) – when a proposed federal action is likely to have significant effects on the quality of the human environment. The regulatory requirements for an EIS are more detailed and rigorous than the requirements for an environmental assessment (40 CFR Part 1502).

The CEQ regulations also ensure that relevant environmental information is identified and considered early in the decision-making process, ensure environmental reviews are coordinated, consistent, predictable, and timely, and reduce unnecessary burdens and delays. Finally, the regulations promote concurrent environmental reviews to ensure timely and efficient decision making (40 CFR Part 1500).

NEPA applies to the USACE permitting decisions under the Clean Water Act and Rivers and Harbors Act (described in Sections 1.4.1.5 and 1.4.1.6, respectively). To comply with NEPA and related laws, the USACE prepared an environmental assessment of a range of alternatives and the direct, indirect, and cumulative effects of Enbridge's proposed action. The USACE published its Draft Environmental Assessment along with a Draft Section 404 Guidelines Evaluation and Draft Public Interest Review (together referred to as a Draft Combined Decision Document) in May 2024. The USACE held a public hearing to solicit comments on the Draft Combined Decision Document in early June 2024 and held a 75-day public comment period. DNR staff reviewed the Draft Combined Decision Document and public hearing comments and considered them when developing this Final EIS.

1.4.1.13 Workplace & Blasting Safety Standards

Wisconsin does not have a federally approved occupational safety and health program. Consequently, the federal Occupational Safety and Health Act (OSHA) regulates workplace health and safety for private entities. Workplaces and work activities associated with the construction and maintenance of Enbridge's proposed Line 5 relocation project would be subject to OSHA regulations.

OSHA sets and enforces standards for the use, storage, and transportation of explosives. Enbridge developed a general blasting plan (Appendix F) to comply with the OSHA standards (29 CFR § 1910.109; 29 CFR Part 1926 Subpart U), National Fire Prevention Association's NFPA 495 Explosive Materials Code, and applicable regulations enforced by the Wisconsin Department of Safety and Professional Services.

1.4.2 Tribal Nation Authorities & Policies

Eleven federally recognized Native American tribes have a presence in Wisconsin. Six Ojibwe tribes have reserved off-reservation treaty rights to hunt, fish, and gather in certain lands ceded to the United States, located approximately in the northern third of Wisconsin. Chapter 4 provides additional information regarding tribal sovereignty, Ceded Territory treaty rights, and the Bad River Band of Lake Superior Chippewa Indian's CWA authorities.

1.4.2.1 Treatment as a State

Several federal environmental laws authorize the EPA to treat eligible federally recognized Native American tribes in a manner similar to a state for implementing and managing certain environmental programs. Such "treatment as a state" is expressly provided for under the Clean Air Act (CAA), Clean Water Act (CWA), and Safe Drinking Water Act. The EPA has granted treatment as a state status under the CWA to the Bad River Band, Lac du Flambeau Band of Lake Superior Chippewa, and Sokaogon Chippewa Community (40 CFR § 130.16). The Bad River Band and Forest County Potawatomi Community have received EPA approval for treatment as a state under the Clean Air Act (42 USC § 7601(d)). Section 4.1.5 discusses Treatment as a State in more detail.

1.4.2.2 Bad River Band Water Quality Standards

EPA granted the Bad River Band treatment as a state when it approved the Band's application to administer a water quality standards program under CWA Section 303(c) and to issue water quality certifications under CWA § 401 in June 2009. EPA approved the Band's water quality standards in September 2011. The Bad River Band's water quality standards prescribe minimum water quality requirements for all surface waters located within the exterior boundaries of the Bad River Reservation to ensure compliance with Section 303(c) of the Clean Water Act. Additionally, the water quality standards are intended to protect public health and welfare, enhance the quality of water, and serve the purposes of the CWA. Discharges of sediment from construction, inadvertent releases from HDD operations, or petroleum from oil spills or leaks from the proposed project that reached surface waters within the exterior boundaries of the Reservation could be contrary to the Bad River Band's water quality standards.

1.4.2.3 Rights in Ceded Territories

Ojibwe tribes in Wisconsin have reserved the right to hunt, fish, and gather on certain lands ceded by various treaties. Subject to regulation, those usufructuary rights can be exercised on public lands within the Ceded Territories. Section 1.4.2 discusses the Ceded Territories and Native American usufructuary rights in more detail.

1.4.3 State of Wisconsin Authorities & Policies

In addition to the federal and tribal programs, permits, and approvals described in Sections 1.4.1 and 1.4.2, Enbridge's proposed pipeline relocation would require permits and approvals from several state agencies as provided in Table 1.4-1. Enbridge may not need all approvals identified in the table. Some approvals would only be required if the company pursued particular actions.

Table 1.4-1 Wisconsin state agency regulatory authorities.

Department of Natural Resources	
Waterway Permit Ch. 30, Wis. Stat. Structures and Deposits in Navigable Waters § 30.12, Wis. Stat. Bridges and Culverts § 30.123, Wis. Stat. Removal of Material from Bed of Navigable Waters § 30.20, Wis. Stat. Operation of Motor Vehicles in Navigable Waters § 30.29, Wis. Stat.	Enbridge has requested permits for placement of temporary structures on the bed (in the form of dam and pump or flow bypass systems), placement of temporary bridges, dredging, and driving on the bed of navigable waters.
Wetland Permit § 281.36, Wis. Stat.	Enbridge has requested wetland permits for placement of temporary matting in wetlands, excavation and backfilling of trenches and bore pits in wetlands, placement of permanent fill in wetlands, and forested wetland conversion.
Water Quality Certification Chapters NR 103 and NR 299, Wis. Adm. Code	Enbridge will request state water quality certification pursuant to CWA Section 401 for activities to be authorized under the federal CWA Section 404 permit.
Storm Water Permit Chapter 283, Wis. Stat. Chapters NR 151 and NR 216, Wis. Adm. Code	Enbridge has requested storm water permit coverage to discharge construction storm water.
Hydrostatic Test Water Appropriation/Discharge Permit Chapter 283, Wis. Stat.	Enbridge is seeking authorization to discharge hydrostatic test waters under the Wisconsin Pollutant Discharge Elimination System permit program.
High Capacity Well Approval § NR 812.09 (4)(a) & (b), Wis. Adm. Code.	Enbridge may apply for a high capacity well permit if dewatering more than 100,000 gallons per day of groundwater.
Incidental Take Permit § 29.604(6), Wis. Stat.	Enbridge may request an incidental take permit if impacts to state listed endangered or threatened species are anticipated.
Burning Permit § 26.12, Wis. Stat. §§ NR 30.03 and NR 30.04, Wis. Adm. Code	Enbridge may need to obtain permits to allow burning of slash during pipeline construction or ROW maintenance.
Particulate Matter Emissions Standards § NR 415.04, Wis. Adm. Code	Particulate matter emissions arising from fugitive dust associated with construction would require measures to prevent fugitive dust from becoming airborne.
Hazardous Air Pollutants Standards Chapter. NR 445, Wis. Adm. Code	Hazardous air pollutant emissions from valves, pumps, and connectors are subject to state air quality standards.

Public Service Commission of Wisconsin (PSC)	
Public Interest Determination Chapter 32, Wis. Stat.	Enbridge initially applied for a Public Interest Determination for authority to acquire property by condemnation. Currently, Enbridge has come to agreement with landowners for land rights needed for the proposed relocation of Line 5 and has now withdrawn its application to the PSC.
Department of Safety and Professional Services (DSPS)	
Blasting Regulations Chapter SPS 307 and § SPS 305.20, Wis. Adm. Code	Enbridge's blasting contractors would need to be licensed, develop site-specific blasting plans, and adhere to landowner notification requirements.
Department of Transportation (DOT)	
Road Crossing Permits § 86.07(2), Wis. Stat.	Enbridge has applied for applicable permits for road crossings

1.4.3.1 Public Trust Doctrine

The Public Trust Doctrine (Wisconsin Constitution Article IX, Section 1; adopted from the Northwest Ordinance in 1848) protects the people's right to access and enjoy the inherent values of Wisconsin's navigable waters. The navigable lakes and rivers of Wisconsin are held in trust for the public. The State of Wisconsin as trustee has an affirmative duty to protect and promote the public interest in navigable waters. These rights include:

- Transportation and navigation on waterways;
- Fish and wildlife;
- Water quality and aquatic habitat;
- Recreational activities, including boating, fishing, hunting, and swimming in waterways; and
- Natural scenic beauty.

1.4.3.2 Eminent Domain

The Wisconsin Constitution, Article I, section 13 establishes eminent domain authority, which is the power to take private property for a public purpose with payment of just compensation. The Eminent Domain statute, § 32.02, Wis. Stat., vests several public and private entities with eminent domain power. Condemnation is the legal process by which the acquiring authority exercises its eminent domain power. On August 7, 2020, Enbridge withdrew its application to the Public Service Commission of Wisconsin (PSC) requesting a public interest determination under § 32.02 (13), Wis. Stat.

1.4.3.3 Criminal Trespass to an Energy Provider Property

Under § 943.143, Wis. Stat., as amended by 2019 Wisconsin Act 33, it is a Class H felony for a person to intentionally enter energy provider property if the person does not have lawful authority and consent of the energy provider. Energy provider property includes oil, petroleum or refined petroleum product distribution systems owned, leased, or operated by an energy provider. Criminal penalties for violation of the statute could be up to 6 years in prison and a fine of up to $10,000. Enforcement of trespass violations is at the discretion of the county district attorney. The Great Lakes Indian Fish & Wildlife Commission

(GLIFWC) completed an analysis of potential impacts to tribal access to lands in Iron County (Appendix AC). The GLIFWC concluded that because of the proposed route, tribal access to Iron County Forest for the purpose of exercising treaty protected harvest would be eliminated in some areas and reduced in others. In the company's comments on the Draft EIS, Enbridge (2022a) indicated, "Enbridge will not impede the lawful exercising of the right to hunt, fish, or gather on property open to the public. In areas where the rerouted Line 5 crosses public land, members of the Signatory Tribes and public can lawfully hunt, fish or gather; however, to ensure public safety, access to the right-of-way will be temporarily restricted during active pipeline construction or maintenance activity. During active construction or maintenance activity, Enbridge will make its best efforts to accommodate requests for access to the ROW for all such lawful activity, and will identify a point of contact to coordinate access locations and timing to ensure public safety."

1.4.3.4 Wisconsin Environmental Policy Act

The Wisconsin Environmental Policy Act (WEPA) requires all state agencies to analyze, consider, and disclose the anticipated environmental impacts of certain proposed actions, along with reasonable alternatives to those actions including a "no action" alternative. This requirement does not apply to local governments or private entities.

Different state agencies have different procedures for complying with WEPA. The DNR's procedures are established in Chapter NR 150, Wis. Adm. Code. In most cases, WEPA compliance is achieved through the DNR's programmatic procedures for those regulatory and resource management actions listed under § NR 150.20(2)(a), Wis. Adm. Code. These actions are classified as "integrated analysis actions," and typically do not require an environmental impact statement (EIS).

Some DNR actions, like the permitting of metallic mines and the licensing of certain new hazardous waste facilities, will automatically require the preparation of an EIS, following the procedures set forth in § NR 150.30, Wis. Adm. Code. The purpose of an EIS is to inform decision-makers and the public about the anticipated environmental and socioeconomic effects of a proposed action or project and alternatives to the proposal. The DNR could also determine that an EIS is required for a proposed project involving one or more DNR actions, as described in § NR 150.20(4)(b), Wis. Adm. Code. In September 2020, the DNR notified Enbridge that an EIS would be prepared for Enbridge's proposed Line 5 pipeline relocation before any decisions on DNR permits would be made.

1.4.3.5 State Energy Policy

The legislature has outlined a state energy policy in s. 1.12, Wis. Stat., that requires state agencies to "investigate and consider the maximum conservation of energy resources as an important factor when making any major decision that would significantly affect energy usage." The policy establishes goals for state agencies and local governments that include reducing energy consumption with respect to economic activity in the state, relying on renewable energy sources in the state to the extent it is cost-effective and technically feasible, and increasing forested areas in the state. The policy prioritizes energy conservation and efficiency and noncombustible renewable energy resources over other energy options, to the extent they are cost-effective and technically feasible. In designing new and replacement energy projects, a state agency must rely to the greatest extent feasible on energy efficiency improvements and renewable energy resources, if they are cost-effective, technically feasible, and do not have unacceptable environmental impacts.

In August 2019, Executive Order #38 directed the Office of Sustainability and Clean Energy (OSCE) to create a comprehensive Clean Energy Plan. Recognizing the existing conditions in Wisconsin and the role the state plays in both regional and national greenhouse gas (GHG) emissions reductions initiatives, the plan seeks to achieve the following objectives:

- Put Wisconsin on a path for all electricity consumed within the state to be 100 percent carbon-free by 2050.

- Ensure that the State of Wisconsin is fulfilling the carbon reduction goals of the Paris Agreement.

- Reduce the disproportionate impacts of energy generation and use on low-income communities and communities of color.

- Maximize the creation of, and equitable opportunities for, clean energy jobs, economic development and stimulus, and retention of energy investment dollars in Wisconsin.

- Improve reliability and affordability of the energy system.

- Strengthen the clean energy workforce through training and education while retraining workers affected by the transition from fossil fuel to clean energy sources.

- Protect human and environmental health by reducing ecosystem pollution from fossil fuels.

The strategies included in the Clean Energy Plan provide a roadmap to accomplish Wisconsin's objective of achieving a carbon-neutral power sector and reducing a range of other energy-related emissions. The plan is also designed to provide environmental justice organizations, nongovernmental organizations, advocacy groups, policymakers, utilities, businesses, tribal governments, state governments, local governments, educators, and residents an actionable plan to transition Wisconsin to a robust and affordable clean energy economy. An assessment of the consistency of Enbridge's proposed Line 5 pipeline relocation with the Clean Energy Plan is included in Section 5.16.3.

1.4.3.6 Public Service Commission

The Public Service Commission (PSC) of Wisconsin regulates more than 1,100 public utilities, including those that are municipally owned. Types of utilities regulated include electric, natural gas, water, and certain aspects of local telephone service, but not liquified petroleum gas or fuel oil. Most of utilities must obtain PSC approval before:

- Setting new rates
- Issuing stocks or bonds
- Undertaking major construction projects such as power plants, water wells, and transmission lines

The PSC works to ensure that, in the absence of competition, adequate and reasonably priced service is provided to utility customers. PSC approval is required before utilities can change rates or build large power plant and major transmission lines. The PSC has specific rules it must follow prior to making decisions on Commission Actions.

The PSC is responsible for siting of most pipelines within Wisconsin but does not have siting authority for liquid petroleum pipelines. The PSC does administer safety regulations (Chapter PSC 135, Wis. Adm. Code) for the construction, installation, operation, and maintenance of gas transmission, distribution, and utilization equipment and facilities.

In addition, if requested by Enbridge, the PSC has the authority to determine that the acquisition of permanent easements and additional temporary workspace for the proposed Project is in the public interest pursuant to § 32.02 (13), Wis. Stat. Enbridge's proposed route as well as the route alternatives cross federally owned lands. If the USACE and the U.S. Fish and Wildlife Service (USFWS) approve a ROW location within federally owned property that is different from the location approved by the PSC, then the location of the federal easement approved by the federal agencies selected for final construction.

1.4.3.7 Wisconsin DNR

As indicated in Table 1.4-1, the Wisconsin DNR is responsible for implementing various conservation and environmental laws.

1.4.3.8 Water Quality Standards

The CWA requires each state to establish water quality standards for all bodies of water in the state. Wisconsin's surface water quality standards (Chapters NR 102 and NR 104, Wis. Adm. Code, promulgated for "waters of the state" pursuant to § 281.15, Wis. Stat.) consist of the designated beneficial use or uses of a waterbody (recreation, water supply, industrial, or other), plus a numerical or narrative statement identifying maximum concentrations of various pollutants that would not interfere with the designated use(s). These standards serve as the backup to federally set technology-based requirements by indicating where additional pollutant controls are needed to achieve the overall goals of the CWA. Wetland water quality standards (ch. NR 103, Wis. Adm. Code) establish functional values and uses of wetlands to be protected and criteria to assure the maintenance or enhancement of these values. When issuing waterway and wetland permits, and when providing CWA Section 401 certifications, the DNR is required to ensure that state water quality standards will be met.

1.4.3.9 Waterway Permits

Chapter 30, Wis. Stat., provides for state oversight of navigable waters, harbors, and navigation. Under this chapter, the DNR regulates activities that could impact navigable waters including work below the ordinary high-water mark or waterway crossing. In addition, the DNR has authority under chapter 30, Wis. Stat., to abate infringements to the public interest in navigable waters. Placement of structures, dredging, and similar activities in or adjacent to navigable waters often require permits from the DNR. Chapter 300, Wis. Adm. Code, provides the rules for administration of such waterway permits. Various chapters of administrative rules (chs. NR 320-353, Wis. Adm. Code) provide specific rules for regulated activities.

Wisconsin implements a three-tier system of permitting based on the projected level of environmental impact, which includes exemptions (§ NR 300.04, Wis. Adm. Code), general permits (§ NR 300.06, Wis. Adm. Code), and individual permits (§ NR 300.07, Wis. Adm. Code). For activities where no exemption or general permit is available, a more detailed Individual Permit application is required. DNR assesses local fishery, wildlife, aquatic habitat, water quality data, public recreational use, natural scenic beauty, and navigation patterns of regulated sites.

Individual permits require a 30-day comment period of which the public is notified by a website and newspaper notice and mailings to interested parties. During the comment period, an informational hearing could be requested. DNR staff conduct the informational hearings to gather observations and facts from others to consider in addition to the agency's own data and applicant submittals when making permit decisions.

A permit is granted for projects when the DNR concludes from this process that the project (individually and considered cumulatively with other projects) will not be detrimental to the public interest, including fish and wildlife, aquatic habitat, public recreation, water quality, navigation, and scenic natural beauty. DNR staff routinely advise applicants on project modifications to reduce impacts and meet standards.

Enbridge's proposed Line 5 relocation project would cross numerous waterbodies and would require construction activities below the ordinary high-water mark. The company has applied for waterway permits for several of its proposed activities (Table 1.4-1). Enbridge also applied for CWA Section 404 (Section 1.4.1.5) and Rivers and Harbors Act (Section 1.4.1.6) permits from the USACE in February 2020. Appendix A includes maps of proposed waterway and wetland crossings. Appendix B includes a table of proposed waterway and wetland crossings. Although the federal waterway permitting process is a separate process involving the USACE, the USACE and DNR use a joint application process for projects involving impacts to waterways and coordinate impact assessment and project review. A public hearing on the waterway permit applications was held in conjunction with the scoping hearing for this EIS. The DNR cannot make waterway permit decisions until a Final EIS has been published and a determination of WEPA compliance has been made.

1.4.3.10 Wetland Permits

All wetlands in Wisconsin are protected by state statute and projects proposing discharges of dredged or fill material to wetlands are regulated by the DNR. Landowners and developers are required to avoid wetlands with their projects whenever practicable. For projects that cannot avoid wetlands and involve the placement of dredged or fill material in wetlands, an individual or general permit is required unless a permit exemption applies. Chapter 300, Wis. Adm. Code, includes the rules for administration of wetland permits. The following activities would require a DNR wetland permit:

- Filling - Placing dredged or fill materials into a wetland (e.g., soil, concrete, gravel, etc.).
- Excavating - Removing material from a wetland if backfilling is also involved.
- Grading - Conducting earthwork to change the grade or contours of the land.
- Mechanized land clearing - Clearing shrubs or trees from wetlands by bulldozing or grubbing and removing the root structures.
- Other activities affecting wetlands resulting in temporary impacts, such as installation of utility infrastructure, use of timber mats, sheds, soil, or spoil piles in a wetland.

Projects that do not meet the eligibility standards for an exemption (§ NR 300.05, Wis. Adm. Code) or general permit (§ NR 300.06, Wis. Adm. Code), require an individual permit (§ NR 300.07, Wis. Adm. Code). Individual permits require a pre-application meeting with the DNR, a practicable alternatives analysis, and wetland compensatory mitigation. Individual permits require a 30-day public comment period during which the public is notified by the DNR website and a newspaper notice. During the comment period, an informational hearing could be requested. A permit is granted for projects when the DNR concludes that the proposed project is the least environmentally practicable alternative, and that the project will not result in significant adverse impacts to wetland functional values and water quality, or in other significant adverse environmental consequences. DNR staff routinely advise applicants on project modifications to reduce impacts and meet standards. The standards for permitting decisions are listed in Section 5.8.1

Enbridge's proposed Line 5 relocation project would impact numerous wetlands. The company has applied for wetland permits for several of its proposed activities (Table 1.4-1) Appendix A includes maps of proposed wetland crossings. Appendix B includes a table of proposed wetland crossings. Enbridge also applied for a CWA Section 404 permit from the USACE in February 2020 (Section 1.4.1.5). Although the federal wetland permitting process is a separate process involving the USACE, the USACE and DNR use a joint application process for projects involving impacts to wetlands and coordinate impact assessment and project review. A public hearing on the wetland permit applications was held in July 2020 in conjunction with the scoping hearing for this EIS. The DNR cannot make wetland permit decisions until a Final EIS has been published and a determination of WEPA compliance has been made.

Wetland compensatory mitigation is required for all individual permits, with limited exception. Purchase of credits from a wetland mitigation bank, from the DNR mitigation in-lieu fee program, or completing a mitigation project (permittee-responsible mitigation) are options for meeting the permit requirement.

1.4.3.11 Storm Water Permits

The DNR implements the federal NPDES program in Wisconsin, except where EPA maintains primary NPDES permitting authority (Section 1.4.1.5). Landowners or operators of projects that cause more than 1 acre of land disturbance due to construction activities are required to obtain coverage under a Wisconsin Pollution Discharge Elimination System (WPDES) permit. Wisconsin has developed a General Permit for the discharge of Storm Water Associated with Land Disturbing Construction Activity (Permit No. WI-S067831-6; Construction Site General Permit). Under this permit, landowners are required to install and maintain practices to help decrease the amount of sediment from construction projects that pollutes Wisconsin's waterways. Permit requirements, including application materials, are outlined in Subchapter III of Chapter NR 216, Wis. Adm. Code. It is important to note that the permit does allow some discharge of pollutants associated with land disturbing construction activity, but the conditions of the permit are intended to limit discharges of pollutants during typical runoff events expected to occur during construction to avoid causing a violation of water quality standards.

Enbridge submitted a notice of intent to discharge storm water associated with land disturbing construction activity, which is an application to be covered under the Construction Site General Permit, on September 9, 2020. Site-specific erosion control plans and maps submitted by Enbridge are included in Appendix E. The DNR cannot make storm water permit decisions until a Final EIS has been published and a determination of WEPA compliance has been made. On September 23, 2020, the DNR notified Enbridge that permit coverage would not be conveyed within 14 working days to allow for the EIS process to be completed, but review of the submitted materials would occur while the EIS was in progress.

To qualify for coverage under the Construction Site General Permit, an applicant must provide documentation, including a written erosion control plan and erosion control maps, to demonstrate how they intend to meet the performance standards in § NR 151.11, Wis. Adm. Code. DNR staff review the plan and could request additional information or suggest potential modifications to the plan to improve the likelihood that performance standards will be met during construction. Once an applicant demonstrates that they have a plan that is likely to meet the performance standards, the DNR conveys coverage under the Construction Site General Permit. Permit conditions and § NR 216.46, Wis. Adm. Code, require that the permittee implement the erosion control plan and maintain the erosion and sediment control practices installed on the site. Maintenance includes repair or replacement of erosion and sediment control practices. Permit conditions and § NR 216.48, Wis. Adm. Code, require that the permittee inspect the implemented erosion and sediment control practices weekly and within 24 hours after a precipitation event of 0.5 inches or greater. The permit requires repair or replacement of erosion and sediment control practices within 24 hours of identifying the need for repair or replacement.

If there is a change in design, construction, operation, or maintenance at the construction site that has the reasonable potential for the discharge of pollutants and which has not otherwise been addressed in the erosion control or storm water management plans, or if the actions required by the plan fail to reduce the impacts of pollutants carried by storm water runoff, then the permittee is required to amend the plans and notify the DNR five working days prior to implementing the changes. The need for an amendment could be identified by either the permittee or the DNR.

In addition to the Construction Site General Permit, Wisconsin has also developed a General Permit for the Operation and Maintenance of Industrial Potable and Non-potable Water Systems and/or Hydrostatic Testing of Petroleum Systems (Permit No. WI-A0057681-05-0). Enbridge would need coverage under this permit to discharge water used for hydrostatic testing of the installed pipeline.

1.4.3.12 Technical Standards

To aid permittees in implementing the performance standards in § NR151.11, Wis. Adm. Code, the DNR has developed Technical Standards for erosion and sediment control practices through a collaborative process specified in § NR 151.31, Wis. Adm. Code. These Technical Standards are focused on storm water discharges and are not intended to provide comprehensive design guidance for all engineering and environmental considerations related to implementing the practices described.

In October 2022, the DNR disseminated Technical Standard 1072, Horizontal Directional Drilling. This Technical Standard identifies practices to protect water quality by reducing sediment discharge from work areas, reducing potential for runoff to carry construction materials into waters of the state, and clarifying expectations for spill prevention and response procedures that are relevant to HDD construction methods. This includes practices to reduce the risk of runoff carrying drilling fluid from an inadvertent release (IR), also known as a frac-out or inadvertent release, to water resources through prevention and response planning. Enbridge has committed to implementing this DNR Technical Standard in its permit applications.

1.4.3.13 Trench Dewatering & High Capacity Well Permits

During excavation, workers could encounter high groundwater or storm water could accumulate in the trenches. Dewatering systems would be placed in the trenches or surrounding low areas to pump and convey the water away from the construction site so construction can continue. Dewatering wells may be placed in the ground prior to excavation to lower the groundwater table to an appropriate level. The Construction Site General Permit and wastewater Pit Trench Dewatering Operations General Permit cover trench dewatering activities from construction sites. Additionally, dewatering well systems and dewatering operations with a combined pumping capacity of 70 gpm (100,000 gallons per day) or more require a high capacity well approval. Enbridge may need to apply for a temporary high capacity well permit in areas where dewatering becomes necessary (§ NR 812.09 (4), Wis. Adm. Code).

1.4.3.14 Incidental Take Permits

Wisconsin's Endangered Species Law (§ 29.604, Wis. Stat.) protects wild plants and animals on the Wisconsin endangered and threatened species lists. It is illegal to take, transport, possess, process, or sell any endangered or threatened wild animal on public or private property. It is also illegal to remove, transport, or carry away an endangered or threatened wild plant from the place where it is growing; or cut, root up, sever, injure, or destroy an endangered or threatened wild plant on public property except for the following activities: 1) forestry practices, 2) agricultural practices, 3) construction, operation, or maintenance of a utility facility, or 4) as part of bulk sampling activities associated with mining. The DNR can allow incidental take of endangered or threatened species under certain circumstances through an Incidental Take Permit (§ 29.604(6), Wis. Stat.). The DNR considers the need for an Incidental Take Permit as part of waterway, wetland, and storm water permitting reviews.

1.4.3.15 Burning Permits

The DNR requires burning permits in forest fire protection areas (§ 26.12, Wis. Stat.; §§ NR30.03 and NR 30.04, Wis. Adm. Code) to conduct legal and responsible burning in the outdoors. These permits include daily burning restrictions and fire safety recommendations. Special permits could be issued for burning outside the restricted burn times, for land clearing, and for piles or prescribed burns exceeding the maximum size limit. Maximum pile sizes and acreages are limited by geographic area and indicated within the daily burning restrictions. Enbridge may need to obtain permits to burn slash generated during pipeline construction or while conducting ROW maintenance.

1.4.3.16 Stepped Enforcement

By policy, the DNR employs a stepped enforcement process to address violations of environmental laws. When violations occur, the stepped enforcement process considers the degree and sequence of enforcement actions necessary to achieve compliance with state laws, regulations, and permits. This means evaluating the severity of the compliance issue(s) along with available department resources to address the compliance issue(s). Enforcement actions generally begin with the lowest form of enforcement and could be incrementally elevated to the highest level of enforcement, resulting in litigation in the courts. Figure 1.4-1 shows the "enforcement steps" that could be taken. The level at which an enforcement action begins is case-specific and based on the severity of the noncompliance issue(s). The DNR responses could escalate with continued noncompliance, allocating additional department resources for documented harm to human health or the environment, chronic noncompliance, or uncooperativeness.

Prosecution/Citation
Referral to DOJ/DA/EPA
Admin./Consent Order
Enforcement Conference
Notice of Violation
Request for Secondary Enforcement
Notice of Noncompliance
Initial Response/Compliance Assistance

Figure 1.4-1 Levels of enforcement action in the DNR's stepped enforcement approach.

The stepped enforcement process does not require all enforcement actions to follow these steps in sequence or that once a facility is at a current "step," actions can only move up. It is possible that a permittee/licensee with an active secondary enforcement case could have unrelated violations, which could result in primary enforcement actions. Conversely, in more severe or repeated cases of violations, enforcement could start with issuing a Notice of Violation. There could even be extreme instances where enforcement is expedited by referring a case immediately to the Wisconsin Department of Justice. In certain instances, enforcement action could result in the DNR considering permit modification, revocation and reissuance, or termination.

In some instances, the cause for noncompliance could have been addressed without DNR intervention (e.g., permittee/licensee identifies and self-corrects non-complainant activity). Self-correction by the permittee/licensee could influence the type of enforcement action taken by the DNR to return the permittee/licensee to compliance. The DNR must, however, still document that a violation occurred, including potentially notifying the permittee, acknowledging the noncompliance as a violation as it could affect future enforcement actions.

The DNR would employ the stepped enforcement process for Enbridge's proposed Line 5 relocation project to assess the particular circumstances and determine the appropriate response if violations of permit conditions were to arise or if inadvertent releases, spills, or pipeline leaks resulted in environmental contamination.

1.4.3.17 Scientific Integrity

The DNR's Scientific Integrity Handbook establishes the agency's principles of scientific integrity, outlines a general policy on the integrity of scientific and scholarly activities, and provides guidelines regarding responsibilities related to carrying out such activities. The handbook applies to all DNR employees when they engage in, supervise, manage, or influence scientific and scholarly activities; communicate information about department scientific and scholarly activities; and use scientific and scholarly information in making agency policy, management, or regulatory decisions. DNR staff followed the scientific integrity guidelines when preparing this EIS to ensure the quality, rigor, and objectivity of the information included and to engender public trust. DNR staff undertook honest investigation, open discussion, refined understanding, and maintained a firm commitment to evidence, while shielding the DNR's work from inappropriate personal biases, outside influences, and conflicts of interest.

1.4.3.18 Wisconsin Department of Safety & Professional Services

The Department of Safety and Professional Services (DSPS) is responsible for ensuring the safe and competent practice of licensed professionals in Wisconsin. The DSPS has adopted rules for the safe use of explosive materials and blasting (SPS 307, Wis. Adm. Code). Specifically, § SPS 307.44(1), Wis. Adm. Code, requires blasting to be conducted "so as to prevent injury and unreasonable annoyance to persons and damage to public or private property outside the controlled blasting site area." All blasting operations must be conducted under the direction and constant supervision of a licensed blaster (§ SPS 305.20, Wis. Adm. Code). To comply with these regulations, Enbridge's blasting contractors would need to be licensed, develop site-specific blasting plans for each proposed blasting location, and adhere to landowner notification requirements. Enbridge's general blasting plan for the proposed Line 5 relocation project (Appendix F) outlines the measures to be employed to comply with federal and state regulations regarding the use, storage, and transportation of explosives.

1.4.3.19 Wisconsin Department of Transportation

The Wisconsin Department of Transportation (DOT) is responsible for the development and operation of a safe and efficient transportation system for the people of Wisconsin, including the state trunk highway system. DOT regulates vehicles and activities that take place within highway ROWs. Enbridge would plan to use existing public and private roads to access the proposed construction workspace to the extent possible to limit environmental impacts of the proposed Line 5 relocation. Road-use permits may be required during construction, including for the transport of oversize or overweight vehicles or loads (Chapters Trans 254 and Trans 255, Wis. Adm. Code). Enbridge has acquired road crossing permits required for state road crossings under § 86.07(2), Wis. Stat. (Appendix M).

1.4.4 Local Government Authorities & Policies

Table 2.1-1 in Chapter 2 provides the township, range, and section locations intersected by Enbridge's proposed Line 5 pipeline relocation. Enbridge's proposed relocation route would cross two counties and eight local jurisdictions:

- Ashland County
  - Town of Ashland
  - Town of Gingles
  - Town of Marengo
  - Town of Morse
  - Town of White River
- Iron County
  - Town of Anderson
  - Town of Gurney
  - Town of Saxon

Additionally, some minor project activities would occur in Bayfield and Douglas counties. Activities in Bayfield County would be limited to mainline block valves, which are further discussed in Section 2.1.4.2 Construction activities in Douglas County would include only a project staging area. Table 3.4-1 lists additional communities located along Enbridge's route alternatives.

These local governments do not have pipeline permitting authority and are not regulators for Enbridge's proposed pipeline relocation project. Section 5.16.3 discusses resolutions passed by local governmental bodies related to the proposed pipeline relocation.

1.4.4.1 Local Permits

Some Wisconsin counties have ordinances that regulate storm water runoff from construction sites, but neither Ashland nor Iron counties have such ordinances. As a result, neither county would require regulatory oversight of Enbridge's proposed construction.

Certain local ordinances create road-use permits intended to protect local governments from incurring costs to repair damages to roads that could occur. Enbridge proposes using existing public and private roads to access the proposed construction workspace to the extent possible to limit environmental impacts. Local road-use permits could be required on an as-needed basis during construction. Enbridge has acquired local road crossing permits required for the proposed project. Appendix M includes the road-use agreements that Enbridge has entered into with local governments.

DNR burning permits (Section 1.4.3.15) do not apply within incorporated cities and villages. These municipalities often can and do create their own burning permit requirements. In addition, some townships could choose to be much more restrictive than state law and may not allow burning at any time. Local burning permits may be required on an as-needed basis during Enbridge's proposed construction and during ROW maintenance.

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2 PROJECT DESCRIPTION

This chapter describes Enbridge's proposed relocation route, construction right-of-way (ROW) requirements, off-ROW requirements, pipe design and installation procedures, and construction phasing and sequencing. The relocated pipeline would cross 186 waterbodies. This chapter describes the waterway crossing methods Enbridge proposes to employ. This chapter also describes construction practices that may be required as permit conditions where appropriate or implemented as best management practices to reduce impacts to wetlands and waterbodies, manage storm water and control erosion, prevent construction-related spills, address invasive species and fugitive dust concerns, and guide site restoration and revegetation. Chapter 6 includes additional information on pipeline operation and maintenance procedures, including Enbridge's Integrity Management Plan, inspection and monitoring program, and ongoing ROW maintenance activities.

2.1 Proposed Relocation Route

As outlined in Section 1.1, Enbridge's proposed Line 5 relocation would reroute an existing 20-mile section of Line 5 around the Bad River Reservation through approximately 41 miles of new pipeline located entirely outside the Bad River Reservation. The relocated pipeline would be located within Ashland, Bayfield, Douglas, and Iron counties. Project activities in Bayfield County would be limited to mainline block valves, which are further discussed in Section 2.1.4.2 Construction activities in Douglas County would include only a project staging area. Construction activities in Ashland and Iron counties would include installation of 41 miles of new pipeline and the construction of new mainline block valves. Figure 1.1-2 depicts Enbridge's proposed relocation route and Table 2.1-1 lists the townships, ranges, and sections intersected by the proposed route. Maps of the proposed route are included in Figure 2.1-7.

Table 2.1-1 Townships, ranges, and sections crossed by Enbridge's proposed Line 5 pipeline relocation.

Township	Range	Sections
T45N	R1W	5, 6, 8, 18
T45N	R2W	1, 2, 13, 14, 22, 23, 27, 28, 29, 30, 31, 32, 33
T45N	R3W	6, 7, 8, 9, 14, 15, 16, 22, 23, 24, 25, 36
T45N	R4W	1, 2
T46N	R1W	3, 4, 10, 15, 16, 17, 20, 21, 22, 27, 28, 29, 32, 33
T46N	R4W	5, 6, 7, 8, 17, 18, 20, 27, 28, 29, 34, 35
T47N	R1W	33, 34, 35
T47N	R4W	3, 8, 17, 20, 29, 32
T47N	R5W	8, 10
T48N	R4W	34

2.1.1 Detailed Route Description

As shown in Figure 1.1-2, Enbridge's proposed Line 5 relocation route begins approximately 4.5 miles west of the western boundary of the Bad River Reservation and ends approximately 3.3 miles east of the eastern border of the Reservation. The proposed route starts at the existing Line 5 near the intersection of State Highway 112 and Summit Road in Ashland County. The route proceeds south for approximately 4.0 miles parallel to an overhead electrical transmission line east of State Highway 112 crossing Bear Trap

Creek (Figure 2.1-1) and then the White River (Figure 2.1-2). The proposed White River crossing is located east of the intersection of State Highways 112 and 118. South of the White River, the proposed route shifts west and again south to cross Rock Creek. South of Rock Creek the route shifts west then turns southeast until it reaches Schwiesow Road south of Deer Creek. From there the proposed route resumes a southerly path. South of the White River, the route continues south for another approximately four miles until it turns southeast between Wiberg Road and State Highway 112.

Angling to the east/southeast, the proposed route continues for approximately 13.3 miles. Within that 13.3 miles the proposed route crosses the Marengo River near Marengo River Road (Figure 2.1-3), the Brunsweiler River near the intersection of County Highway C and Van de Bruggen Road, Trout Brook near the intersection of North York Road and Highway 13 (Figure 2.1-4), Billy Creek east of the intersection of Poppe Road and Levelius Road, and Silver Creek near the intersection of County Road C and Ryefield Road.

Approximately 0.25 mile north of the intersection of State Highway 13 and State Highway 169 the proposed route turns east. After crossing State Highway 13 the route crosses the Bad River approximately 0.2 miles east of Highway 13 (Figure 2.1-5). The proposed route is located between the southern boundary of Copper Falls State Park and the town of Mellen. Approximately 0.8 miles east of Highway 169 the proposed route then turns northeast for approximately 11 miles. It crosses Camp Four Creek approximately 0.8 miles southwest of the Ashland/Iron County line and crosses Feldcher Creek just east of the Ashland/Iron County line and south of Casey Sag Road, Tyler Forks River approximately 1.0 mile southwest of Vogues Road, and the Potato River just south of the intersection of North Curry Road and Curry Road (Figure 2.1-6). North of the Potato River, the proposed route turns north and crosses U.S. Highway 2 east of the intersection of Highway 2 and Le Duc Road and rejoins the existing Line 5 approximately 0.3 miles east of Le Duc Road northeast of Cedar.

Appendix A includes detailed maps of Enbridge’s proposed relocation route and Appendix B includes a table of proposed waterway and wetland crossings. Figure 2.1-7 depicts the proposed route and the locations of proposed waterway and wetland crossings. Appendix M includes Enbridge’s road-crossing permits and agreements.

Figure 2.1-1 Bear Trap Creek near Enbridge's proposed Line 5 crossing.
Photo: Lucas Mulhall, DNR

Figure 2.1-2 White River upstream of Enbridge's proposed Line 5 crossing.
Photo: Luke Schletzbaum, DNR

Figure 2.1-3 Marengo River at Marengo River Road near Enbridge's proposed Line 5 crossing.
Photo: Dreux J. Watermolen, DNR

Figure 2.1-4 Trout Brook at Highway 13 near Enbridge's proposed Line 5 crossing.
Photo: Dreux J. Watermolen, DNR

Figure 2.1-5 Bad River at Highway 13 near Enbridge's proposed Line 5 crossing.
Photo: Dreux J. Watermolen, DNR

Figure 2.1-6 Sloping Hillside along Potato River near Enbridge's proposed Line 5 crossing.
Photo: Dreux J. Watermolen, DNR

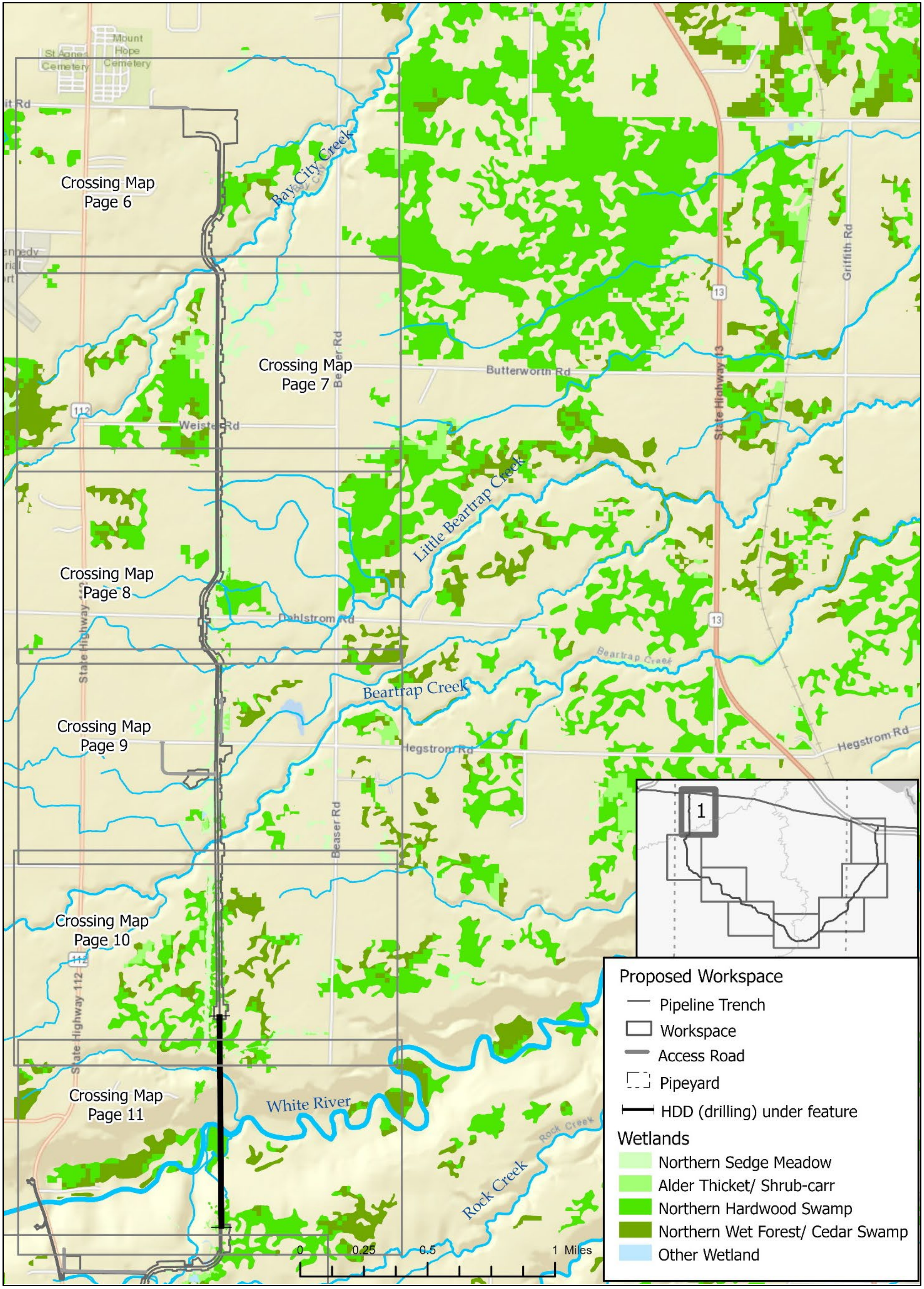

Figure 2.1-7 Wetland & waterway crossings along Enbridge's proposed Line 5 relocation route (map 1 of 8).
Outlines refer to Enbridge maps of delineated wetlands & waterbodies, and their page numbers, in Appendix A

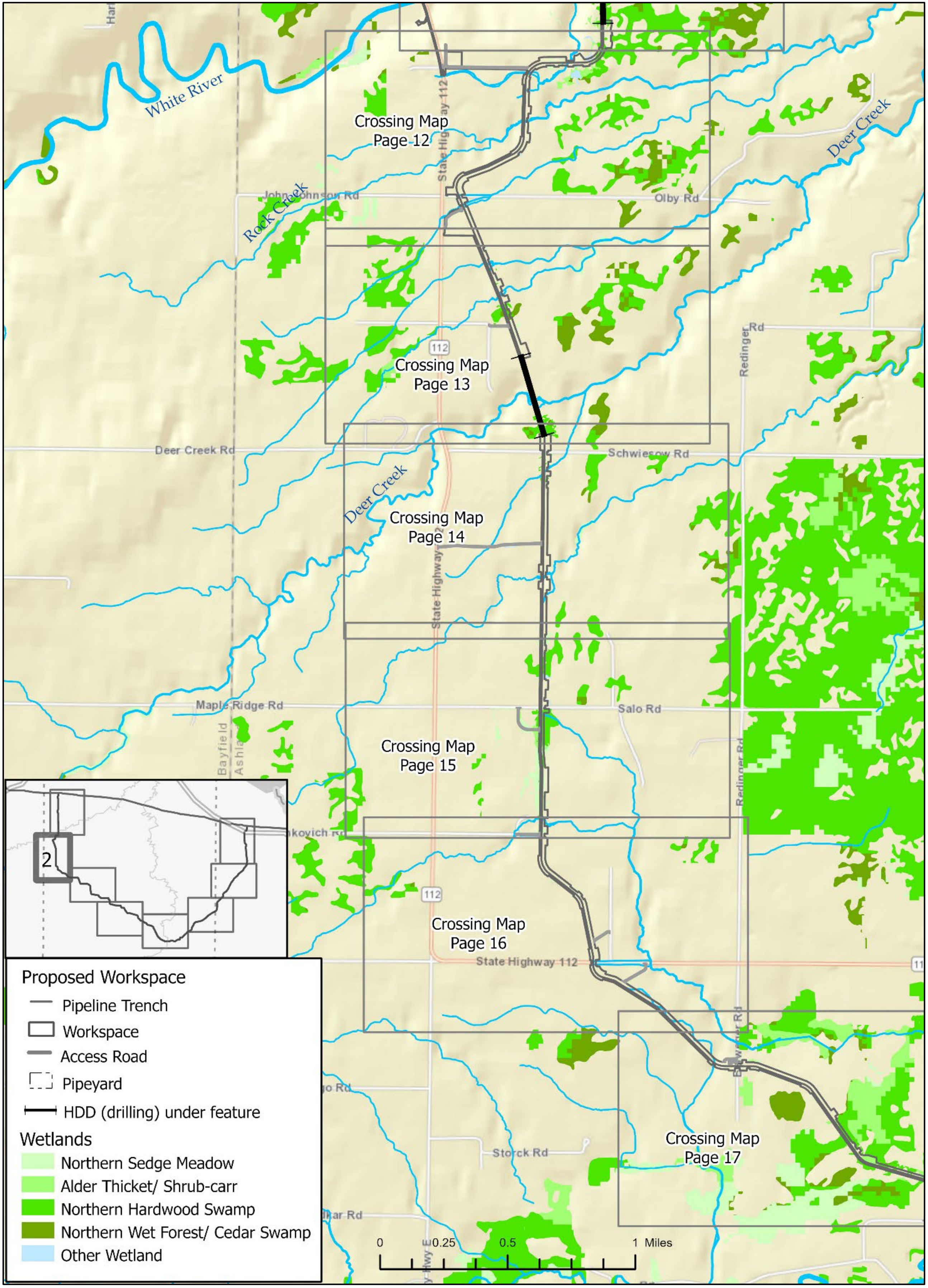

Figure 2.1-7 Wetland & waterway crossings along Enbridge's proposed Line 5 relocation route (map 2 of 8).
Outlines refer to Enbridge maps of delineated wetlands & waterbodies, and their page numbers, in Appendix A.

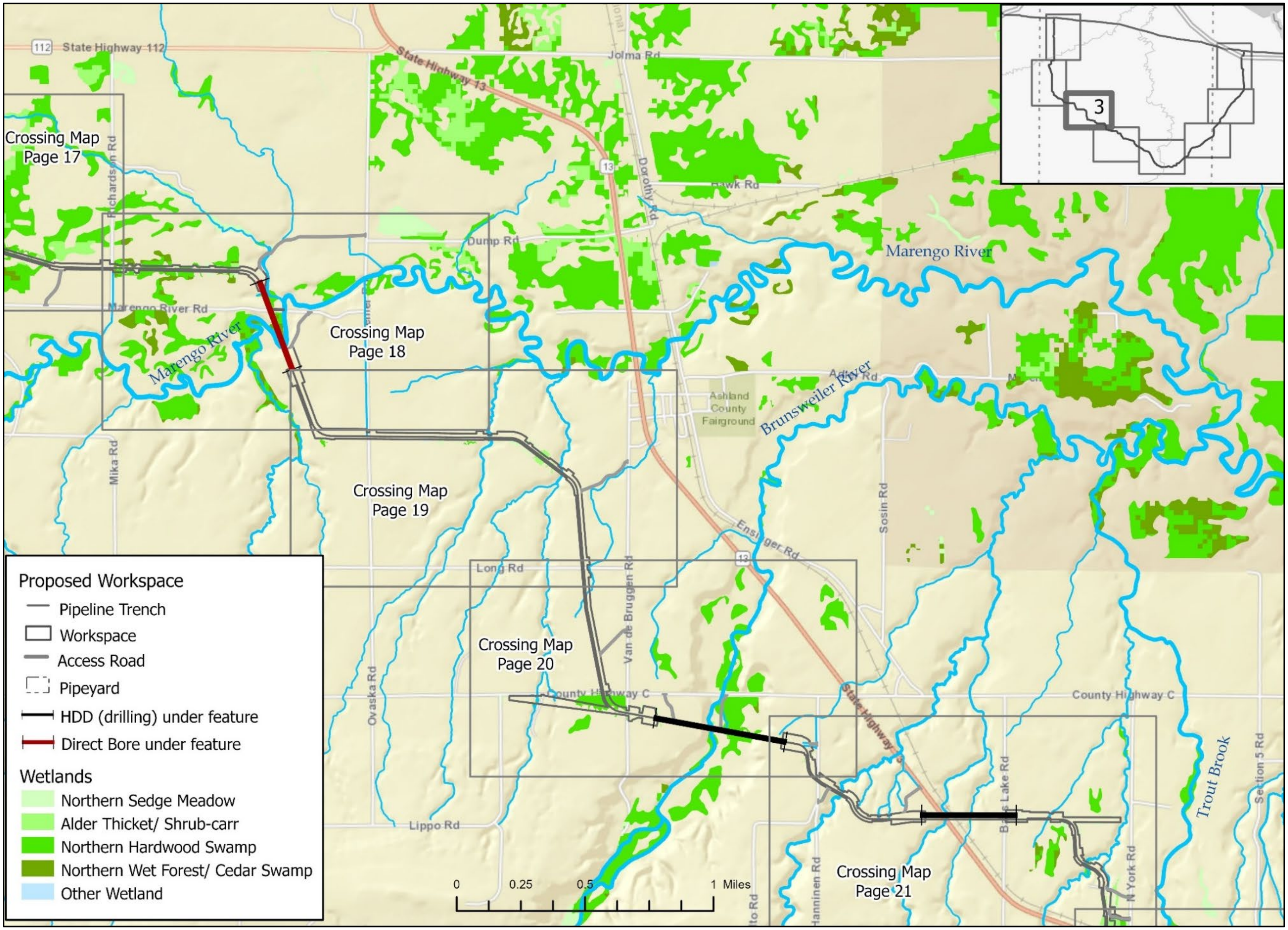

Figure 2.1-7 Wetland & waterway crossings along Enbridge's proposed Line 5 relocation route (map 3 of 8).
Outlines refer to Enbridge maps of delineated wetlands & waterbodies, and their page numbers, in Appendix A.

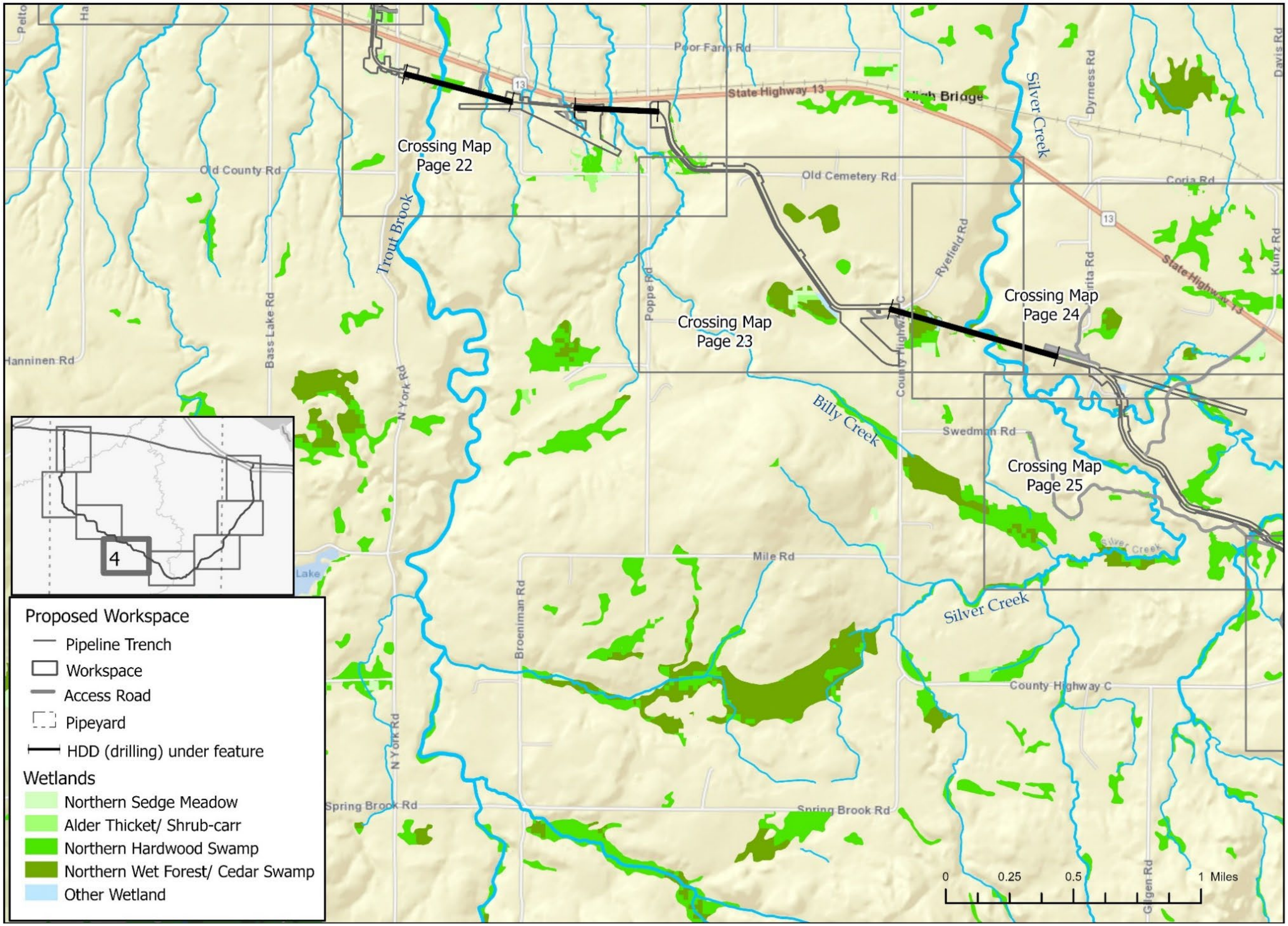

Figure 2.1-7 Wetland & waterway crossings along Enbridge's proposed Line 5 relocation route (map 4 of 8).
Outlines refer to Enbridge maps of delineated wetlands & waterbodies, and their page numbers, in Appendix A.

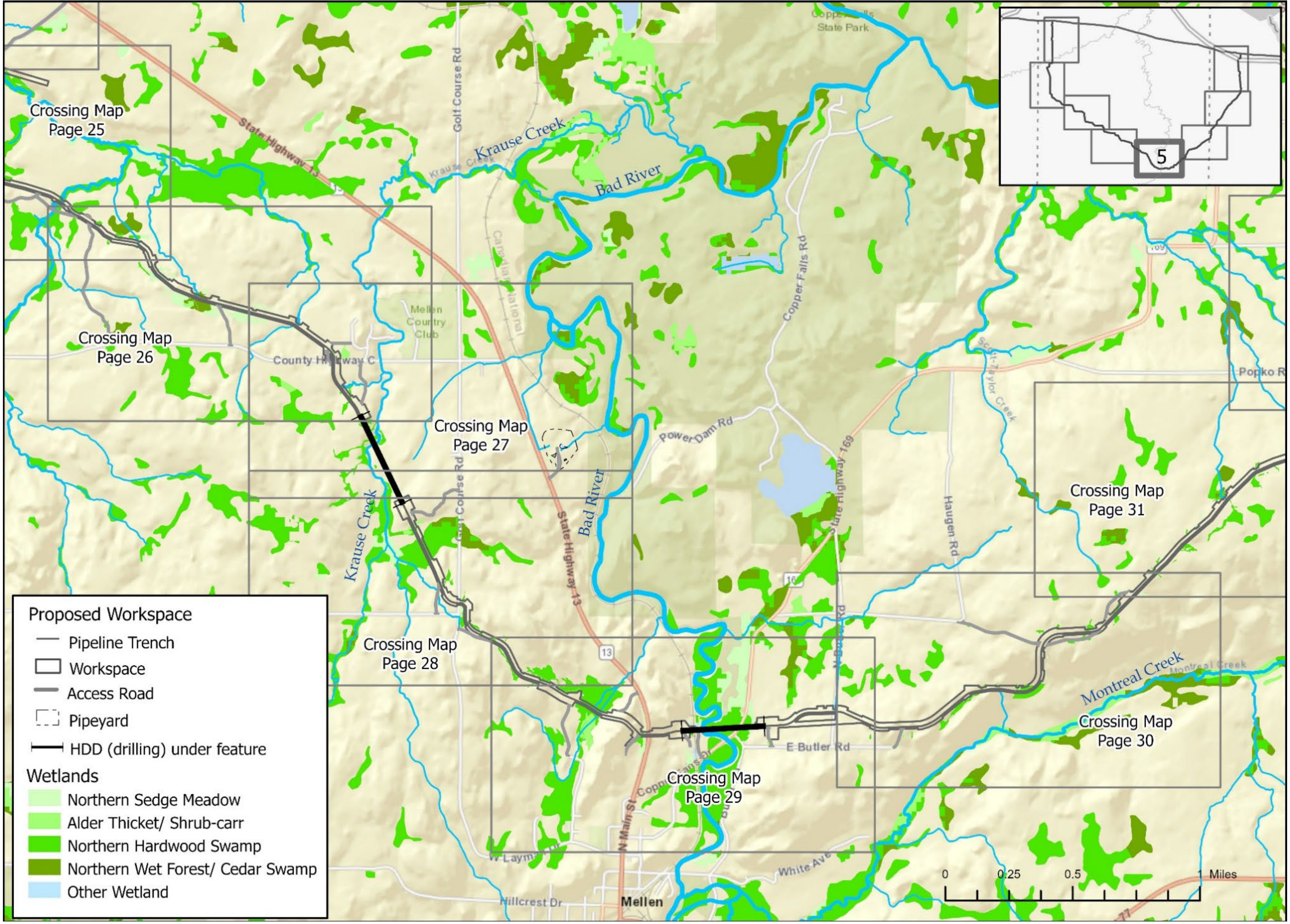

Figure 2.1-7 Wetland & waterway crossings along Enbridge's proposed Line 5 relocation route (map 5 of 8).
Outlines refer to Enbridge maps of delineated wetlands & waterbodies, and their page numbers, in Appendix A.

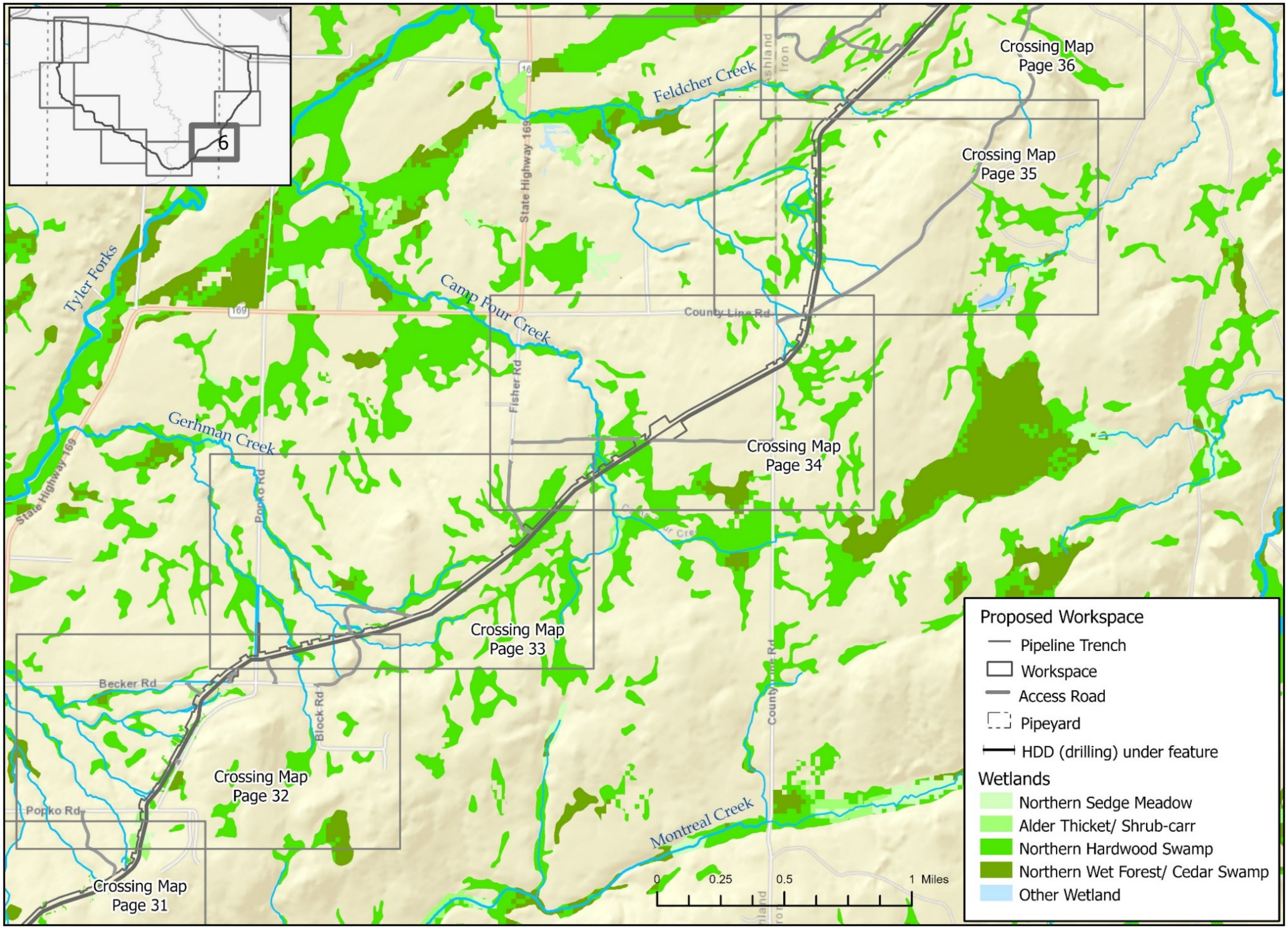

Figure 2.1-7 Wetland & waterway crossings along Enbridge's proposed Line 5 relocation route (map 6 of 8).
Outlines refer to Enbridge maps of delineated wetlands & waterbodies, and their page numbers, in Appendix A.

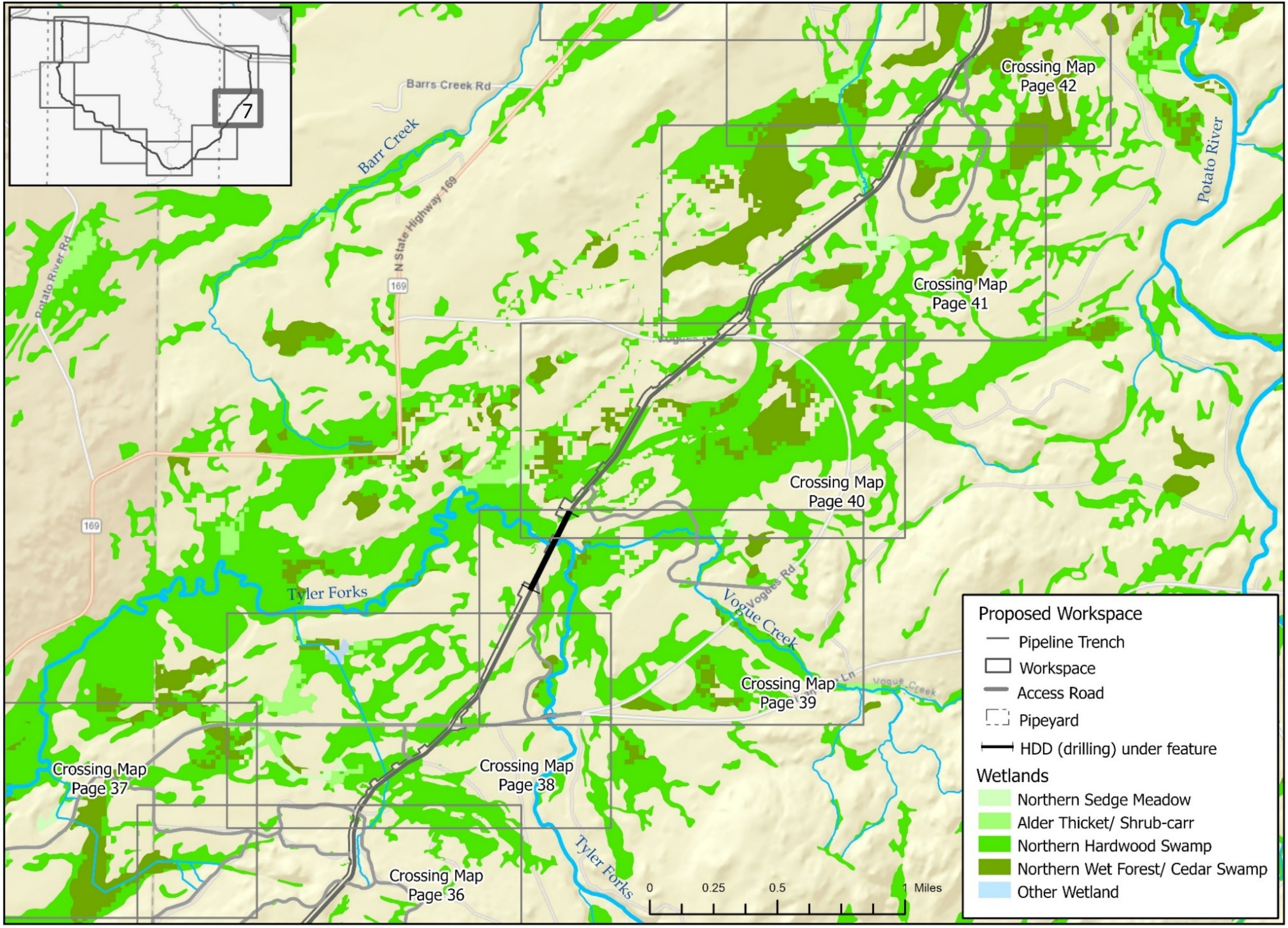

Figure 2.1-7 Wetland & waterway crossings along Enbridge's proposed Line 5 relocation route (map 7 of 8).
Outlines refer to Enbridge maps of delineated wetlands & waterbodies, and their page numbers, in Appendix A.

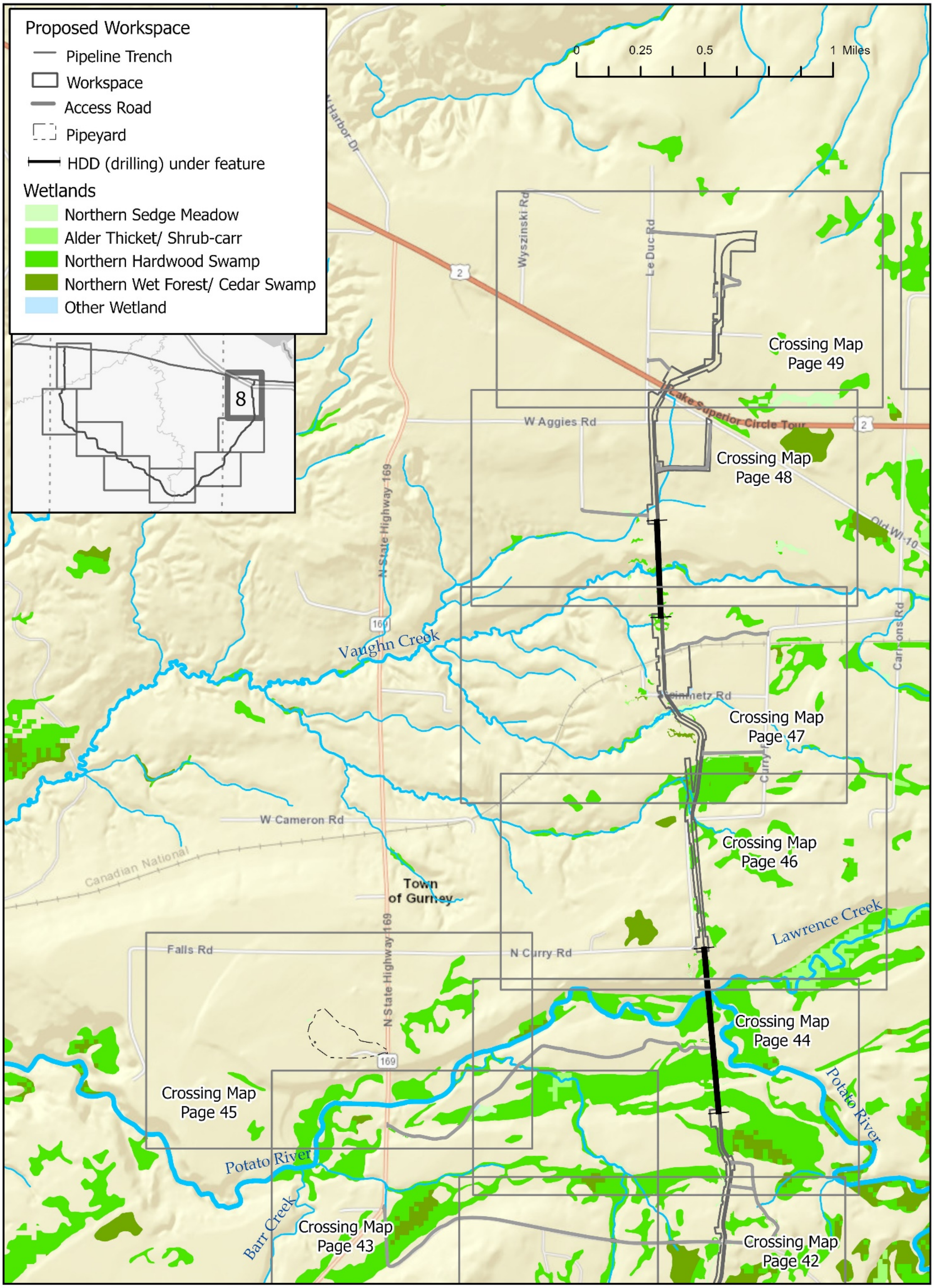

Figure 2.1-7 Wetland & waterway crossings along Enbridge's proposed Line 5 relocation route (map 8 of 8).
Outlines refer to Enbridge maps of delineated wetlands & waterbodies, and their page numbers, in Appendix A.

As part of the DNR wetland permit review, the agency must evaluate Enbridge's efforts to avoid, minimize, and mitigate wetland impacts. This begins by evaluating various relocation route alternatives, as discussed in Section 2.1.2, to avoid impacts wetlands. The DNR review of proposed waterways permits is also informed by Enbridge's efforts to limit potential detrimental impacts to the public interest in navigable waters. The abundance and distribution of waterways and wetlands present within the region, coupled with engineering constraints, existing infrastructure, and various other factors would make the total avoidance of waterways and wetlands impracticable for any pipeline relocation route alternative. Further efforts to limit water resources impacts via refinement of Enbridge's preferred relocation route during design are discussed below. Measures to minimize water resources impacts via pipeline installation method selection are discussed in Section 2.5.3. Section 2.8 describes measures to limit impacts during construction.

Enbridge has indicated that the proposed relocation route was identified through an assessment of technical and economic feasibility, constructability, impacts on environmental resources, and coordination with agencies and other stakeholders to identify and, where practicable, avoid sensitive habitats or resources. This included configuring the ROW to limit the environmental footprint while adhering to Enbridge's stated purpose and need for the project (Section 1.3). The routing process used during design was intended to avoid waterbodies, wetlands, and steep slopes at the macro and micro routing level to the extent practicable. In addition to the location of these features, Enbridge considered the following factors during route selection, design, and refinement:

- Avoidance of impacts to residences, schools, churches, commercial buildings, and traffic.
- Avoidance of sensitive habitats or resources.
- Avoidance of wooded areas where non-wooded lands are available. This is evident primarily along the western portions of Enbridge's proposed route.
- Avoidance of geohazard areas such as unstable slopes and slopes steeper than 20 percent (Figure 2.1-8).
- Co-location along existing utility corridors. Enbridge indicated that it was unable to find connected existing corridors that it could follow along the eastern portion of the route; while several roads and other corridors are present in the area, the orientation of these corridors was not consistent with the project needs.
- Engineering constraints such as the minimum radius of curvature feasible for the pipe.
- The workspace needs associated with different construction methods, including trenching and HDD. This included identifying where a change in installation method could shift impacts to other resources but not provide a meaningful net reduction in overall impacts.
- The extent to which a potential modification would increase the total area disturbed or the duration of construction-related impacts.
- The willingness of landowners to allow access for surveys and to enter into easement agreements.

Establishment and refinement of route alternatives occurred early in the project planning process to allow Enbridge to pursue landowner approvals and conduct surveys. Enbridge has indicated that consideration of new alignments or workspaces beyond the existing survey corridor after those efforts were completed would increase overall project costs and result in project delays.

During its review of Enbridge's CWA permit application, the USACE asked Enbridge to evaluate minor variants of one of Enbridge's relocation route alternatives (Chapter 3) that could reduce the effects on public lands and potentially reduce the overall project length and associated environmental disturbance. The USACE evaluated the additional information and has preliminarily determined that the alternative routes would result in great impacts to aquatic resources or would result in greater environmental damages compared to the Enbridge's proposed route, and that the proposed route is the least environmentally damaging practicable alternative (USACE, 2024a).

Appendix A includes maps of proposed waterway and wetland crossings. Appendix B includes a table of Enbridge's proposed waterway and wetland crossings. A comparison of pipeline relocation route alternatives considered for this EIS is provided in Section 3.5. Appendix C includes maps of the route alternatives.

2.1.2 Route Selection & Geohazard Avoidance & Mitigation

Geologic hazards (geohazards) are a subset of natural hazards that can pose a threat to pipelines, including the loss of soil cover above and around sections of buried pipe (exposure). Geohazards are caused by a combination of soil conditions, topography, natural forces, and water movement that can cause rapid landform changes. Geohazards include mudslides, avalanches, rapid erosion, and other land deformations. 'Hydrotechnical' geohazards are specific to stream channels and include scour, aggradation/degradation, bank erosion, encroachment, avulsion, and meander cutoff. While geohazards are primarily a natural phenomenon, human changes to the environment can alter features in a way that makes them more stable or less stable. In the Line 5 project area, geohazards are most likely to be influenced by water movement, such as when streams meander or water within a soil layer causes slope subsidence. Gullies and ravines can also down cut and expose underground pipelines. Steep slopes can fail, as shown in Figure 2.1-8. Large rain events accelerate these changes and can cause roadways to wash out due to culvert failure.

As discussed in Chapter 6 (Section 6.2.2.6), pipeline exposure increases the risk of pipe failures and spills. In addition, construction in an area of geohazard risk can either increase or decrease the risk of future changes depending on how the area is restored. Enbridge's general approach to designing the proposed route was avoidance of mapped geohazard areas (2021a). Possible hazards included slope instability, flowable soils, and areas where hydrotechnical geohazards could occur. Enbridge's investigation included two phases, the first of which was a desktop evaluation including project data, topographical investigation, geological investigation, hydrotechnical investigation, and localized investigation. The second phase was a field investigation of areas identified in the desktop evaluation. Enbridge's staff and contractors visited the sites, took photos, and noted the presence of:

- Geohazard type and size.
- Slope instability features (i.e., angles, materials, soil properties, cracks, or depressions).
- Subsidence features (i.e., soil layering, new growth patterns).
- Soil characteristics and sampling.
- Shallow or exposed bedrock outcrops.
- Vegetation.
- Springs, water seepage, ponding, or high-water table.
- Stream characteristics (e.g., channel movement, undercut banks).

Figure 2.1-8 Example of a slope failure due to erosion.
Photo: Dreux J. Watermolen, DNR

Geohazards that could not be avoided were evaluated and Enbridge identified a mitigation strategy for each identified geohazard. Enbridge used data collected in the field to develop a risk-ranked profile for the investigated areas. A preliminary qualitative geohazard threat level was assigned (Low to High). According to Enbridge (2021a), the threat level was related to potential magnitude, location, likelihood, and severity of potential impact to the pipeline. Figure 2.1-9 depicts the evaluated geohazard areas Enbridge identified along the proposed Line 5 relocation route, including general geohazards and hydrotechnical geohazards. These geohazards are discussed, and mapped, in further detail in Chapter 5 (Section 5.6.6). Table 5.6-14 and Table 5.6-15 provide detailed information about the individual geohazards.

Enbridge evaluated proposed waterway crossings for the possibility of various geohazards including scour, aggregation/degradation, bank erosion, encroachment, avulsion, and meander cutoff (Enbridge, 2021a). Each waterway crossing was assessed by:

- Visual observations of proposed channel crossings,
- Topographic measurement and physical sampling of channels,
- Comparison of present and historic aerial imagery,
- Analysis of the channel crossing watersheds,

- Determination of recurrence interval peak flood flows,
- Determination of threshold channels,
- Determination of channel properties related to geometry-flow dynamics specific to various recurrence intervals, and
- Determination of scour depths and estimation of the likelihood of meandering based on various recurrence intervals and historic aerial imagery.

The results of these evaluations are included in Table 5.6-14, Table 5.6-15, and Figure 5.6-11. DNR staff visited several locations with features identified as geohazards to corroborate Enbridge’s assessments.

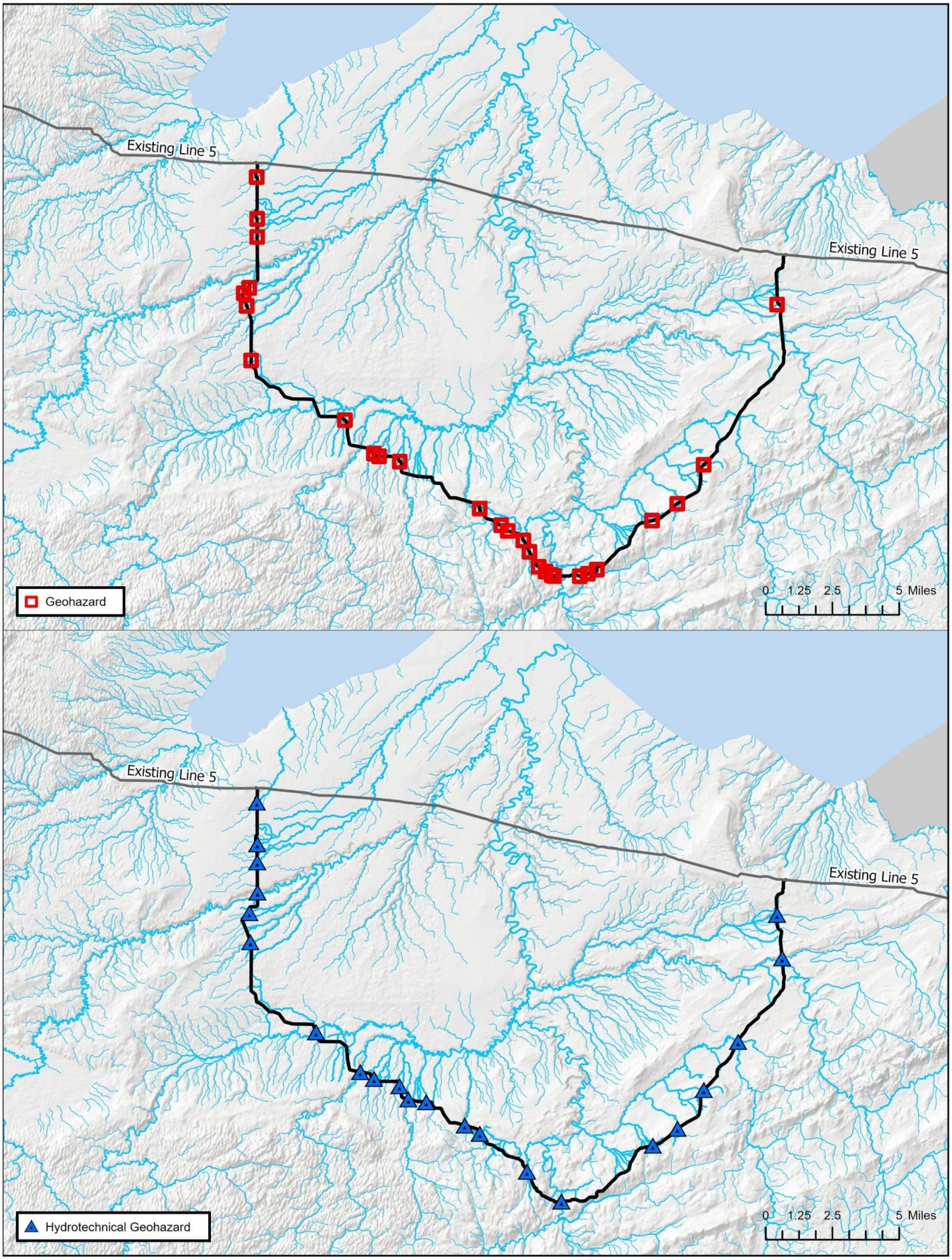

Figure 2.1-9 Geohazards identified along Enbridge's proposed Line 5 relocation route.
Top: Geohazards; Bottom: Hydrotechnical geohazards.
Source: Enbridge

According to Enbridge (Enbridge, 2021a), the site-specific measures developed for the proposed Line 5 relocation route to address the identified geohazards include:

- Avoidance of side slopes to cross topographic contour lines perpendicular with the pipeline,
- Avoidance of paralleling meandering watercourses,
- Drainage control including trench plugs, riprap ditches, pipe trench drains, longitudinal drains, and transverse drains,
- Surface water controls including waterbars (aka slope breakers; Figure 2.6-9) and diversion ditches,
- Depth of cover,
- Backfill and compaction requirements,
- Soil amendments,
- Mechanically stabilized slope options, and
- Slope facings.

Should additional geohazards be encountered during a construction phase, the hazard would need to be evaluated and appropriate measures designed and implemented. In some cases, Enbridge could install monitoring devices such as strain gauges, inclinometers, GPS pins, or similar devices.

2.1.3 Project Adjustments Following Release of the Draft EIS

On July 11, 2023, Enbridge submitted to the DNR a document titled “Line 5 Wisconsin Segment Relocation Project, Project Update Information” (Enbridge, 2023a). This document detailed changes to the proposed project that were made after the Draft EIS was released in December 2021. These changes are summarized below and are discussed in more detail in the referenced sections.

2.1.3.1 Mainline Block Valves

Enbridge added mainline block valves to comply with federal rules that PHMSA finalized in April 2022. The revised federal safety standards relevant to Enbridge’s proposed pipeline reroute modified the spacing requirement for valve placement on new pipelines that are six inches or greater in diameter. Enbridge determined that three additional mainline valves would be needed to comply with the final rule, increasing the total number of valves to be installed on the proposed reroute from seven to ten. Mainline block valves are discussed in Section 2.1.4.2.

2.1.3.2 Access Road Changes

Enbridge proposes eliminating two previously proposed temporary access roads at mile post (MP) 10.6 and MP 24.1, totaling 0.34 acres. Three permanent access roads would be added, one for each new valve site. The three new driveways would total 0.25 acres. The access for mainline valve site 6 was relocated to shorten the distance to a public road and reduce the total permanent impervious area associated with this valve site to less than one acre. Temporary and permanent access roads are discussed in Section 2.3.3.

2.1.3.3 Minor HDD Route Adjustments

Enbridge adjusted the proposed HDD at the Highway 13 crossing, located at MP 15.1 in Ashland County. The proposed modification shifts the HDD approximately 100 feet north of the original proposed alignment to increase the separation between an adjacent property and the intersection of a private driveway with Highway 13. Enbridge also modified the Silver Creek HDD. This modification lengthens the HDD by approximately 200 feet to maintain pipeline depth of cover along a portion of the HDD path adjacent to an existing sand and gravel business on the east side of the river crossing. Enbridge's proposed HDD crossings are discussed in Section 2.5.2.2.

2.1.4 Associated Facilities Proposed

2.1.4.1 Cathodic Protection & Alternating Current Mitigation Systems

Cathodic protection is a technology commonly used to protect submerged or buried metal structures against corrosion. The technique converts active areas on a metal surface to passive (i.e., making the surfaces the cathode of an electrochemical cell). During construction, Enbridge proposes installing a cathodic protection system on the new pipeline to protect it from external corrosion. This system would involve passing a low-voltage electric current between an external anode, which is designed to corrode, and the pipeline so the pipeline metal becomes the system cathode and does not corrode.

Pipelines that share, parallel, or cross high-voltage alternating current (AC) power transmission lines can be subject to electrical interference from inductive, resistive (conductive), and capacitive coupling. Such AC interference can create safety hazards or compromise pipeline integrity by causing pipeline corrosion to set in faster. Enbridge proposes installing an AC mitigation system, a grounding system to safely remove AC current and protect the pipeline from potential stray voltage and accelerated corrosion.

2.1.4.2 Mainline Block Valve Sites & Pumping Stations

Enbridge proposes the construction of ten new main block valve sites, which would also function as emergency flow restricting devices. Mainline block valves are pipeline control devices that can be closed to prevent liquid from flowing. Enbridge used a process called intelligent valve placement analysis to identify optimal valve locations to reduce the potential consequences in the event of a pipeline rupture and crude oil release. According to Enbridge, the process examines the pipeline segment by segment on an iterative basis until the lowest reasonably practicable release volume between valves is achieved along the pipeline based on a total number of valves and valve location.

Valve placements are influenced by several factors, including topography, location of flood plains, presence of high-consequence areas (HCAs; as defined by PHMSA), availability of land, availability of power, accessibility, and environmental effects such as wetland avoidance. As a result of the initial intelligent valve placement evaluation, Enbridge determined to implement seven remote-operated valves for the approximately 41-mile proposed route. Enbridge reviewed placement of additional valves and determined that there was no significant reduction in risk based on the geography, topography, and distance from HCAs.

On April 8, 2022, PHMSA finalized Valve Installation and Minimum Rupture Detection Standards (Docket No. PHMSA-2013-0255-0005) that update requirements for the placement of valves. The rulemaking revised the federal safety standards applicable to most newly constructed pipelines. As relevant to Enbridge's proposed Line 5 relocation project, the final rule modifies the spacing requirement for valve placement on new pipelines that are 6 inches or greater in diameter. As noted in Section 2.1.3.1, Enbridge determined that three additional mainline valves were required to comply with the final rule. The intelligent valve placement analysis and project plans were updated to include the three additional valves (Enbridge, 2023a).

The plans call for two block valve sites on sections of the existing Line 5 pipeline west of the replacement pipeline, one block valve site east of the replacement pipeline, and seven block valve sites on the replacement pipeline. The present plans include constructing two mainline block valve sites in Bayfield County, six block valve sites in Ashland County, and two block valve sites in Iron County. The locations of the proposed mainline block valve sites are shown in Figure 1.1-2 and on the proposed relocation route maps in Appendix A.

The mainline block valve sites would each be approximately 0.13 acres in size and would include the valve, instrumentation, controls, an electrical service building and grounding, perimeter fencing, a permanent access road, and a small, graveled parking/turn-around area (Figure 2.1-10).

Figure 2.1-10 A mainline block valve site.
Photo: Dreux J. Watermolen, DNR

New power lines would be required to provide power to the new mainline block valve sites. Enbridge is working with local electrical service providers to establish permanent electrical services to the block valve sites (Enbridge, 2020e). Permits that may be required for new power lines would be obtained by the utility providing the electrical services.

No new pumping stations are proposed for the Line 5 relocation, but Enbridge proposes minor modifications to the existing Ino Pump Station in Bayfield County. The existing drag reducing agent injection system would be replaced with a new system. A new 40-foot by 8-foot equipment skid would be installed. The new equipment would include tanks for drag reducing agent storage, tank mixers, transfer pumps and accompanying appurtenances.

2.2 Construction Right-Of-Way Requirements

A ROW is a corridor or linear strip of land where a pipeline or other utility line is installed. Prior to installing any pipeline, Enbridge would need to obtain easements from landowners that allow the company to enter the ROW for purposes of construction, operation, and maintenance. Constructing a pipeline requires both a permanent ROW within which the pipe would reside and an adjacent, temporary ROW to provide the workspace needed during construction for both safe operation of construction equipment and stockpiled soils removed from the trench excavation. Enbridge proposes to generally use a combined 120-foot-wide construction ROW (permanent and temporary) for the new 30-inch-diameter pipeline (Figure 2.2-1). The construction ROW is divided between the spoil side (area used to store topsoil and excavated materials) and the working side (equipment work area and travel lane). To minimize wetland disturbance, Enbridge proposes to reduce the construction ROW to 95-feet-wide in wetlands (Figure 2.2-2 and Figure 2.8-1) and at waterbody crossings (Figure 2.2-3), where practicable based on site-specific conditions.

Following construction, Enbridge would maintain the permanent 50-foot-wide ROW clear of woody vegetation to allow aerial inspections and facilitate access for maintenance. In areas where the pipeline was installed via HDD and direct bore methods, the permanent operational ROW would be reduced from 50 feet to 30 feet. Enbridge would need to acquire 50-foot or 30-foot permanent easements from landowners for the permanent ROW. Enbridge has indicated that the company has reached options and/or easement agreements with 100% of the landowners along the relocation route. Enbridge would also need to acquire temporary easements from landowners for the temporary construction ROW, as well as for other temporary off-ROW construction requirements (Section 2.3).

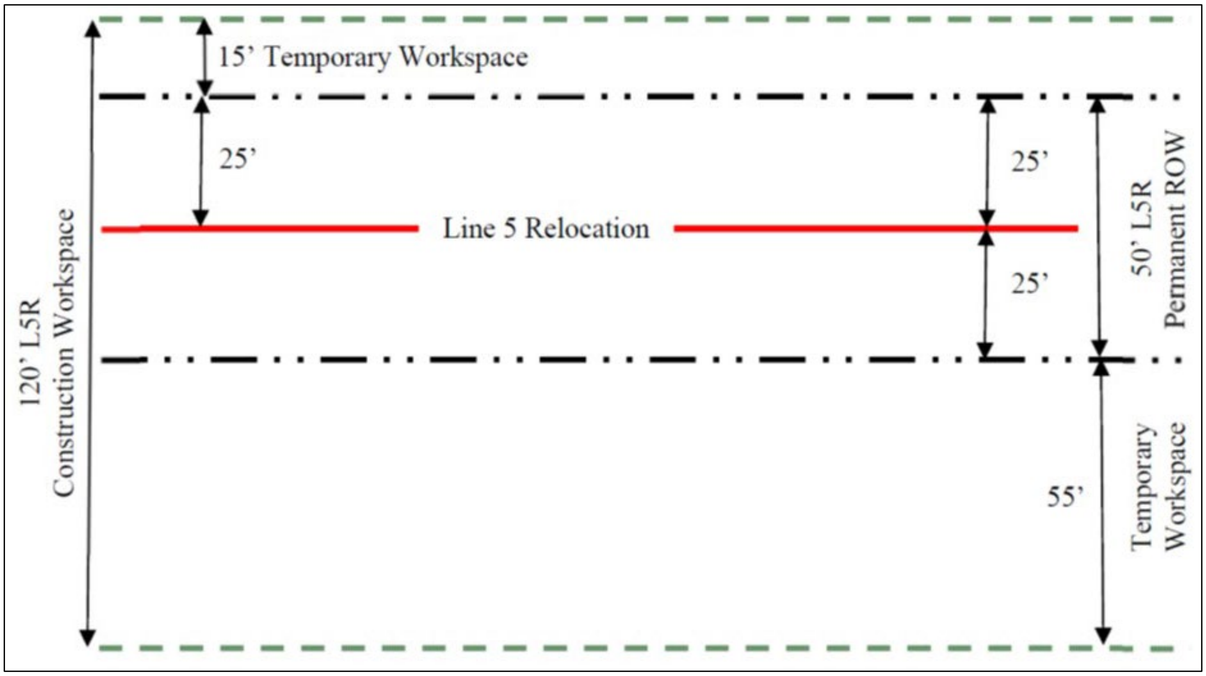

Figure 2.2-1 Typical construction workspace – uplands.
Source: (Enbridge, 2020e)

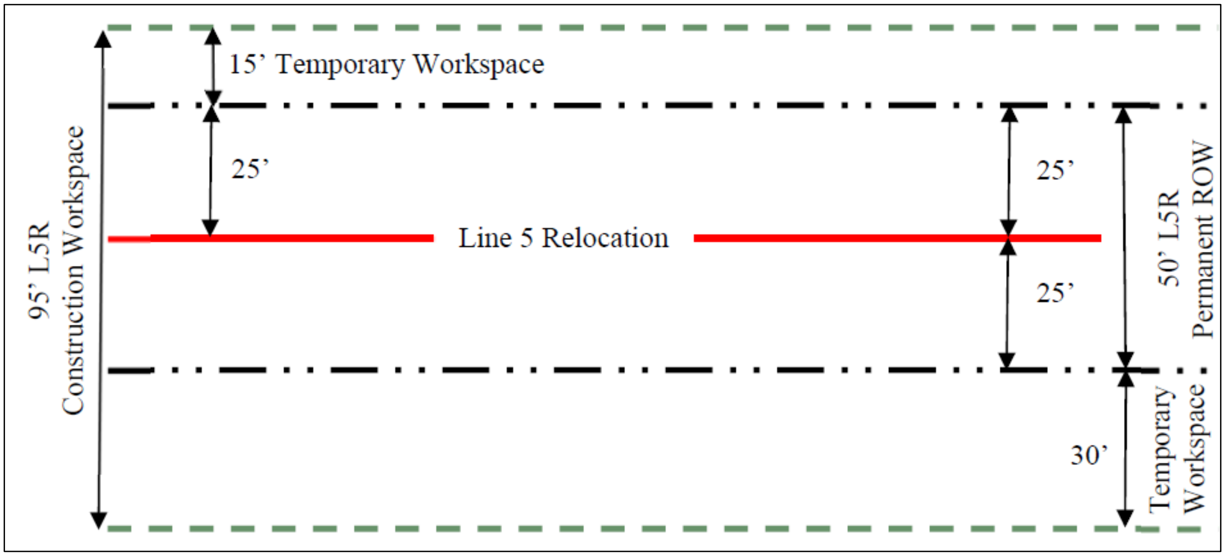

Figure 2.2-2 Typical construction workspace – wetlands.
Source: (Enbridge, 2020e)

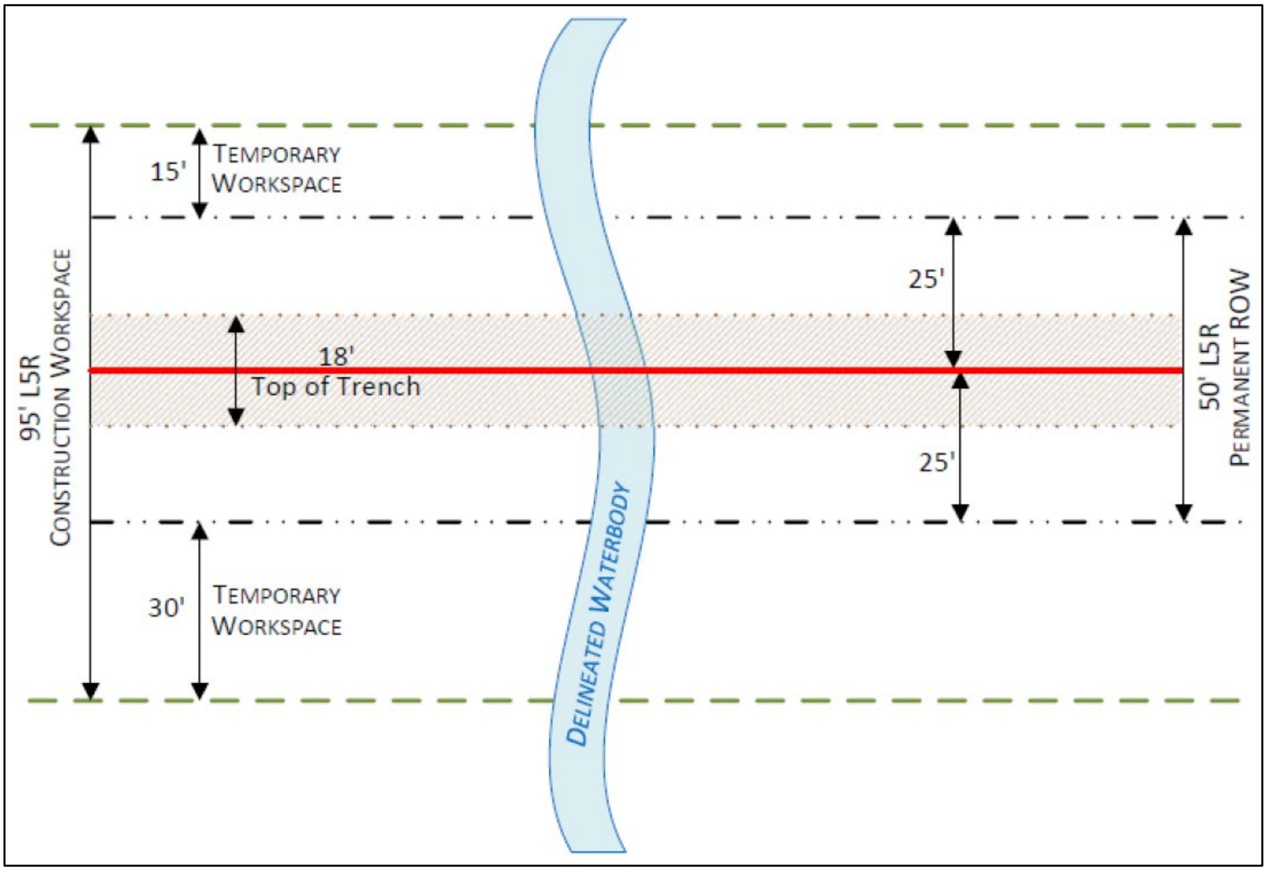

Figure 2.2-3 Typical construction workspace – waterways.
Source: (Enbridge, 2024b)

2.3 Off-ROW Construction Requirements

Additional construction workspace areas, beyond the 120-foot-wide construction ROW (or 95-foot-wide construction ROW in wetlands), would also be needed during construction, and are further discussed below. These temporary off-ROW construction workspace areas would require temporary easements.

2.3.1 Additional Temporary Workspaces

Additional temporary workspaces are construction workspaces that would be temporarily needed outside the typical construction ROW at select locations to stage equipment, stockpile spoil material, and conduct material fabrication and assembly. Generally, additional temporary workspaces would be necessary where the proposed route crosses features like waterbodies, wetlands, roads, steep slopes, railroads, and existing pipelines and utilities. In some cases, additional temporary workspaces could be sited within wetland boundaries due to site-specific conditions. Table 2.3-1 below provides the typical dimensions used for additional temporary workspaces. The locations of additional temporary workspaces are identified in Enbridge's Construction Site General Permit application and are depicted on the maps in Appendix E.

Table 2.3-1 Typical dimensions of additional temporary workspaces.

Feature	Dimensions on each side of feature[1]
Open-cut road crossings	150 feet by 50 feet
Bored road and railroad crossings	150 feet by 50 feet
Foreign pipeline and utility crossings	150 feet by 50 feet
Horizontal directional drill crossings	200 feet by 100 feet
Waterbody crossings	150 feet by 50 feet
Wetland crossings	150 feet by 50 feet

[1] Areas are in addition to the typical 120-foot-wide construction ROW.
Source: (Enbridge, 2020e)

2.3.2 Staging Areas

Additional off-ROW areas that would be needed during pipeline construction include temporary staging areas, also commonly referred to as laydown yards or pipe yards. These areas would be used to store pipe and other construction materials, host temporary staff buildings such as construction trailers, and allow equipment parking and construction staging activities. Suitable locations for staging areas are typically clear, open, generally flat areas, such as unused parking lots, fallow fields, or existing industrial areas that would only require minor land leveling, if needed. Enbridge has identified four staging areas. One staging area would be in Douglas County, one in Iron County, and two in Ashland County. All four proposed staging area sites have been used previously for sand or gravel extraction and timber storage. Enbridge could identify additional staging areas as the planning and engineering for the proposed pipeline relocation progresses. If additional staging areas are required, they would need to be reviewed for sensitive environmental features and would require landowner and applicable regulatory approvals prior to use. Staging areas would be leased sites and would be restored upon the completion of the proposed pipeline construction unless otherwise permitted or authorized by the landowner and applicable regulatory agencies.

2.3.3 Access Roads

Off-ROW access roads would be necessary for equipment access, material deliveries, and personnel access. Off-ROW access would typically be needed where access within the construction ROW is restricted due to steep slopes, sensitive resources, railroad crossings, or other access limitations. Where access from existing public roads is not feasible, utilities often seek to use existing farm tracks or other types of informal roads or paths to access the construction ROW. Enbridge has identified existing access roads that the company proposes to use during construction (Table 2.3-2). In these areas, Enbridge would obtain applicable landowner and regulatory approvals prior to using the off-ROW access roads. The only new permanent access roads proposed would be those constructed for the proposed mainline block valve sites. Off-ROW access roads would total approximately 31 miles, with approximately 13 miles in Ashland County, 16 miles in Iron County, and less than 1 mile each in Douglas and Bayfield counties.

Table 2.3-2 Proposed access roads to be used during construction.

Access road id	County (ies)	Approximate milepost [a]	Length (miles)	Temporary/ permanent	Public/private road	Existing/new	Anticipated temporary improvements [b]
001	Ashland	0.0	0.15	Temporary	Private	Existing	Grading, gravel/rock
003.01	Ashland	2.7	0.32	Temporary	Private	Existing	Grading, gravel/rock, matting
13	Ashland	6.0	0.08	Temporary	Private	Existing	Grading, gravel/rock
014	Ashland	6.9	0.41	Temporary	Private	Existing	Grading, gravel/rock
015	Ashland	7.7	0.15	Temporary	Private	Existing	Grading, gravel/rock, matting
016	Ashland	8.1	0.09	Temporary	Private	Existing	Grading, gravel/rock, matting
017	Ashland	8.6	0.07	Temporary	Private	Existing	Grading, gravel/rock, matting
018	Ashland	8.8	0.12	Temporary	Private	Existing approach	Grading, gravel/rock, bridging
019	Ashland	9.3	0.06	Temporary	Private	Existing approach	Grading, gravel/rock, matting
020	Ashland	10.3	0.15	Temporary	Private	Existing	Grading, gravel/rock
021	Ashland	11.1	0.48	Temporary	Private	Existing	Grading, gravel/rock, matting, bridging
022	Ashland	11.4	0.16	Temporary	Private	Existing approach	Grading, gravel/rock
024	Ashland	12.9	0.22	Temporary	Private	Existing approach	Grading, gravel/rock, matting
025	Ashland	13.5	0.14	Temporary	Private	Existing	Grading, gravel/rock
026	Ashland	14.0	0.11	Temporary	Private	Existing	Grading, gravel/rock, matting
026.01	Ashland	14.1	0.14	Temporary	Private	Existing	Grading, gravel/rock, matting
027	Ashland	14.5	0.03	Temporary	Private	Existing	No Improvements needed
028	Ashland	14.7	0.07	Temporary	Private	Existing approach	Grading, gravel/rock, matting
028.1	Ashland	15.0	0.12	Temporary	Private	Existing approach	Grading, gravel/rock
029	Ashland	16.0	0.10	Temporary	Private	Existing	No Improvements needed,
030	Ashland	16.7	0.08	Temporary	Private	Existing	Grading, gravel/rock
031	Ashland	17.1	0.02	Temporary	Private	Existing	Grading, gravel/rock
031.01	Ashland	17.1	0.03	Temporary	Private	Existing	Grading, gravel/rock
034	Ashland	18.7	0.16	Temporary	Private	Existing	Grading, gravel/rock
039	Ashland	20.5	1.21	Temporary	Private	Existing	Grading, gravel/rock, matting, bridging
040.02	Ashland	19.5	0.20	Temporary	Private	Existing	Grading, gravel/rock
042	Ashland	20.0	0.76	Temporary	Private	Existing	Grading, gravel/rock, matting, bridging
043	Ashland	20.5	0.18	Temporary	Private	Existing	Grading, gravel/rock, bridging
044	Ashland	20.7	0.02	Temporary	Private	Existing	Grading, gravel/rock
045	Ashland	20.7	0.52	Temporary	Private	Existing	Grading, gravel/rock, matting, bridging
046	Ashland	21.4	0.16	Temporary	Private	Existing	Grading, gravel/rock

Access road id	County (ies)	Approximate milepost [a]	Length (miles)	Temporary/ permanent	Public/private road	Existing/new	Anticipated temporary improvements [b]
047	Ashland	21.8	0.08	Temporary	Private	Existing	Grading, gravel/rock, matting
048	Ashland	22.1	0.18	Temporary	Private	Existing	Grading, gravel/rock, matting
049	Ashland	22.6	0.24	Temporary	Private	Existing	Grading, gravel/rock, matting
050	Ashland	22.9	0.11	Temporary	Private	Existing	Grading, gravel/rock, matting, bridging
050.01	Ashland	23.2	0.11	Temporary	Private	Existing	Grading, gravel/rock, bridging
050.02	Ashland	23.6	0.21	Temporary	Both	Existing	Grading, gravel/rock
050.03	Ashland	23.8	0.10	Temporary	Private	Existing	Grading, gravel/rock, matting
051.01	Ashland	23.9	0.08	Temporary	Both	Existing	Grading, gravel/rock, matting
052	Ashland	24.1	0.06	Temporary	Private	Existing	Grading, gravel/rock,
054	Ashland	24.2	0.11	Temporary	Private	Existing	Grading, gravel/rock, matting
055	Ashland	24.4	0.07	Temporary	Private	Existing	Grading, gravel/rock, matting
058	Ashland	25.0	0.08	Temporary	Private	Existing	Grading, gravel/rock, matting
060	Ashland	25.7	0.32	Temporary	Private	Existing	Grading, gravel/rock, matting
061	Ashland	26.0	0.20	Temporary	Private	Existing	Grading, gravel/rock, matting
062	Ashland	26.0	0.13	Temporary	Private	Existing	Grading, gravel/rock, matting
063	Ashland	27.2	0.31	Temporary	Private	Existing	Grading, gravel/rock, matting
064	Ashland	27.7	0.01	Temporary	Private	Existing	Grading, gravel/rock
065	Ashland	28.00	0.06	Temporary	Private	Existing approach	Grading, gravel/rock, matting
066	Ashland	28.1	0.03	Temporary	Private	Existing	Grading, gravel/rock
067	Ashland	28.3	0.10	Temporary	Private	Existing	Grading, gravel/rock
068	Ashland	28.6	0.30	Temporary	Private	Existing	Grading, gravel/rock, matting, bridging
069	Ashland	28.9	0.35	Temporary	Private	Existing	Grading, gravel/rock, matting, bridging
070	Ashland	29.5	0.32	Temporary	Private	Existing	Grading, gravel/rock, matting
071	Ashland	30.0	0.49	Temporary	Private	Existing	Grading, gravel/rock, matting, bridging
072	Ashland	30.1	0.47	Temporary	Private	Existing	Grading, gravel/rock, matting
073	Iron	30.9	0.12	Temporary	Public	Existing	Grading, gravel/rock, bridging
074	Iron	30.9	1.89	Temporary	Public	Existing	Grading, gravel/rock, matting, bridging
075	Iron	32.1	0.28	Temporary	Public	Existing	Grading, gravel/rock, matting
076	Ashland, Iron	32.4	1.58	Temporary	Both	Existing	Grading, gravel/rock, matting, bridging
077	Iron	32.7	0.41	Temporary	Public	Existing	Grading, gravel/rock, bridging
078	Iron	32.5	0.32	Temporary	Public	Existing	Grading, gravel/rock, matting
079	Ashland, Iron	32.7	1.17	Temporary	Both	Existing	Grading, gravel/rock, matting
081	Iron	33.0	0.14	Temporary	Public	Existing	Grading, gravel/rock, matting
082	Ashland, Iron	33.2	2.39	Temporary	Both	Existing	Grading, gravel/rock, matting, bridging
083	Iron	33.9	0.95	Temporary	Public	Existing	Grading, gravel/rock, matting
084	Iron	34.3	1.27	Temporary	Both	Existing	Grading, gravel/rock, matting, bridging
085	Iron	33.4	0.21	Temporary	Both	Existing	Grading, gravel/rock, matting, bridging
087	Iron	36.3	1.12	Temporary	Public	Existing	Grading, gravel/rock, matting
088	Iron	36.6	0.23	Temporary	Public	Existing	Grading, gravel/rock, matting
089	Iron	36.9	1.60	Temporary	Both	Existing	Grading, gravel/rock, matting, bridging

Access road id	County (ies)	Approximate milepost [a]	Length (miles)	Temporary/ permanent	Public/private road	Existing/new	Anticipated temporary improvements [b]
090	Iron	37.2	0.60	Temporary	Public	Existing	Grading, gravel/rock, matting, bridging
091	Iron	37.1	0.09	Temporary	Public	Existing	Grading, gravel/rock, matting
092	Iron	37.6	1.47	Temporary	Both	Existing	Grading, gravel/rock, matting, bridging
094	Iron	38.0	0.01	Temporary	Both	Existing	Grading, gravel/rock
095	Iron	38.8	0.24	Temporary	Private	Existing	Grading, gravel/rock, matting
098	Iron	39.3	0.43	Temporary	Private	Existing	Grading, gravel/rock
099	Iron	39.8	0.26	Temporary	Private	Existing	Grading, gravel/rock, matting
101	Iron	40.3	0.10	Temporary	Private	Existing	Grading, gravel/rock
102	Iron	40.8	0.02	Temporary	Private	Existing	Grading, gravel/rock
103	Iron	40.8	0.14	Temporary	Private	Existing	Grading, gravel/rock
104	Iron	41.0	0.25	Temporary	Private	Existing	Grading, gravel/rock
203.01	Ashland	4.8	0.33	Temporary	Private	New	New, Improvements needed, Matting
204	Ashland	4.9	0.09	Temporary	Private	Existing	Grading, gravel/rock
Bayside 1	Ashland	N/A	0.17	Temporary	Private	Existing	No improvements
Bayside 2	Ashland	N/A	0.02	Temporary	Private	Existing	No improvements
MLV 1	Bayfield	0.0	0.28	Permanent	Both	Existing/new	Grading, gravel/rock, , matting
MLV 2	Bayfield	0.0	0.13	Permanent	Both	Existing/new	Grading, gravel/rock, culvert
MLV 2A	Ashland	2.5	0.16	Permanent	Private	Existing	Gravel/rock
MLV 3	Ashland	5.6	0.11	Permanent	Both	Existing/new	Grading, gravel/rock, culvert
MLV 4	Ashland	9.3	0.03	Permanent	Both	New	Grading, gravel/rock, culvert, matting
MLV 5	Ashland	16.1	0.10	Permanent	Both	New	Grading, gravel/rock, culvert, matting
MLV 5A	Ashland	21.8	0.04	Permanent	Private	New	New construction
MLV 5B	Ashland	28.1	0.05	Permanent	Private	Existing approach	New construction
MLV 6	Iron	40.0	0.39	Permanent	Private	Existing	Grading, gravel/rock
MLV 7	Iron	41.1	0.03	Permanent	Private	New	Grading, gravel/rock, culvert
South Range 1 Yard	Douglas	N/A	0.02	Temporary	Private	Existing	No improvements
South Range 2 Yard	Douglas	N/A	0.32	Temporary	Private	Existing	No improvements
South Range 3 Yard	Douglas	N/A	0.18	Temporary	Private	Existing	No improvements

MLV = mainline block valve; N/A = not applicable.

[a] Milepost where access road intersects with pipeline.

[b] Temporary improvements such as grading and addition of gravel/rock will be based on actual site-specific field conditions at the time of construction.

Source: Enbridge, 2023

Prior to construction use, off-ROW access roads could need modifications and improvements to allow for safe equipment movement to and from the construction ROW. These modifications could include vegetation removal, grading, and/or gravel placement. Enbridge does not propose to install gravel in wetlands crossed by access roads, unless required for safety reasons. Any such placement requires regulatory approval by DNR and could be further limited by permit conditions. It is Enbridge's intent to place construction matting on temporary access roads that cross wetlands. Enbridge could leave newly modified temporary roads upgraded for use during construction intact through mutual agreement with the landowner unless otherwise restricted by federal, state, or local regulations or permit requirements. Where modifications to access roads are temporary, the land used for access would be restored to original conditions, as practicable, and seeded and stabilized. Enbridge would coordinate the use of private roads with the landowners and the use of public roads with the appropriate local, county, or state road authority. Sections 1.4.3.9-1.4.3.12 describe permits required for waterway and wetland disturbance and storm water runoff management.

2.3.4 Access Across Waterways

2.3.4.1 Driving on the Bed

Prior to construction, the project corridor would need to be cleared of vegetation. To access the project corridor, waterways would generally be crossed via existing culverts, bridges, or fords. In some cases, new temporary clear span bridges are proposed to be constructed. Enbridge has indicated in Section 4.3.2 of its EIR (Enbridge, 2020e) that there could be situations where a vehicle or single piece of equipment, such as a crane, would drive on the bed of the waterway twice (one-pass during installation, one-pass during removal) to safely install and remove a temporary clear span bridge and prevent bridge failure. The locations where this would occur depend on conditions that could exist at the time of each temporary clear span bridge installation, and are not known in advance, except for the Tyler Forks low-water crossing at the intersection of Casey Sag Road and a forestry/fire road. All other equipment and vehicles would be required to use the temporary clear span bridge or existing waterway crossing.

Impacts to waterways from permitted driving on the bed would be limited by the following actions:

- Operating vehicles and equipment at the minimum speed required to maintain controlled forward motion.
- Operating vehicles and equipment to travel along the most direct route to safely cross the waterway.
- Inspecting vehicles and equipment prior to travel below the ordinary high-water mark, ensuring they are free of soil, debris, and fluid leaks.
- Operating vehicles and equipment should be conducted in a manner to prevent the displacement of soil within the waterway channel or on its banks during the driving activity.
- Minimizing the duration of the vehicles and equipment crossing the bed.
- Stabilization of any bank disturbance with erosion and sediment controls.

2.3.4.2 Temporary Clear Span Bridges

Access through the ROW to conduct construction activities often requires the installation of temporary clear span bridges to avoid equipment driving on the bed of waterways. Project activities at Enbridge's proposed waterbody crossings include the installation of temporary clear span bridges to move construction equipment across the feature and facilitate installation of the pipeline.

Temporary clear span bridges would have wood or metal approaches/ramps and completely span the waterway from top of channel to top of channel with no support pilings in the waterway. Temporary clear span bridges would be designed to withstand the maximum foreseeable flow of the stream, would not restrict the flow of water while the bridge is in place, would be constructed with clean materials, and would be securely anchored. Enbridge anticipates there would be situations where a single piece of equipment would need to drive across the bed of a waterway prior to installation to safely install the temporary clear span bridge.

To safely support construction equipment and vehicle use, each bridge would need to be securely installed and level, which could require minor grading and earth work above the ordinary high-water mark of the waterway. Approximately 400 square feet of bank disturbance would be anticipated for each temporary clear span bridge crossing.

Temporary bridge crossings would be installed during vegetation clearing activities and would not be removed until restoration activities are complete. Three types of temporary clear span bridge designs would be used, depending on the type and size of the waterway crossing. Temporary clear span bridge designs would be constructed out of timber matting or similar materials (Type A) or would otherwise be engineered bridges for larger crossings and greater capacity (Type B and Type C, depending on crossing length) (Figure 2.3-1).

Enbridge's proposed construction activities would result in the installation of approximately 187 temporary clear span bridges. Based on field observations, all but two waterway crossings would be less than or equal to 35 feet wide. Approximately 167 of the temporary clear span bridges would be Type A, a typical temporary clear span bridge constructed out of timber matting (or similar material; Figure 2.3-1) used for crossing smaller waterbodies. Additionally, Enbridge proposes installing two Type C temporary clear span bridges across Tyler Forks near MP 33.43 and MP 34.04, where the waterway crossings are approximately 68-feet and 58-feet wide, respectively.

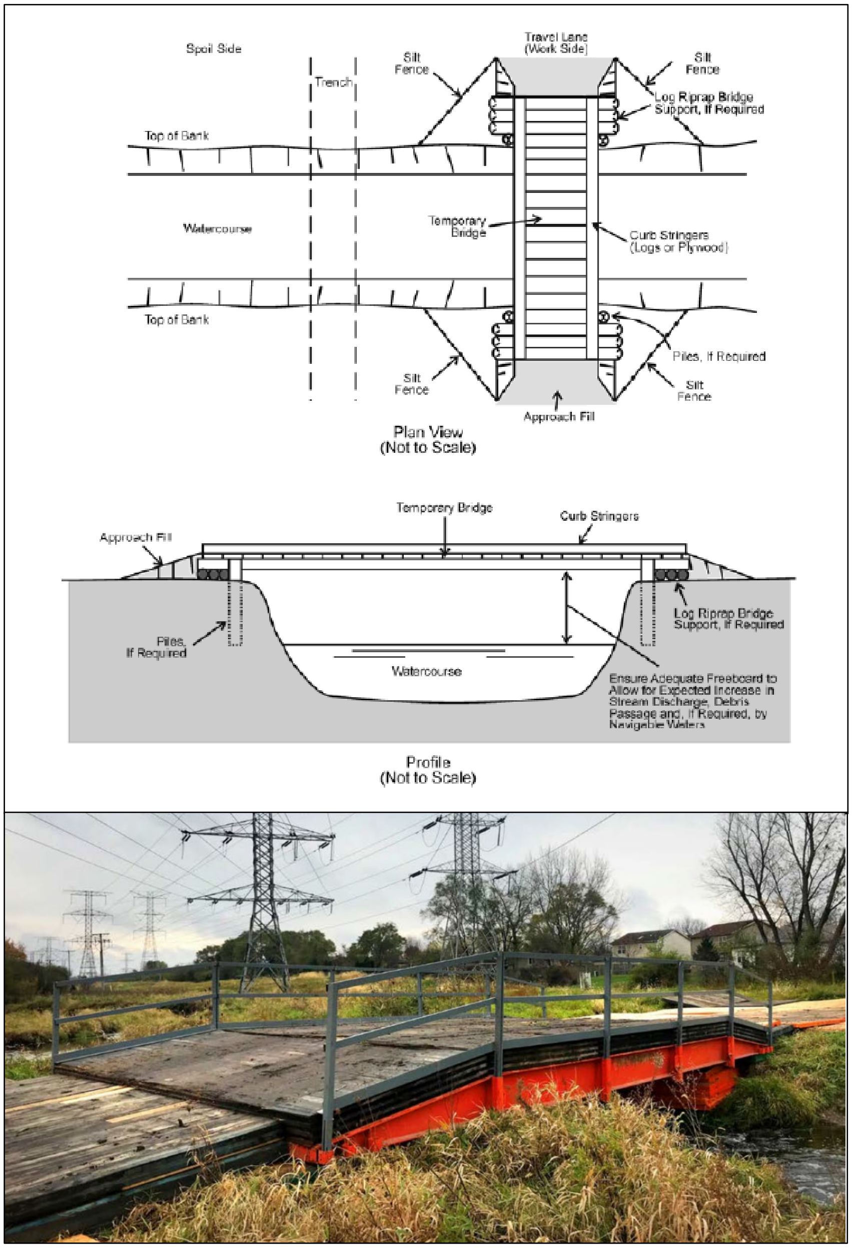

Figure 2.3-1 Typical temporary clear span bridge design (top) and Type B bridge (bottom)
Source: Enbridge's EPP (Appendix D)

2.4 Pipe Design

The pipeline would be constructed with a 30-inch outside diameter American Petroleum Institute (API) 5L PSL 2, Grade X70 steel pipe meeting PHMSA requirements governing transportation of hazardous liquids by pipeline (49 CFR Part 195). The pipe would be manufactured and constructed in accordance with standards issued by the American Society of Mechanical Engineers, NACE International, and API (Table 2.4-1). The entirety of the pipe would be manufactured with fusion-bond epoxy coating to protect against corrosion and would be inspected and integrity-tested at the factory. External cathodic protection systems would be installed to inhibit corrosion during the operating life of the pipeline (Section 2.1.4.1). Pipe installed by horizontal directional drilling (HDD) or any type of bore would also have an abrasion resistant overlay.

Table 2.4-1 Pipe specifications.

Design criteria	Value or standard
Longitudinal seam factor	1.0
Pipe coating	Fusion bond epoxy
Pipe diameter	30 inches
Pipe design factor	0.72
Pipe industrial specification	Api 5l psl2
Pipe grade	X70
Minimum yield strength	70,000 psi*
Tensile strength	82,000 psi
Wall thickness	0.500 to 0.750 inches

*psi=pounds per square inch

Pipe wall thickness for the pipeline would depend on the location it underlies, with thicker walls being used where stresses are greatest, such as at road and river crossings where HDD would be used for installation. The wall thickness for the Line 5 pipeline would range from 0.500 to 0.750 inch. Approximately 30 miles of general use pipes would have 0.500-inch-thick walls; approximately five miles of pipes at road crossings, railroad crossings, and valve assemblies would have 0.500-inch-thick walls; approximately three miles of HDD or direct bore crossings would have 0.625-inch-thick pipe walls; and approximately three miles of pipes at HDD crossings of railroad crossings would have 0.750-inch-thick pipe.

2.5 Pipeline Installation Methods Overview & Selection

Pipe installation can be completed in several different ways. The most common method is open cut trench installation. Other specialized trenchless methods can be used to cross waterbodies, wetlands, roads, and other features. This section describes the various methods and how Enbridge determined which to propose for crossing waterbodies, wetlands, and other sensitive features. Section 2.6 describes the typical pipeline construction sequence in greater detail. Section 2.8 explains the specialized construction techniques and procedures employed for waterbody and wetland crossings to address storm water and erosion, invasive species, and fugitive dust concerns. Additionally, Enbridge's Environmental Protection Plan (EPP, Appendix D) outlines construction-related environmental policies, procedures, and mitigation measures the company developed and committed to as means of reducing construction impacts to the environment.

2.5.1 Trench Installation Methods

Most underground pipelines are constructed by digging a long hole, or trench, in the ground, lowering the pipe in, then placing material above the pipe to fill the hole to the desired grade, also known as backfilling. Trenching is most often conducted using a backhoe or wheel-type ditch-digging machine. Backhoes are typically used to excavate the trenches in wetlands. Excavated material would be stockpiled within the approved construction ROW separate from the topsoil (Figure 2.5-1 and Figure 2.6-4). Construction equipment and vehicles would be confined to approved ROWs and additional temporary workspaces (Figure 2.2-1, Figure 2.2-3; and maps in Appendix E). Care would be exercised to protect drainage systems, such as ditches, swales, and drain tiles, and to repair or replace damaged drainage systems. Enbridge has proposed installing 75% of the proposed pipeline via trenching and the company's EPP (Appendix D) contains additional information regarding proposed trench installation procedures.

Figure 2.5-1 Pipeline trench installation in an agricultural setting. Excavated material is stockpiled separately from topsoil.
Photo: Stock image

Different trenching methods can be used to cross waterbodies and wetlands. “Wet” methods involve work in the waterbody or wetland while water remains present in or continues to flow across the in-stream work area. “Dry” methods involve isolation of in-stream work zones while bypassing the flow around the work zones using a dam and pump or dam and flume system. Table 2.5-1 overviews these methods, which are also described in Enbridge’s EPP (Appendix D).

Depending on soil conditions and trench depth, various methods are used to keep the trench open between excavation and backfilling operations. These methods could include sloping the sides of the trench and use of trench boxes or shields to support the sides of the trench. Where the soils are very prone to caving into the trench, sheet piling would be driven on either side of the trench prior to excavation. Enbridge completed geotechnical investigations to identify areas where this is likely to be needed (Figure 2.5-2).

The pipeline would be buried in accordance with PHMSA regulations (49 CFR Part 195), which stipulate a minimum of 3 feet of top cover for normal excavations and 18 to 30 inches of cover for rock excavations (depending on the location) to prevent damage to the pipeline from normal use of the land. The depth of cover would vary depending on permit requirements, landowner agreements, and site-specific conditions (e.g., depth of drain tile). Greater pipeline depths than those presented would result in greater amounts of ditch spoil that could require additional temporary workspaces for storage of the spoil. Additional details on trench installation methods, such as pipe installation and trench backfilling are presented in Section 2.6. Enbridge has proposed installing 75 percent of the proposed pipeline via trenching.

Table 2.5-1 Overview of pipeline waterbody crossing installation methods.

Method	Description	Applicability	Advantages	Disadvantages
Open cut (non-isolated "wet")	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 (Figure 14 in Enbridge's EPP, Appendix D).	Suitable for ephemeral and intermittent waterbodies where there is no perceptible flow (dry or frozen), such as agricultural ditches. This method could also be used in waterbodies that are part of a wetland complex where isolating the flow is not feasible. In Wisconsin, these are primarily waterbodies located within large, saturated wetlands, and waterbodies impacted by beaver dams.	• Rapid construction / installation. • Minimizes period of in-stream activity. • No need for specialized equipment. • Compatible with granular substrates and some rock. • Maintains stream flow. • No sediment release or relatively short duration of sediment releases (<24 hours).	• Could require implementation of erosion and sediment control BMPs to limit sediment release during excavation and backfilling. • Could interrupt stream flow.
Dry crossing (isolated): Dam and pump	Creates a dry work area by damming the flow up- and downstream of the crossing and pumping water around the work area. Dam materials could include but are not limited to sandbags, aqua dams, sheet piling, or street plates (Figure 15 in Enbridge's EPP, Appendix D).	Suitable for streams with low flow and defined banks where fish passage is not of concern. Works best in non- permeable substrate and may be preferred for crossing meandering channels.	• Provides relatively dry working conditions. • Maintains stream flow. • Minimal release and transport of sediment downstream unlikely to result in significant effects on aquatic habitat. • Could reduce trench sloughing and trench width.	• Requires specialized equipment and materials. • Minor sediment release during dam construction, dam removal, and as water flushes over area of construction. • Fish salvage could be required from dried up reach within the construction workspace. • Creates short-term barrier to fish movement. • Seepage could occur in coarse, permeable substrates.
Dry crossing (isolated): Dam and flume	Creates a dry work area by damming the flow up- and downstream of the crossing and installing flume to convey water. Dam materials could include but are not limited to sandbags, aqua dams, sheet piling, or street plates (Figure 16 in Enbridge's EPP, Appendix D).	Suitable for crossing relatively narrow streams with straight channels and 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.	• Provide relatively dry or no flow working conditions. • Maintains stream flow. • Could allow fish passage. • Minimal release and transport of sediment downstream unlikely to result in significant effects on aquatic habitat. • Could reduce trench sloughing and trench width.	• Minor sediment release during dam construction, dam removal, and as water flushes over area of construction. • Fish salvage could be required from dried up reach within the construction workspace. • Short-term barrier to fish passage if water velocity in culvert is too high.

Source: Enbridge, DNR

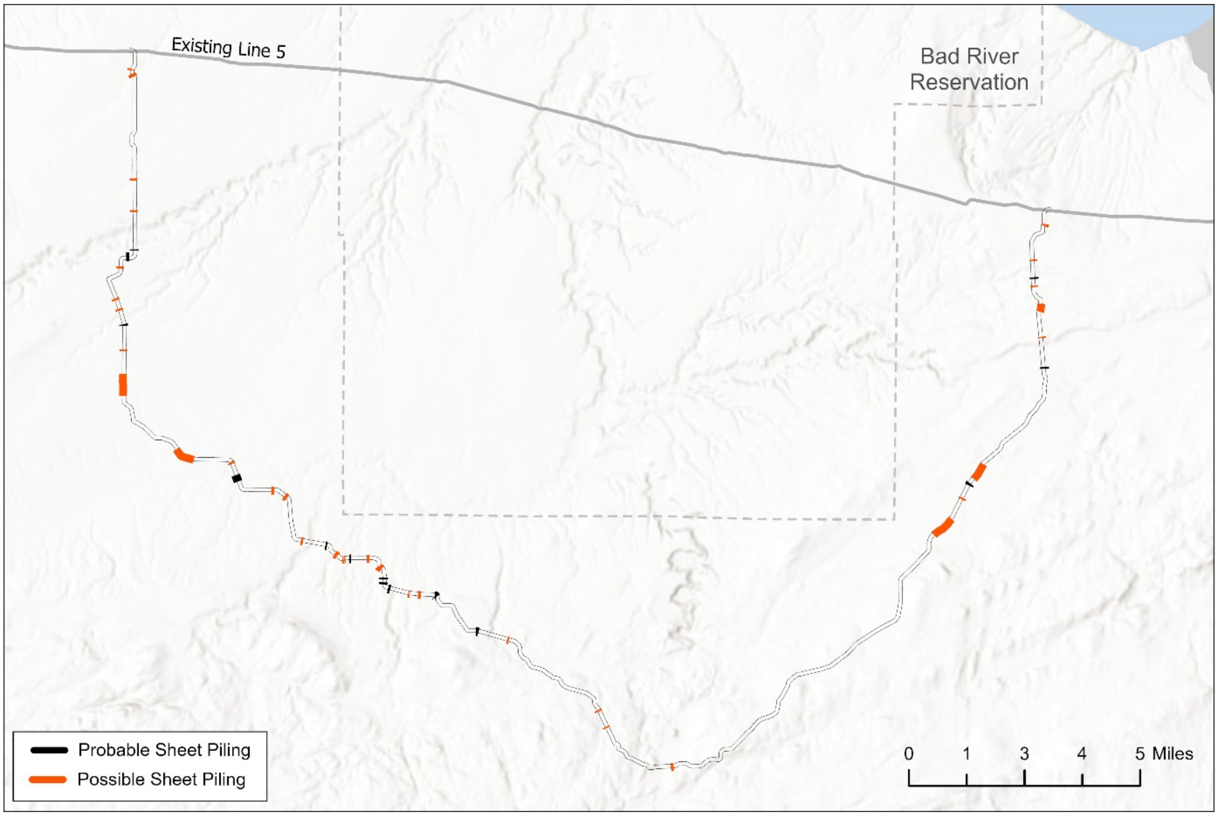

Figure 2.5-2 Possible sheet pile locations.

2.5.1.1 Open-cut Trench Method

The open-cut trench method, also referred to as a 'wet trench' method (Figure 14 in Enbridge's EPP, Appendix D) is used to cross streams and rivers that lack standing or flowing water within the construction work area at the time of construction. In-stream work including trenching and backfilling would typically be completed within 24 hours or less on minor waterbodies (i.e., those less than 10 feet wide) and 48 hours or less on intermediate waterbodies (between 10 and 100 feet wide) and could be further specified within waterway permits if necessary to protect the public interest in those waters. Open-cut trenching within a waterway results in removal or disturbance of material from the bed and is therefore regulated by DNR as "dredging." Enbridge proposes this method of pipeline installation in approximately 70 navigable waterways.

Figure 2.2-3 depicts a typical waterway crossing workspace. Enbridge proposes to use the following procedures during open-cut trench crossings:

- Sediment control measures and best management practices (BMPs) would be implemented before grading from the 20-foot vegetative buffer left on each stream bank.
- Spoil containment structures would be installed back from the stream bank so that spoil does not migrate into the stream.
- Grading would be directed away from the waterbody to minimize the potential for sediment to enter the stream. Grading of stream banks would be restricted to the trench line and areas necessary for safe bridge installation.

- After grading, backhoes or draglines would be used to excavate the trench. Where possible, excavating equipment would operate from one or both banks, without entering the stream. If equipment must encroach into the stream, it would operate on clean construction mats (free of soil and plant material prior to being transported onto the construction ROW).
- Streambed material would be segregated (e.g., the upper one foot would be stored separately from the remaining trench spoil) and placed within a spoil containment structure in approved construction work areas. Storage of streambed spoil within the stream would only be allowed if expressly approved in state or federal permits.
- Earthen trench plugs (hard plugs) between the stream and the upland trench would be left undisturbed during excavation of the in-stream trench to prevent diversion of the stream flow into the open trench and to prevent water that could have accumulated in the adjacent upland trench from entering the waterbody. Trench plugs would be removed immediately prior to pipe placement, and then be replaced when the pipe is in place.
- Trench water accumulated upslope of trench plugs would be dewatered and appropriately treated prior to trench plug removal.
- Backfilling would begin after the pipe is positioned in the trench at the desired depth. Backfill material would consist of the spoil material excavated from the trench and streambed unless otherwise specified in state or federal permits. The in-stream trench would be backfilled so that the stream bottom is as near as practicable to its preconstruction condition, with no impediments to normal water flow.
- For trenched waterway crossings, permanent stabilization of waterway crossings would begin within 24 hours of backfilling the crossing and prior to restoring flow. Restoration of the waterway and its banks would be completed as described in Section 2.8.12. Upon completion of bank stabilization, if flow bypass systems were implemented at the crossing, they would be removed and natural waterway flow would be resumed.

Unless the waterway to be crossed is completely dry below the ordinary high-water mark for the entire duration of the activity, including accounting for rain events during construction, the DNR would require trenching in the waterway be completed using a work zone isolation/flow bypass approach appropriate for the conditions of the waterway (Section 2.5.1.2).

2.5.1.2 Work Zone Isolation/Flow Bypass Methods

2.5.1.2.1 Dam & Pump Method

The dam and pump method (Figure 15 in Enbridge's EPP, Appendix D) is a work zone isolation system or flow bypass system suitable for low-flow streams and is generally preferred for crossing meandering channels. The dam and pump method involves damming of the stream upstream and downstream of the proposed trench before excavation and pumping water around the construction area. The following procedures would be used for dam and pump crossings:

- Dams made of sandbags, bladder dams (e.g., AquaDams ®), sheet piling, and/or steel plates would be constructed to prevent the stream from flowing into the construction area. The dams would be continuously monitored for a proper seal and additional sandbags, plastic sheeting, steel plating, or similar materials would be used where necessary to seal seeping water.
- Stream flow would be pumped around the construction area (commencing simultaneously with dam construction to prevent interruption of downstream flow) through a hose and be discharged to an energy dissipation device (splash pup or plywood sheets) to prevent downstream streambed scouring.

- The pump and fuel containers would be located on the upstream side of the crossing and would be placed in impermeable, sided structures that would act as containment units.
- The pump water intake would be suspended to prevent streambed sediment from entering the intake. The pump water intake would also be equipped with a screen, or equivalent device, to prevent fish from entering the intake.
- Pumps would have a capacity greater than the anticipated stream flow. The pumping operation would be staffed 24 hours per day, and pumping would be monitored and adjusted as necessary to maintain an even flow of water across the work area and near-normal water levels upstream and downstream from the crossing.
- Once measures to isolate the work area from the stream flow are in place, the open cut trenching method (Section 2.5.1.1) would be used to install the pipe.

2.5.1.2.2 Dam & Flume Method

The flume method (Figure 16 in Enbridge's EPP, Appendix D) is suitable for crossing relatively narrow streams that have straight channels and are relatively free of large rocks and bedrock at the point of crossing. The flume method involves placing flume pipe(s) in the streambed to convey stream flow across the construction area without introducing sediment to the water. The following procedures would be used for flume crossings:

- Flume(s) of between typically 40 to 60 feet in length and of sufficient diameter to transport the maximum anticipated flows to be generated from the watershed would be placed in the stream before trenching begins. The flumes would be aligned so as not to impound water upstream of the flumes or cause downstream scouring or bank erosion.
- The upstream and downstream ends of the flumes would be incorporated into dams made of sandbags and plastic sheeting (or equivalent). The upstream dam would be constructed first and would funnel stream flow into the flumes. The downstream dam would prevent backwash of water into the trench and construction work area. The dams would be continuously monitored for a proper seal. Adjustments to the dams would be made where necessary to prevent large volumes of water from seeping around the dams and into the trench and construction work area.
- Once measures to isolate the work area from the stream flow are in place, the open cut trenching method (Section 2.5.1.1) would be used to install the pipe.

2.5.1.3 Trench Installation in Shallow Bedrock Areas

Several areas have been identified along the project route where trenching operations are expected to encounter shallow bedrock or large boulders that are not readily removed by conventional means. The locations of known shallow bedrock or large boulders, referred to as blasting candidate areas, are shown in Figure 2.5-3 and are generally located between MP 19.8 and MP 32.8. These areas have been identified through mapping, hammer probing, test digs, hydro-vacuum excavation, hand auguring, and soil borings. Blasting would be conducted by drilling holes into the rock where removal is required and detonating explosives in those holes in a sequential pattern to break the rock into fragments while limiting the effects outside of the trench. The strength of the explosives used would be limited to that needed for excavation. Special mats are typically used over the trench during blasting to contain rock fragments where rock is particularly hard or where there is something to protect, such as an overhead utility crossing. The timing of detonating adjacent charges is planned to maximize the effect within the trench and minimize the effects outside of the trench area.

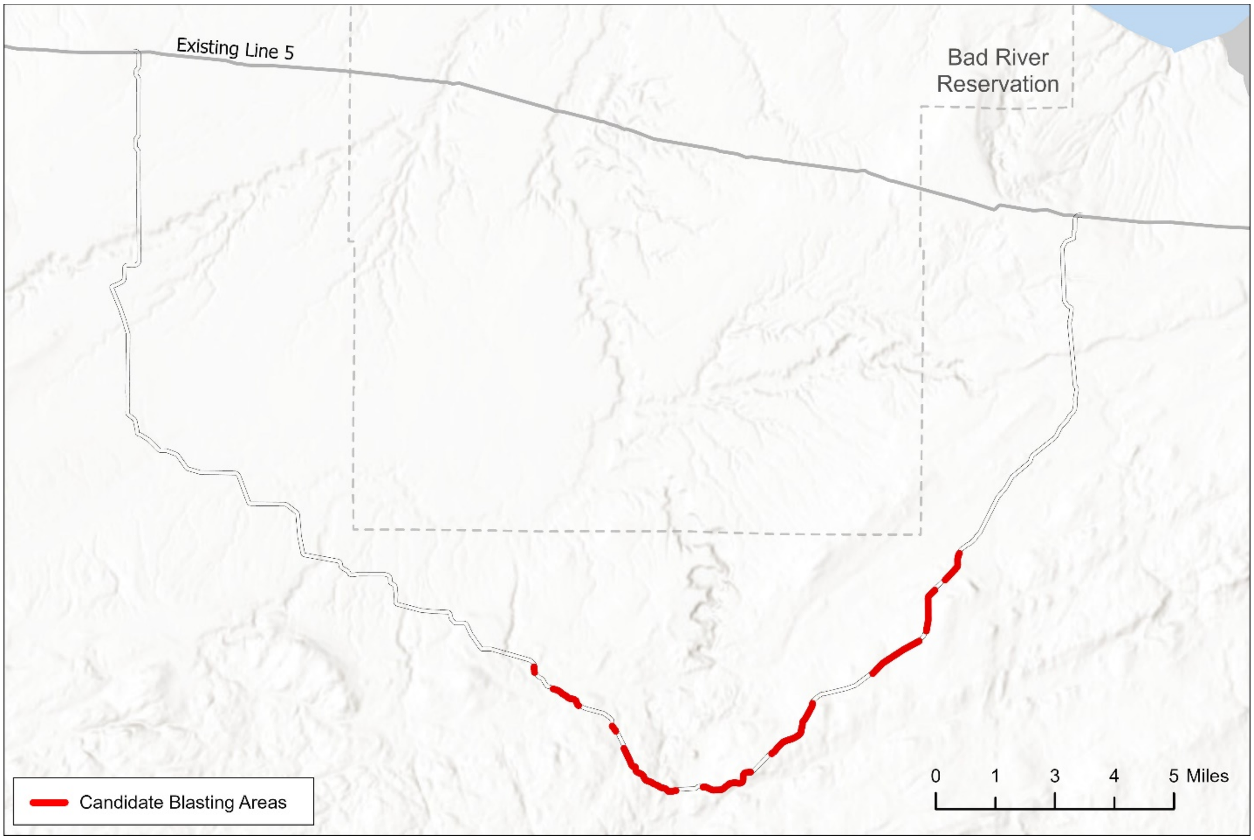

Figure 2.5-3 Candidate blasting locations identified by Enbridge.

Enbridge's General Blasting Plan (Appendix F) further describes methods that would be implemented to remove rock from trenches consistent with OSHA and DSPS standards (29 CFR § 1910.95 and Part 1926; Subchapter IV of SPS 307, Wis. Adm. Code). These methods include use of a blasting contractor with personnel licensed to conduct operations in Wisconsin, preparation of site-specific blasting plans, notifications to persons living or working in the vicinity of the blasting, control of explosives material, and monitoring. These regulations also set blast vibration limits for structures and underground utilities (Chapter SPS 307, Wis. Adm. Code). Enbridge has committed to conducting blasting in accordance with applicable federal, state, and local regulations and according to guidelines designed to control propagation of energy to protect persons and property in adjoining areas.

Care would be taken when blasting in the vicinity of water wells. For the proposed construction route, Enbridge determined that there are two water supply wells within areas identified as having shallow bedrock. These wells are located 200 feet or more from the proposed pipeline centerline where blasting would potentially occur. Enbridge would evaluate the use of alternative excavation methods, such as jack hammer, to avoid potential well damage from blasting.

2.5.1.4 Bedrock Crossing Areas

Enbridge's proposed route alignment would cross seven waterbodies where bedrock excavation could be required in concert with the previously described installation methods. DSPS would require a blasting contractor to employ practices to protect the waterway. Best management practices could also be employed to protect adjacent lands and could be required as conditions of applicable regulatory approvals.

Additional information on anticipated blasting effects can be found in Section 5.5.2.13. Following blasting activities and pipe installation, stream channels would be restored to as near pre-construction contours, alignment, and conditions as practicable. Trench plugs would be used to limit water flow along the pipeline, similar to other waterway and wetland crossings.

2.5.2 Trenchless Installation Methods

Trenchless methods, direct bore and horizontal directional drilling (HDD), allow for pipe placement in areas that are not conducive to open cut trenching but have suitable soils for a trenchless installation method. Trenchless methods can also be used to limit service interruptions of man-made features like roads and railroads. Table 2.5-2 lists locations where Enbridge proposes using these types of methods to cross waterbodies. Enbridge proposes using the direct bore method at one site to cross the Marengo River and two of its unnamed tributaries. Enbridge would use HDD for 12 other waterbody crossings, comprising approximately 15 percent of the length of the relocated pipeline. Enbridge would adhere to the measures specified in its EPP (Appendix D) and any additional conditions included in state and federal permits.

Table 2.5-2 Proposed trenchless waterbody crossing locations.

Waterbody/road & MP	Length (feet)	Method
White River – MP 4	4,485	HDD
Deer Creek – MP 6	1,790	HDD
Marengo River – MP 11	2,013	Direct Bore
Brunsweiler River – MP 14	2,809	HDD
Highway 13 – MP 15	2,018	HDD
Trout Brook – MP 16	2,356	HDD
Billy Creek – MP 18	1,788	HDD
Silver Creek – MP 19	3,674	HDD
Krause Creek – MP 22	2,092	HDD
Bad River – MP 24	1,788	HDD
Tyler Forks – MP 34	1,851	HDD
Potato River – MP 38	3,496	HDD
Vaughn Creek – MP 39	2,072	HDD
Total:	**32,232**	

2.5.2.1 Direct Bore Method

Direct bore or Direct Pipe™ installation is a trenchless pipeline installation method that uses a micro tunnel boring machine (TBM) in combination with a pipe thruster to tunnel a pipeline under a crossing. The micro TBM is attached to the front of the pipeline and is advanced along a shallow arc, pushed forward by the pipe thruster. Slurry lines return the drilling fluid and cuttings to the surface rather than through the borehole. The pipeline is installed in a single TBM pass. The method has the advantage of smaller diameter drilling space than an HDD with less cuttings resulting in less potential for an inadvertent release. This method has been proposed for crossing three navigable waterways–the Marengo River (near MP 11.2) and two unnamed tributaries of the Marengo River (near MP 11.4)–due to the presence of soft soils. For crossing railroads and some roads (Table 2.5-2), conventional direct boring between two excavations on either side of the feature would be used where required by the owner of the feature. Typical bore pits on both the entry side and exit side would be 120 feet long by 20 feet wide and approximately 10 to 15 feet deep. The variation in bore pit depth would depend on depth of road ditches and the need to maintain depth of cover, presence of existing foreign utilities to bore under, and type of bore machine used. Sheet piling could be used on the sides of bore pits in areas where side slumping or water infiltration pose safety concerns for workers in the bore pits.

Table 2.5-3 Proposed direct bore road and railroad crossing locations.

Crossing	MP	Crossing ID	Comment
Hegstrom Road	2.535	WI-AS-027.000-RX	
Olby Road	5.504	WI-AS-058.000-RX	
State Highway 112	8.642	WI-AS-088.000-RX	
Berweger Road	9.369	WI-AS-094.000-RX	
County Highway C	13.648	WI-AS-128.000-RX	
Van De Bruggen Road	13.780	WI-AS-132.000-RX	
Hanninen Road	14.622	WI-AS-140.001-RX	
State Highway 13 and WATCO Railroad	16.185	WI-AS-146-010-RX	Railroad & road bored crossing
North York Road	16.400	WI-AS-148.000-RX	
County Highway C	21.904	WI-AS-195.000-RX	
Wisconsin State Highway 13	23.965	WI-AS-210.007-RX	
Vogues Road	35.107	WI-IR-007.000-RX	
Curry Road	38.528	WI-IR-021.003-RX	
Stienmetz Road	39.082	WI-IR-027.003-RX	
WATCO Railroad	39.232	WI-IR-022.000-RX	Railroad only bored crossing
West Aggies Road	40.147	WI-IR-037.004-RX	
U.S. Highway 2	40.297	WI-IR-039.0004-RX	

Note: List does not include road or railroad crossings within HDDs

2.5.2.2 Horizontal Directional Drilling Method

The HDD or "guided bore" method involves drilling a pilot hole under the surface resources (e.g., wetlands or waterbodies), then enlarging the hole through successive ream borings with progressively larger drill bits until the hole is large enough to accommodate a pre-welded segment of pipe. Throughout the process of drilling and enlarging the hole, drilling fluid would typically be circulated to lubricate the drilling tools, remove drill cuttings, and provide stability to the drilled holes. The drilling fluid would consist primarily of water (approximately 95%) and bentonite, which is a type of clay. Water for the drilling fluid would be obtained from a known safe source free of bacterial and chemical contamination (DNR, 2022b). Additives could be included in the drilling mud to improve its ability to transport cuttings to the surface, provide a stable hole, and lubricate the drilling tools. Enbridge has stated in its Construction Site General Permit application that the company will only use additives that are considered pre-approved for use in potable well drilling (§ NR 812.091, Wis. Adm. Code) or are listed on the DNR's Approved Horizontal Directional Drilling Products List (DNR, 2022c). Pipe sections long enough to span an entire crossing would be strung and welded along the construction work area on the opposite side of the waterbody and then pulled through the drilled hole. This method can be used for large river crossings where the flow of water cannot be readily managed and in sensitive areas where land disturbance needs to be avoided to the maximum extent practicable.

Based on the pipeline diameter and thickness that is proposed for this project, the HDD method would require a minimum length of approximately 1,300 feet with 56 feet of depth and a 90-foot bottom tangent (under optimal conditions). During installation, the pipe would be pulled through a curved, underground pathway. The minimum installation length (1,300 feet) could be extended by modifying the angle of entry and exit locations, the elevations of entry and exit locations, the depth of primary and non-primary obstacles, and the burial depth among other factors. If the hydrofracture factor of safety or the hydrotechnical scour susceptibility require adjustments that affect HDD depth, those adjustments could in turn affect the length of the HDD. Installation modifications could affect the length of the HDD and pullback length; for example, Enbridge states the shortest HDD drill path for the proposed project is 1,774 feet and would require an additional 1,800 feet for assembly of the pullback segment of pipeline (Enbridge, 2023b).

Land disturbance associated with HDDs is primarily located in the work areas at the beginning and end of the drilling path. The drilling path itself is generally cleared of woody vegetation but is typically not subject to grubbing operations. A wire may be temporarily placed on the ground and across waterbodies along the bore path as part of the system to guide the drilling operation. Typically, access along the drilling path by foot or low ground pressure vehicles would be maintained to allow monitoring of the drill path. At the beginning, or "rig side," of the drill paths, a 200-foot by 250-foot work area would be needed for equipment (Figure 2.5-4), drilling mud management, and material storage. At the exit, or "pipe side" (Figure 2.5-5), a 150-foot by 250-foot work area would be needed for equipment, drilling fluid management, and hydrostatic testing equipment. Attached to this work area would be a pipe assembly area in line with the drill path that is 100 feet wide by the length of the drill path plus 200 feet. Access to both the entry and exit work areas would need to accommodate tractor trailer deliveries.

Estimated construction durations for HDD installations are longer than for trenched installations. If work is conducted in 12-hour shifts, durations of 20-98 days are anticipated for each HDD crossing planned for the Line 5 relocation project (See Appendix G). These durations would be reduced if a second 12-hour shift would be implemented each day.

Twenty-three waterbodies would be crossed via HDD as some of the 12 HDDs would cross multiple streams and wetlands. The USACE asked Enbridge to provide site-specific commentaries for each proposed HDD crossing. The reports provided by Enbridge (Appendices H and AH) provide general site descriptions, photos of proposed staging areas, summaries of subsurface conditions, design geometry, installation loading analyses, hydrofracture analyses using the Delft method, construction durations, feasibility assessments, and design drawings. In addition, the DNR asked Enbridge to submit HDD inadvertent release mitigation and contingency plans for each of the proposed HDD crossings. These plans (Appendix N) identify measures to prevent and mitigate inadvertent releases, which are releases of drilling mud to the environment at points other than the HDD inlet and outlet mud pits and the drill hole. The plans include a list of the equipment the contractor would have at the site for use in responding to an IR. The contingency plans also include details on communication protocols, contractor means and methods, response decision points, drilling equipment monitoring details, an inventory of equipment, and release containment methods.

Figure 2.5-4 HDD drill rig.
Photo: Matt Jacobson, DNR, October 25, 2021, in Michigan

Figure 2.5-5 HDD exit side with pipe.
Photo: Amy Minser, DNR, December 5, 2023, in Illinois

Pipeline segments installed by HDD (approximately 15% of the total length of the relocated pipeline) would avoid disturbance within streambeds and along banks unless it became necessary to clean up an inadvertent release. HDD installation would also avoid anticipated effects on streamflow and fish passage. Less restoration would be required between the entry and exit points, but a larger area of restoration would be needed at the entry and exit points. Enbridge did not propose using the HDD method for more of the project due to what the company has stated as the following risks, limitations, and considerations:

- Successful completion of an HDD depends on material being drilled through. Attempting an HDD through fractured or unconsolidated subsurface material can increase the risk of inadvertent releases or failure to successfully complete the HDD.
- Design of an HDD requires collection of geotechnical information along the proposed HDD drill path early in the design and evaluation stages. Gathering this information requires access to the HDD sites, which can involve clearing, installing matting through wetlands, bridging waterbodies, and ground disturbance at the geotechnical boring sites.
- The footprint needed to install a 30-inch pipe via HDD can impact feasibility due to the following factors:
    - HDDs require a minimum straight ROW length of approximately 3,600 feet. If this length is not available, then additional ROW is required, which can increase impacts to wetlands and waterways and result in no net reduction of wetland and waterway impacts due to the use of HDD.
    - If a pipe staging area extends across a local road, it can require that road to be closed for a couple weeks or more.
    - HDDs require a long flat or gently sloped staging area slightly longer than the HDD drill path to fabricate the pipe string and allow continuous pullback of the pipe.
- Due to the depth of HDD installation, the pipeline cannot be accessed for maintenance if there were to be an integrity issue between the entrance and exit. An integrity issue along the HDD segment would require the complete replacement of the HDD segment with new pipe, resulting in additional impacts. Hydrostatic testing is completed prior to pipe installation to allow any concerns to be addressed prior to pulling the pipe into place.
- Installation via HDD takes longer than trench installation, resulting in a longer duration of construction disturbance at the drilling site, in adjacent workspace, and along the access routes to and from the HDD workspaces. For example, a 1,300-foot HDD and associated workspace, including pipe assembly workspace, can require 1,500 feet of additional disturbance or more. The drilled installation of 1,300 feet takes a minimum of approximately eight weeks. The same 1,300 feet of pipeline installation by open cut trench installation would take two to three weeks to complete and restore. Over the 8-week period, when the HDD would be being completed, access routes to and from both sides of the HDD ROW cannot be restored. The result is the direct construction impacts remain in place longer on each side of the HDD, which could increase secondary construction impacts.
- There are a limited number of experienced HDD contractors and rigs capable of installing a 30-inch diameter pipeline available to support the work across the country. Enbridge has stated that they have been able to contract for sufficient equipment and crews to complete the proposed HDDs and direct pipe installation locations. Adding additional HDDs would require extending the construction calendar by months or contracting for additional crews of unknown skill and experience.

- Increased truck traffic would occur along routes leading to the entry and exit work areas over the duration of the HDD installation. This would include water transported to the site to formulate the drilling fluid and be used for hydrostatic testing of the HDD pipe segment prior to installation along with other supplies and equipment. Disposal of drilling fluid can also increase traffic.
- As the length of an HDD increases, the risk of failure also increases. When all other factors are equal, HDDs at or near the minimum practicable length have the least likelihood of in-hole failure.
- Successful installation using the HDD method is not guaranteed. Failure can increase environmental disturbance spatially as well as temporally. Failure can include any of the following:
  - Drill hole collapse results in a loss of the drill hole as well as potential surface subsidence.
  - Drilling equipment can break off or become lost down hole. Efforts to retrieve lost drilling equipment extends the duration of the drilling activity. Unrecoverable drilling equipment could also result in a need to abandon the current drill hole path and require reinitiating the HDD process, along an adjacent pathway, from the pilot hole stage.
  - Damage to the pipe (e.g., ovality, pipe coating loss, gouging of the steel) during pullback or pipe installation caused by unforeseen obstructions not identified by the geotechnical investigations could result in the completed HDD being unusable and necessitate reinitiating the HDD process.
  - Pullback failure—an infrequent type of HDD failure that occurs when drawing the assembled pipe through the completed bore hole—can occur if the pipe becomes lodged and cannot be freed, resulting in the need to cut off the downhole segment of pipe and begin drilling again along an adjacent pathway.
- Installing the pipeline by HDD is typically at least three times more expensive than installing the pipeline by trenched construction methods. Additional costs would include specialized equipment and work crews, additional engineering and geotechnical investigations, drilling fluid material and mud disposal, thicker walled pipe, and mainline trenching crew move-arounds. The mainline trenching crew move-arounds would require loading all the equipment, materials, and personnel and transporting them around the HDD. Once equipment, material, and personnel are transported around the HDD and unloaded, there is travel back to the ROW on the other side of the HDD. Mainline crew move-arounds range from a few hundred to several hundred thousand dollars per move-around and take a material amount of time to complete, which adds time to the construction schedule and the duration of ROW disturbance (Enbridge, 2023b).

2.5.3 Waterway Crossing Method Selection

Each waterway crossing method has benefits, challenges, and risks that must be assessed in the context of site-specific conditions. In response to regulatory agency requests, Enbridge provided Figure 2.5-6, which summarizes Enbridge's process for selecting and proposing waterway crossing installation methods.

Since the proposed pipeline would cross approximately 200 navigable waterways of various sizes, Enbridge has assumed that trenching, which can typically be completed in less time than trenchless installation methods, would generally be the least impactful in terms of duration of disturbance for most locations. The main drivers for Enbridge's decision to propose using a trenchless method included large waterways with high flows or deep depths; waterways with steep banks; waterways that had bank materials that would be difficult to restore; feasibility based on geotechnical data; impacts on navigation; the waterway designation; and presence of endangered species. In these types of situations, open-cut trenching could require the installation of more extensive flow by-pass systems, the driving of vehicles/equipment on the bed, and/or the side-casting of excavated materials below the ordinary high-water mark. The waterway crossing methods proposed for specific waterways have been selected based on site-specific conditions for those waterways. Due to the number of small waterways, Enbridge has not individually assessed all waterways. The DNR requested and received site-specific narratives on specific crossings. To illustrate this process, the Enbridge narrative for MP 14.7 (Unnamed Tributary to Brunsweiler River) is included below:

> "*Waterbody sasc1006p is a perennial stream bordered by a floodplain wetland complex. The identified ordinary high-water mark is approximately 8 feet wide with water's edge to water's edge distance at the time of survey being approximately 4 feet and water's depth of approximately 0.5 feet.*
>
> *The adjacent wetland (wasc1033) includes both emergent as well as shrub-carr habitat. Construction will temporarily disturb approximately 0.17 acre of wetland (approximately 0.05 acre of emergent wetland and approximately 0.12 acre of shrub-carr wetland). Approximately 0.07 acre of shrub-carr wetland will be converted to emergent wetland following restoration.*
>
> *The unnamed tributary to the Brunsweiler River as described above is not a wide, or deep, fast flowing waterbody. Based on these factors, the open-cut flow path would be followed on the decision flow chart. Since the waterbody is classified as a perennial tributary to a trout stream, Enbridge selected a dry crossing method to reduce the potential for downstream sediment transport during active construction.*
>
> *Although the waterbody is located in a valley with slopes greater than 20 percent on both the east and west approaches, these slopes can be reconstructed using BMPs and restoration techniques, such as installation of erosion control blankets, trench breakers, slope breakers, and reseeding. Enbridge is developing a site-specific slope restoration plan for this location incorporating these BMPs. Enbridge will submit this plan to the DNR upon completion of the drawing.*
>
> *Although technically feasible based on desktop analysis, an HDD of sasc1006p using a general minimum HDD drill radius of approximately 1,300 feet would require additional workspace that would likely increase the impact on some neighboring wetlands, require additional tree clearing, place the pullback section of pipe within 200 feet of a residence, and would increase the activity level and duration of construction. The proposed crossing method will minimize in-stream sedimentation. Based on a literature review and modelling results, the proposed crossing method will have only a minor, localized, and temporary effect and will not impact stream-wide water quality, while avoiding these secondary impacts.*" (Enbridge, 2023b).

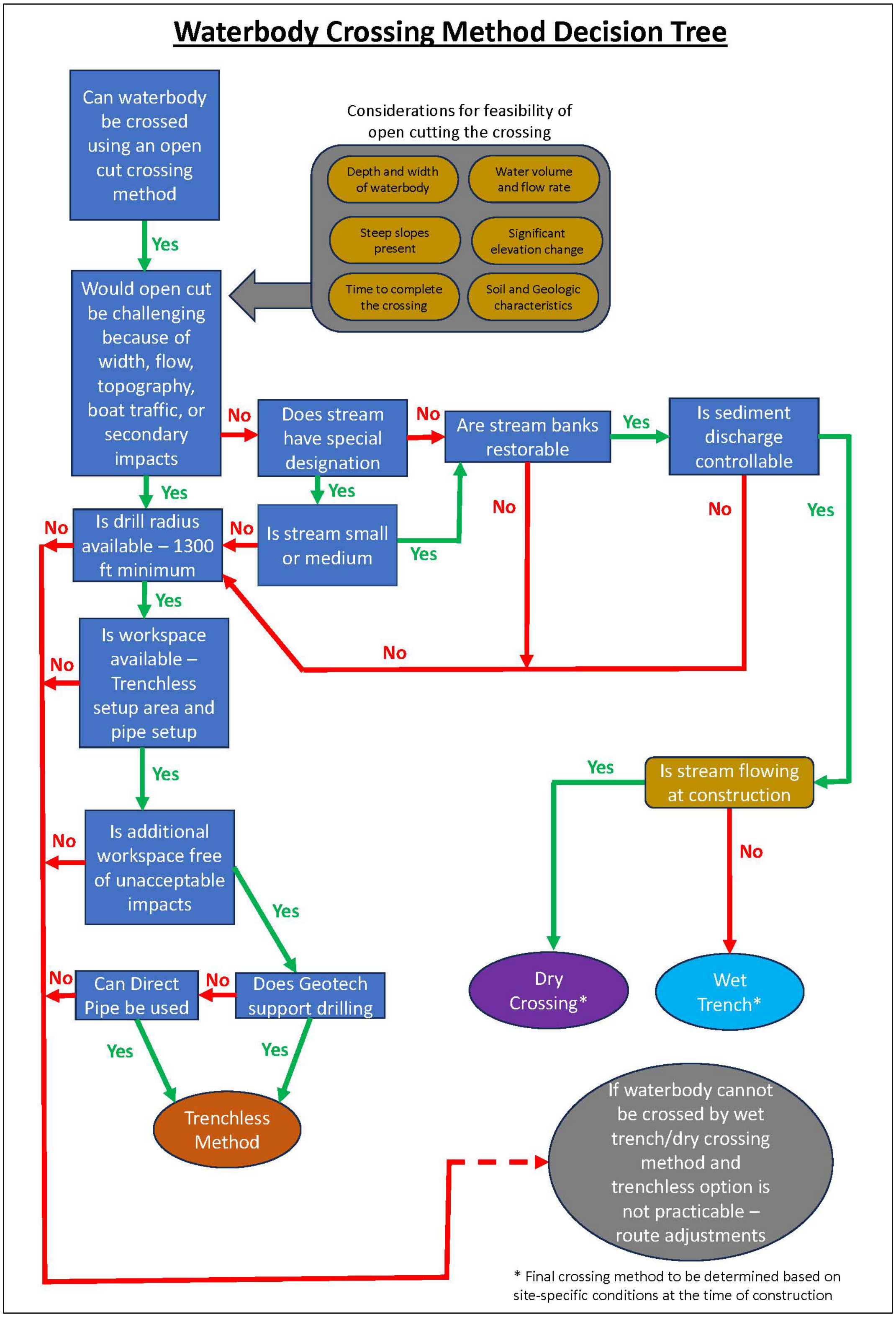

Figure 2.5-6 Enbridge's decision tree for selecting proposed waterbody crossing methods.
(Enbridge, 2023b)

2.6 Construction Phases & Sequencing

Pipeline construction generally proceeds as a ‘moving assembly line,’ with each construction crew proceeding along the pipeline ROW in a continuous operation with each step being completed in sequence (Figure 2.6-1). Once a crew completes work in an area, the crew would move on to the next area where the same type of work is required, and the crew behind them would begin the next type of work in the sequence. Constructing the pipeline in short segments using an assembly line approach would limit the total area disturbed at the same time.

Pipeline construction activities for Enbridge’s proposed Line 5 pipeline relocation route would generally progress as follows:

- ROW acquisition
- Preparation of the ROW, including access road construction and additional temporary workspace preparation, ROW clearing and grading, and installation of sediment and erosion controls for the ROW, access roads, and additional temporary workspaces
- Hauling and stringing pipe
- Trench excavation
- Trench dewatering (if necessary)
- Pipe joint field bending
- Pipe joint line-up, welding, and weld inspection
- Field coating
- Pipeline placement
- Trench backfilling
- Hydrostatic test water appropriation and pipeline hydrostatic testing
- Treatment or discharge of hydrostatic test water in accordance with WPDES permit conditions
- Cleanup and ROW restoration
- Revegetation
- Post-construction monitoring

The following sections describe the activities associated with each step outlined above. Sections 2.5.2 and 2.8.5 describe the specialized construction techniques for crossing waterways. Section 2.8.7 describes the specialized techniques for crossing wetlands. The construction process would be coordinated to minimize the duration of disturbance of an individual tract of land to the extent practicable, stabilizing disturbed areas before moving on to new areas. The Construction Site General Permit requirements would require timely stabilization to limit the duration of soil exposure. Stabilization would generally include temporary or final seeding, hydroseeding, erosion control mat installation, placement of anchored straw, or installation of proposed gravel surfaces. Where specialty crews are required for HDD, waterway crossings, and other activities, the work would occur on separate timelines. Enbridge’s EPP (Appendix D) presents additional detailed construction and site restoration information.

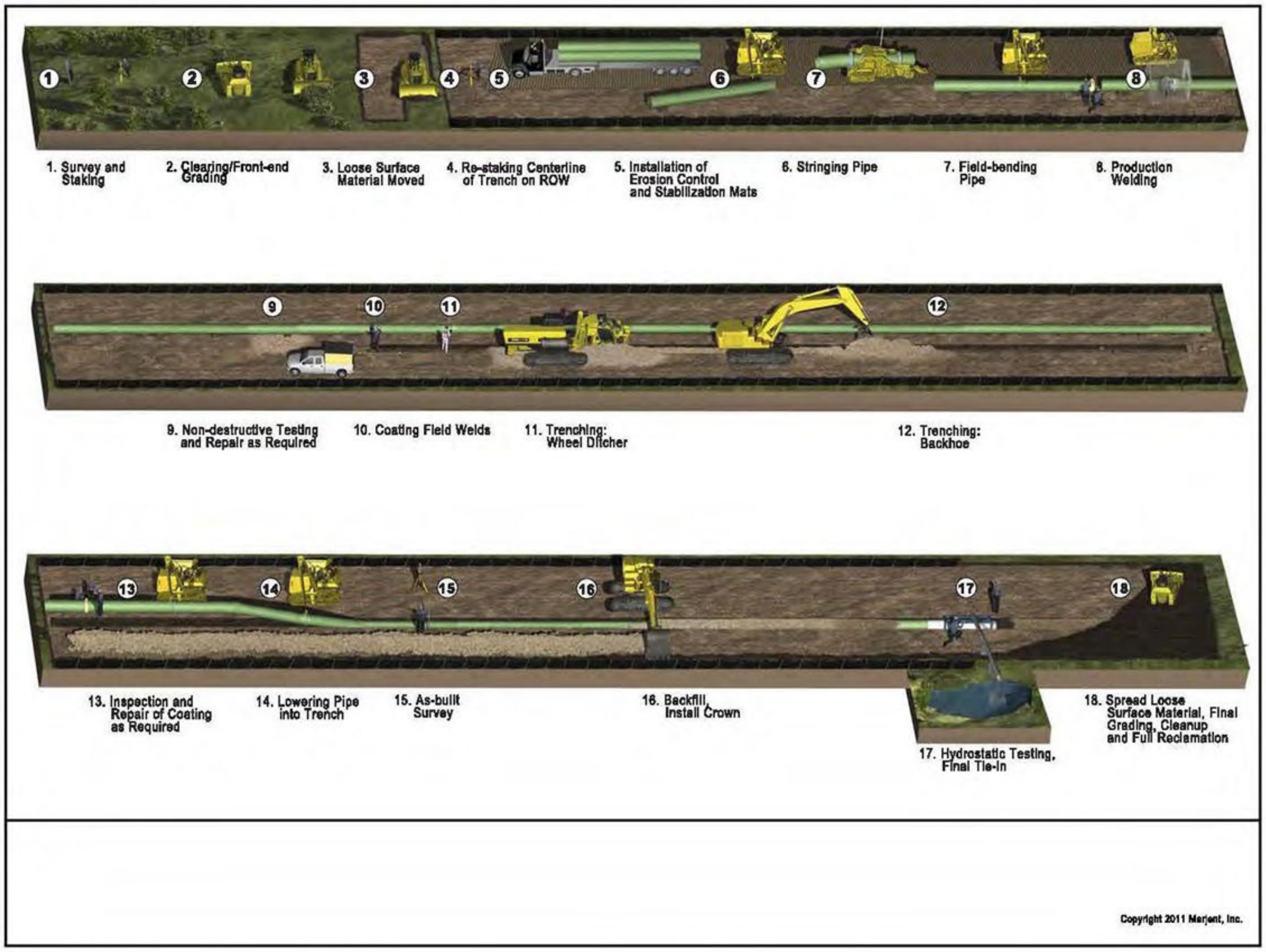

Figure 2.6-1 Typical pipeline construction sequence.

2.6.1 Right-of-Way Acquisition

Enbridge’s proposed pipeline relocation route is located primarily on private lands. Enbridge has reached option agreements and/or easement agreements with all landowners along its proposed Line 5 relocation route.

2.6.2 Preparation of ROW, Access Roads, & Additional Temporary Workspaces

Civil survey crews would stake the pipeline centerline, the construction ROW, and the locations of approved access roads and additional temporary workspaces prior to clearing vegetation or ground disturbances. Sensitive areas like wetlands, waterbodies, cultural resources, and other environmentally sensitive areas would be marked with flagging, signs, and fencing. The pipeline centerline would be marked at designated intervals, at known foreign line crossings, and at points of intersection. Crews would modify or remove fences when encountered within the construction area or, if necessary, for ROW access. Prior to initiation of staking, Enbridge would notify landowners.

2.6.3 Installation of Sediment & Erosion Controls

Where access allows, temporary erosion control devices would be installed at the base of sloped approaches to streams, wetlands, and roads. Where vegetation limits access, these devices would be installed following vegetation clearing and prior to grubbing (root and stump removal) and grading activities. Temporary devices would be installed at the boundaries of the construction ROW as shown on the applicable site-specific erosion and sediment control plans. Additional temporary sediment and erosion control devices would be installed as considered necessary to protect vulnerable areas outside of the construction ROW. Proposed temporary erosion control devices are shown on the maps in Appendix E.

2.6.4 Clearing & Grading

Clearing would be limited to the extent needed for access and construction of the pipelines. Enbridge's contractors would clear the ROW in accordance with applicable permit conditions and landowner agreements, would protect trees to the extent possible, and would remove stumps where necessary. During the initial ROW clearing process, matting would be installed where needed to ensure stable work conditions and reduce impacts in environmentally sensitive areas. The contractor would haul stumps and debris created from preparation of the construction area to an approved disposal site, mulch, or otherwise handle in accordance with applicable permit conditions. Non-merchantable timber and slash would be disposed of by mowing, chipping, grinding, or hauling to an approved offsite disposal facility or used in stabilizing erodible slopes or construction entrances. In non-agricultural, non-wetland areas, and with landowner approval, wood chips may be uniformly spread (at less than 1-inch thickness) across the construction ROW where they would ultimately be incorporated into the topsoil layer during grading activities. If proposed, Enbridge would need to obtain the appropriate permits to burn non-merchantable wood (Section 1.4.3.15).

Within wetlands, grading would be confined to the area of the trench, except where required to ensure safety and to restore the construction ROW after backfilling the trench. Vegetation and trees within wetlands would be cut off at ground level, leaving existing root systems intact. Cleared debris would either be removed from the wetland for disposal or would be left in the wetland and spread evenly in the construction ROW to a depth not to exceed two inches which would allow for normal revegetation, as specified in state and federal permit conditions.

At some sites, the clearing crew and related equipment, as well as equipment necessary for installation of temporary clear span bridges or construction matting, could require a single pass through the stream bed to clear bank vegetation, unless restricted by state or federal permit requirements or other regulations. A fence crew, typically operating in conjunction with the clearing crews, would cut and brace fences and would install temporary gates along the route in accordance with landowner agreements to control livestock and limit public access. Avoidance areas would be signed and fenced to prevent disturbances from construction activities. An environmental crew would work in conjunction with the clearing crew to install erosion and sediment controls following vegetation removal and prior to grubbing (removal of stumps, roots, buried logs, and other debris) and grading activities. Proposed erosion and sediment controls and temporary clear span bridges are shown in Appendix E. These erosion and sediment controls would be required to be inspected and maintained throughout the construction and restoration phases of the project consistent with Enbridge's EPP (Appendix D) and state and federal permit conditions.

When crossing streams and rivers, a 20-foot buffer of undisturbed herbaceous vegetation would be left on all waterbody banks as measured from the ordinary high-water mark during initial clearing, except where grading is needed for clear span bridge installation or where specified by applicable regulations and/or state or federal permit conditions. Woody vegetation within this buffer would be cut and removed during clearing, leaving the stumps and root structure intact. Non-woody vegetation and the soil profile would be left intact until trenching of the stream crossing is ready to begin. Sediment control measures would be installed and maintained at the 20-foot buffer line adjacent to streams immediately after clearing and prior to initial ground disturbance. Use of this 20-foot buffer along with Enbridge's other BMPs outlined in its EPP (Appendix D) is intended to reduce sediment discharge to adjacent waters as required by § NR 151.11, Wis. Adm. Code.

Following clearing or topsoil removal, the construction work area would be graded where necessary to provide a level work surface and safe working area, accommodate pipe-bending equipment, and allow the operation and travel of construction equipment. More extensive grading would be required in steep side slope or vertical areas and where necessary to prevent excessive bending of the pipeline. Enbridge's contractor would grade the construction area only to the extent necessary to provide a safe work area and would do so in a manner that minimizes effects on natural drainage and slope stability.

Topsoil would be separated from subsoil to preserve the physical and chemical properties that are conducive to good plant growth in selected areas where soil productivity is an important consideration, such as in hayfields, pastures, residential areas, golf courses, unsaturated wetlands, and other areas as requested by a landowner or as specified in Enbridge's plans, commitments, or state or federal permits. In deep soils (more than 12 inches of topsoil), topsoil would be stripped to a minimum depth of 12 inches, unless otherwise specified by other plans, permit conditions, or the landowner. If less than 12 inches of topsoil are present, the topsoil would be stripped to the depth that is present. When constructing in wetlands without standing water, up to 12 inches of topsoil would be stripped from the trench line and stockpiled separate from trench spoil to preserve the native seed stock. DNR Technical Standard 1059, Seeding for Construction Site Erosion Control, states that "Permanent seeding requires a seedbed of loose topsoil to a minimum depth of 4 inches with the ability to support a dense vegetative cover" (DNR, 2003). Additional space could be necessary for spoil storage when stripping more than 12 inches of topsoil.

A visible separation or physical barrier between the topsoil and subsoil piles would be maintained to prevent mixing (Figure 2.6-4). Topsoil would not be used to construct trench breakers or to pad the pipe. Stockpiled topsoil and spoil piles would be located outside of water conveyances (i.e., ditches, swales, and waterways) to maintain natural drainage. Figures 1, 2, and 3 of Enbridge's EPP (Appendix D) depict topsoil segregation methods.

Typically, topsoil would not be segregated in forested areas or wetlands with standing water. Topsoil segregation is challenging in forested areas because there is typically very little topsoil. Roots and stumps make it difficult or otherwise impractical for construction equipment to adequately segregate the topsoil. Stumps are left in place, except for in the open trench area, and help provide stability to the soil following construction. Vegetation is cut to ground level within the work zone, and stumps and roots are left intact outside the trench excavation zone. Standing water wetlands can also make topsoil segregation difficult due to the liquid nature of the saturated soils. The saturated state of the soils could cause the soils to flow, making it challenging to create distinct separate piles. Enbridge states in wetlands with standing water, they would attempt to segregate as much of the organic layer as possible based on site/saturation conditions. Topsoil would be segregated to the extent practicable in areas of steep side slopes adjacent to wetlands and waterbodies, including forested areas, where excavating subsoil to create a level workspace. A more detailed discussion of topsoil segregation is in Enbridge's EPP (Appendix D). Restoration of areas where topsoil could not be segregated would require additions of topsoil during restoration to meet the 4-inch topsoil requirement in the DNR Technical Standard 1059, Seeding for Construction Site Erosion Control.

2.6.5 Hauling & Stringing Pipe

Coated pipe, valves, and fittings would be hauled by truck from material storage yards to various points along Enbridge's proposed Line 5 relocation route. These materials would be offloaded along the construction route using side boom tractors, mobile cranes, or vacuum lifting equipment. Prior to trench excavation, pipe would be placed (strung) along the construction ROW and arranged to be accessible to construction personnel (Figure 2.6-2, Figure 2.6-3).

Figure 2.6-2 Example of pipe stringing.
Photo: Enbridge

Figure 2.6-3 Aerial photo of construction workspace with pipe staged next to trenches.
Photo: Stock image

2.6.6 Trench Excavation

Detailed information of trench excavation can be found in Enbridge's EPP (Appendix D). Trenching is typically conducted using a backhoe or wheel-type ditch-digging machine. Backhoes are typically used to excavate the trenches in wetlands. Excavated material is stockpiled within the approved construction ROW, separate from the topsoil (Figure 2.6-4).

Figure 2.6-4 Trenching across an unnamed stream and riparian wetland, Enbridge Southern Access, Jefferson County.
Photo: Ben Callan, DNR

Construction equipment and vehicles would be confined to approved ROW and extra workspaces. Methods to protect drainage systems, such as ditches, swales and drain tiles, and to repair or replace damaged drainage systems are discussed in Enbridge's Agricultural Protection Plan (Appendix AF). In areas where a pipeline would cross an agricultural ditch or swale, the pipeline depth would be adjusted to allow for ongoing maintenance of the ditch. Drain tile would be repaired as described in Enbridge's EPP (Appendix D) and Agricultural Protection Plan (Appendix AF). The timing of drain tile repair would depend on whether a tile line is dry or flowing. Flowing tiles would be temporarily or permanently repaired immediately. Dry tiles and temporarily repaired tiles would be permanently repaired within 14 days of pipeline installation. Additionally, damaged drains would be temporarily or permanently repaired within 48 hours of heavy rains (greater than one inch).

The pipeline would be buried in accordance with PHMSA regulations (49 CFR § 195.248), which stipulate a minimum of 30 inches of top cover for normal excavations and 18 to 30 inches of cover for rock excavations (depending on the location) to prevent damage to the pipeline from normal use of the land. The depth of cover would vary depending on permit requirements, landowner agreements, and site-specific conditions (e.g., depth of drain tile). The depths of cover over the proposed pipeline would comply with the minimum federal requirements specified in Table 2.6-1. According to Enbridge, their internal design specifications for depth of cover in rock areas requires a minimum of 24 inches of cover in shallow bedrock areas, measured from subgrade (grade following topsoil segregation), which are more stringent than federal requirements listed Table 2.6-1.

Site specific conditions would influence the protection used for pipelines in areas of shallow bedrock. Typical protection materials would include rock jackets, wood lagging, sand padding and bedding, or continuous concrete coatings. According to Enbridge, these methods produce the desired depth of cover in rock excavation areas. Enbridge does not specify trenchless methods to achieve depth of cover. Greater pipeline depths than those presented would result in greater amounts of ditch spoil that could require additional temporary workspaces for storage of the spoil. In areas where trenchless methods would be implemented, the depths presented in Table 2.6-1 do not represent depths of burial that would typically result for trenchless methods, such as HDD that can result in depths of burial of tens of feet.

Table 2.6-1 Pipeline burial depths.

Land type crossed	Planned depth of cover (inches)	
	Normal excavation	Rock excavation[1]
Industrial, commercial, and residential areas	36	30
Crossing of inland bodies of water with a width of at least 100 feet from ordinary high-water mark to ordinary high-water mark	48	18
Drainage ditches at roadways and railroads	36	36
Any other area	30	18

[1] Rock excavation is any excavation that requires blasting or removal by equivalent means.
Source: 49 CFR § 195.248

2.6.7 Trench Dewatering

Groundwater or storm water runoff could accumulate in a trench during construction activities and could require extraction and discharge. All applicable permits would be obtained for discharge activities, and dewatering would occur in compliance with applicable DNR Technical Standards. A floating suction hose and elevated intake, or other similar measures, would be used to keep the intake hose of the dewatering system off the bottom of the trench to reduce the potential for capturing additional sediment in trench water. Discharged water would be pumped into a sediment filter bag or a straw bale dewatering structure to prevent heavily silt-laden water from flowing into streams or wetlands (see Section 5.0 of Enbridge's EPP for further information; Appendix D). The specifications for filter bags vary depending on the materials being used. The use of filter bags with either a straw bale structure or geotextile lined straw bale dewatering structure generally increases efficiency of filtration of the discharge. Geotextile bags would be sized appropriately for the discharge flow and suspended sediment particle size according to the DNR's General Permit for Dewatering Operations standards (WPDES Permit No. WI-0049344-0-5-0). The size of straw bale dewatering structures, if used, would depend on the maximum water discharge rate. Multiple filtering mechanisms (e.g., geotextile bag within a straw bale dewatering structure) may be used as necessary. Flocculants could be required as needed and as described in the DNR Technical Standard 1061, Dewatering Practices for Sediment Control. Dewatering operation discharge sites that drain away from waterbodies or wetlands would be selected. Water would be discharged to well-vegetated upland areas at a rate that promotes filtering and soaking into the ground surface.

2.6.8 Pipe Bending

Straight sections of pipe would be delivered to the work site. Within the limits of field procedures, individual sections of pipe would be bent within the temporary ROW next to the trench to conform to the contours of the trench and terrain where necessary (Figure 2.6-5). A track-mounted, hydraulic pipe-bending machine would be used for this purpose. Larger bends, if required, would be pre-bent prior to arrival at the work site.

Figure 2.6-5 Bent section of pipe in trench.
Photo: Stock photo

2.6.9 Lineup, Welding, & Weld Inspection

Following bending, sections of pipe would be aligned and welded together (Figure 2.6-6). Federal regulations, as specified in 49 CFR § 195.234, generally require nondestructive testing 10 percent of field welds. Enbridge requires each individual field weld to be non-destructively inspected prior to coating. Non-destructive inspections do not alter the weld being examined (i.e., no samples need to be sent to a lab for inspection); common methods include x- rays or ultrasound tests. Weld defects would be repaired or removed as outlined in the API Standard 1104, "Welding of Pipelines and Related Facilities." Repaired welds would be non-destructively tested to verify the final weld quality.

Figure 2.6-6 Pipe welding.
Photo: Enbridge

2.6.10 Field Coating

Part of the pipe fabrication process would be protecting the pipe with an external coating designed to protect it from corrosion. The coating is applied to the pipe at the mill, except for an area at the ends of the pipe segments. Following welding and inspection, girth welds would be coated with similar or compatible protective materials in accordance with required specifications. Pipe coating would be inspected for defects prior to lowering-in. Areas of defects or damage would be repaired prior to placement.

2.6.11 Pipe Placement & Marking

The trench would be inspected for proper depth and for rocks or other obstructions that could damage the pipes or the protective coating. If the presence of water in the trench obstructs proper inspection, dewatering would be necessary. Dewatering would be conducted in accordance with Enbridge's EPP (Appendix D) and applicable state and federal permits. Additionally, the trench would be inspected for entrapped wildlife. If an animal were encountered, it would be removed.

In areas where the bottom of the trench contains rock, the pipe would be lowered onto suitable padding materials, such as sand, placed on the bottom of the trench and up the sidewalls. Topsoil would not be used as a bedding or padding material in trenches. Additionally, in areas where the excavated trench material, such as rock, could damage the pipe or the pipe coating, the pipe would be protected with a wrapping material or other similar measure.

The pipe strings would be placed in the ditch to conform to the alignment of the ditch and not damage the coating. Sideboom tractors, spread out along the pipeline segment, would simultaneously lift the welded pipeline sections and move them over the open trench (Figure 2.6-7). The sideboom tractors would then lower the pipeline segment into the trench.

Figure 2.6-7 Sideboom tractors lowering pipe into a trench.
Photo: Enbridge

To slow the movement of water through the trench, trench breakers (e.g., stacked sandbags), also referred to as trench checks, would be installed in the trench around the pipe in steeply sloped areas to prevent movement of subsurface water along the pipeline in accordance with Enbridge's EPP (Appendix D) and specifications from applicable regulating agencies.

The pipeline would be marked at all road, railroad, and stream crossings, and in sufficient numbers along the remainder of the line such that the location is known to the general public in accordance with 49 CFR § 195.410.

2.6.12 Trench Backfilling

The trench would be backfilled with the spoil materials excavated from the trench after the lowering in of welded pipeline strings. The requirement for pipe protection would be determined during the trenching operation. In areas where the excavated material is rocky, the pipeline would be protected with a rock shield or covered with other appropriate fill, such as crushed limestone or screened sand. Excavated rock would then be used to backfill the trench to the top of the existing bedrock in the trench. The remainder of the trench would be filled with other excavated soil materials. Angle blade dozers, draglines, or backhoes would place the spoil on top of the pipeline. In areas where topsoil segregation occurred, subsoil would be replaced first, followed by topsoil. The trench would be backfilled to grade or higher to accommodate trench soil settling.

Backfilled trenches would be graded to restore natural ground contours and surface drainage patterns as close to preconstruction conditions as practical. Trench breakers would be installed in the trenches on steep slopes to control subsurface drainage within trenches. Trench breakers would be installed at stream and wetland crossings to minimize the flow of water from the waterbody into the trench.

Excess backfill material would be managed in accordance with regulations and landowner requests. In general, excess excavated materials or materials unsuitable for backfill would be spread over the ROW in an upland area (with landowner approval) or disposed of at a licensed disposal facility. Beneficial use of excess rock could include construction of off-road vehicle barriers (if requested by the landowner).

During backfilling of wetland areas, subsoil would not be mounded above the height of the adjacent undisturbed trench wall. Any subsoil that would exceed the elevation of the ground adjacent to the trench would be removed from the wetland and disposed of in an upland area or an Enbridge-approved disposal site. After the trench is backfilled with subsoil, the previously segregated topsoil would be spread over the trench area and mounded no more than 12 inches above the adjacent, undisturbed soil. It is expected the mounded topsoil would settle to pre-construction elevations that match adjacent undisturbed areas.

2.6.13 Pipeline Cleaning & Hydrostatic Testing of New Pipe

After backfilling is complete, the integrity of new sections of pipe would be tested via the hydrostatic testing method. Hydrostatic testing involves filling new pipe segments with water acquired in accordance with applicable permits, raising the internal pressure level, and holding that pressure in accordance with 49 CFR 195, Subpart E. Prebuilt sections of pipe to be installed using horizontal directional drilling methods would typically be hydrostatically tested prior to being pulled into place.

The first step in hydrostatic testing is cleaning the segment of pipe. The segment of pipeline would be prepared by removing accumulated construction debris, mill scale, dirt, and dust using a cleaning pig (Figure 2.7-1). The debris would be collected in a temporary receiver and disposed of at an appropriate offsite location consistent with applicable solid waste regulations. Upon completion of the cleaning operation, the pipeline would be sealed with test headers and rinsed. Rinse water would be treated and disposed of in accordance with applicable wastewater permit conditions.

Then the pipeline would be hydrostatically tested in accordance with PHMSA regulations to ensure that the system would be capable of operating at the design pressure. The length of individual test segments would be determined by topography and water availability. For each pipe section to be tested, Enbridge would excavate around each end of the section and install a manifold to the end of the pipe. The manifolds would include valves to allow for the filling and draining of the test section and the release of displaced air, and to connect to testing equipment that would be used to measure and record the pressure within the test section. Once the hydrostatic testing is completed, the manifolds would be removed, and the separate pipeline test sections would be welded together. The excavations at the ends of the test sections would remain open only during testing and would be backfilled when the test is completed.

The length of open trench required to install the manifolds would be dependent on site-specific conditions but is typically less than 200 feet. To meet applicable safety standards for workers, the excavation would be slightly wider than the excavation width required to install the pipe. Temporary erosion and sediment control structures at the excavation sites would be installed and maintained in accordance with the requirements of § NR 216.46, Wis. Adm. Code, and the DNR's Construction Site General Permit. Dewatering of the open trench, if necessary, and restoration of the sites after removal of the manifolds and backfilling would be accomplished in accordance with Enbridge's EPP (Appendix D).

Following hydrostatic testing, the test section would be depressurized, and water would be discharged to either upland or to a surface water in accordance with a DNR-issued permit. Enbridge could apply for coverage under the Operation and Maintenance of Industrial Potable and Non-potable Water Systems and/or Hydrostatic Testing of Petroleum Systems permit (WPDES Permit No. WI-A0057681-05-0). Under this general permit, discharges to upland areas would be to a well-vegetated area with an appropriate dewatering structure such as a geotextile filter bag and/or a hay bale structure lined with geotextile fabric. If water will be completely infiltrated with no accumulation of standing water or runoff to surface water or wetlands via any pipe, ditch, channel, tunnel, conduit, swale, or storm sewer, the permit provisions for discharge to groundwater would apply. Otherwise, the discharge would be regulated as a surface water discharge. In both cases, monitoring, reporting, and effluent limitations would be as required by the permit.

Direct discharges to surface waters, if allowed by permit, would be directed into an energy dissipation device such as a splash pad. If the water source is inside the Lake Superior basin, the water must be discharged back into the Lake Superior basin in accordance with the Great Lakes-St. Lawrence River Basin Water Resource Compact and Wisconsin's implementing statute, s. 281.346, Wis. Stat. Hydrostatic test water would be discharged at a rate specified in the hydrostatic testing permit. If no maximum discharge rate is identified, discharges would be monitored and adjusted as necessary to avoid scouring, erosion, or the transportation of sediment from the discharge location. To minimize the potential for introduction or spread of invasive species due to hydrostatic testing activities, water would be discharged to the same location from which it was appropriated. If the water would be used to test multiple pipe sections, following the final test, the water would be discharged. Test water would not be discharged to a waterbody other than the appropriation source, unless coordinated and permitted through applicable agencies.

All landowners within 200 feet of each hydrostatic test area would be notified of the planned test and advised to stay a safe distance from the pipeline being tested. After completion of hydrostatic testing, Enbridge would conduct an internal inspection of the pipeline using a caliper pig, an electronic inspection tool. The caliper pig would travel inside the pipe, and its onboard computers would mechanically, ultrasonically, or magnetically examine the condition of the pipe. This technique would identify potential problems such as dents, gouges, or cracks. The results of the inspection would be analyzed; if problems were identified, that section of pipe would be repaired or replaced.

2.6.14 Cleanup & ROW Restoration

After the pipelines have been installed and tested, all remaining construction debris (including excess rock and litter generated by construction crews) would be removed and additional temporary workspace would be restored. Disturbed areas would be re-graded and restored as closely as practicable to preconstruction conditions. Restoration includes placing topsoil, preparing a seedbed for permanent seeding (where applicable), modifying temporary erosion control measures as needed (Appendix E), repairing or replacing fences, and installing permanent erosion controls as needed, such as permanent slope breakers (Figure 2.6-9) to control sheet flow runoff, and seeding. Cleanup and rough grading (including modifying temporary erosion control measures) would begin within 14 days after backfilling the trench. If seasonal or other weather conditions prevent compliance with this timeframe, temporary stabilization measures would be implemented and temporary erosion control measures would be maintained until conditions allow completion of restoration. Once all land disturbing construction activities have been completed in an area and a uniform perennial vegetative cover has been established with a density of at least 70 percent (ex. Figure 2.6-8) of cover or equivalent permanent stabilization measures have been completed for that area, temporary erosion control measures would be removed from that area. Additional descriptions of restoration practices for upland areas, waterbodies, and wetlands are provided in Section 2.8 and in Enbridge's EPP (Appendix D).

Figure 2.6-8 Revegetated pipeline ROW.
Photo: Enbridge

In sloped areas, permanent berms (diversion dikes or slope breakers) like those shown in Figure 2.6-9 would be installed according to the maximum spacing requirements specified in the EPP (Appendix D) unless otherwise specified in permit conditions. Permanent berms of compacted earth would be constructed with a two to four percent out-slope. Storm water deflected by berms would be directed toward appropriate energy-dissipating devices, and off the construction ROW if possible. Permanent berms would be inspected and repaired to maintain function and prevent erosion. Jute erosion control blankets would be placed on slopes over 30 percent or that connect directly with sensitive resource areas (e.g., wetland or waterway). These blankets are made from plant fibers and are used to protect soil surfaces from water and wind erosion and provide partial shade and heat storage to accelerate vegetation growth. Slopes are typically seeded prior to placing erosion control mats so that vegetation grows through them.

Figure 2.6-9 Slope breakers.
Photo: Enbridge

2.7 Decommissioning Existing Pipeline

Decommissioning the existing section of Line 5 within the Bad River Reservation could be accomplished by either abandoning the pipeline in place, removing the pipe, or a combination based on site-specific requirements. This work would begin once the newly constructed segment was in service. Enbridge proposes abandoning the existing line segment in place between the interconnect points. Site-specific factors such as landowner agreements, future land uses, structural integrity of the pipeline, long-term maintenance of an in-place pipeline, disturbance to sensitive environments, potential for leaks of hazardous waste and associated liabilities, and the potential for future reuse of excavated steel pipe could impact any final decisions regarding abandonment in place.

2.7.1 Pipeline Cleaning

According to Enbridge, their pipeline decommissioning is a multi-phase process that starts with cleaning the existing pipeline. PHMSA requires that any decommissioned (permanently removed from service) pipeline be cleaned and capped regardless of whether the pipeline is deactivated, abandoned in place, or removed. The first step in cleaning would be creating an access portal on each end of the pipe segment to be abandoned. The decommissioned pipe would be wiped with cleaning pigs (Figure 2.7-1), which would be pushed through the pipeline using nitrogen, a non-combustible gas. After cleaning pig runs, a cleaning solution would be inserted into the pipeline between cleaning pigs to further remove petroleum residue. Wiping and drying pigs would be conveyed through the pipeline to remove residual liquids. Testing and analysis would be used to determine how many runs of each phase would be necessary. The process would be repeated until a residue thickness remaining in the pipe was less than the currently acceptable limit for a 30-inch diameter pipe. A specialized third-party consultant would test liquid materials removed from the pipe. Materials removed from the pipeline would be transported to an approved, licensed disposal facility. Cleaning would be completed prior to either decommissioning in place or pipeline removal.

2.7.2 Pipeline Abandonment In Place

Enbridge proposes decommissioning the Line 5 segment between the interconnect points by abandoning the line in place. Under this scenario, the existing pipeline would be disconnected from operating facilities and cleaned as described above. Then, the ends of sections remaining in place would be sealed and rendered inactive in accordance with federal regulations. Examples of suitable plug materials would be concrete grout or polyurethane foam. Additional plugs and caps would be considered at waterbody and wetland crossings, at the boundaries of sensitive land uses (e.g., natural areas, parks), and at the top and bottom of steep slopes. Abandoned pipe crossing under railroads and roads could be filled with concrete to prevent settlement over the abandoned pipe.

PHMSA regulations for abandoning a pipeline in place include disconnection, purging, and sealing (49 CFR § 192.727). Additionally, Enbridge would be required to report to PHMSA on the abandonment of a pipeline that crosses over, under, or through a commercially navigable waterway (49 CFR § 195.59). The preferred method to submit data on pipeline facility abandonment is to submit to the National Pipeline Mapping System the abandoned facility location, size, date, method of abandonment, and a certification that abandonment procedures comply with all applicable laws and regulations. The National Pipeline Mapping System maintains the national database of hazardous liquid pipeline locations to help ensure that they are maintained in accordance with pipeline safety regulations.

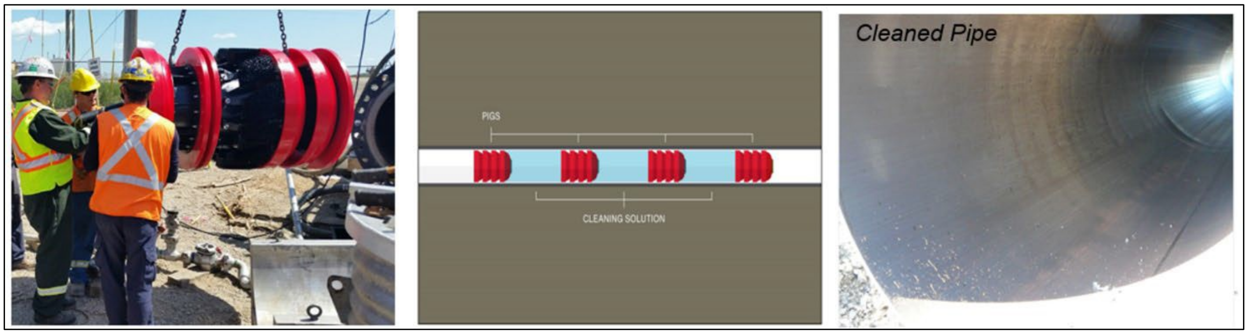

Figure 2.7-1 Pipeline cleaning process.
Left photo: photo of a cleaning pig. The red plastic disks seal against the inside of the pipe to propel the device and to remove loose sedimentation or scale buildup. The black rectangles at the top and the circular disks in the center are magnets to attract and remove any loose metal objects in the pipe. *Center illustration*: illustration of the cleaning process with cleaning solutions between pigs. *Right photo*: photo of a cleaned pipe after pigging. Photos: Enbridge

2.7.3 Pipeline Removal

If Enbridge were to remove the Line 5 pipeline in whole or in part, construction operations would be like those associated with pipeline construction, but in reverse order. Removal of an existing pipeline would involve topsoil removal, backhoe excavation of the subsoil to a depth at least even with the top of the pipe, pipe removal, backfilling and compaction of the trench, replacement of the topsoil, and revegetation measures. Many of the same construction techniques and environmental protection measures would apply to pipeline removal including the use of work windows to avoid sensitive species lifecycles (e.g., breeding, nesting), vehicle and equipment crossing methods, wetland crossings, sediment control measures, and bank restoration. Reconstruction or addition of waterway bank stabilization structures would be required as part of pipeline removal where bank stability concerns are encountered. State and federal permits would be required for any work in waterbodies and wetlands. Work that would require more than one acre of land disturbing activities within the Bad River Reservation would require coverage under an NPDES construction site storm water permit issued by the EPA and subject to CWA Section 401 certification by the Bad River Band.

2.8 Construction Practices Intended to Reduce Impacts

Enbridge's EPP (Appendix D) outlines the typical practices the company would implement during construction to limit impacts to natural and cultural resources during construction. Enbridge would also be required to comply with the conditions of state and federal permits needed for construction. Landowner agreements could also contain property-specific commitments that Enbridge has made. These practices are summarized below. Some practices overlap categories so are listed only in the first category in which they appear.

2.8.1 Design & Implementation Planning

Enbridge would provide the following documents for its contractors to use for the purposes of limiting resource impacts during construction and restoring disturbed areas to pre-construction conditions:

- Environmental Protection Plan (EPP; Appendix D).
- Erosion and Sediment Control Plan (Appendix E).
- Agricultural Protection Plan (Appendix AF).

- Geotechnical reports summarizing surface and subsurface assessments (Appendix O).
- Summaries of existing conditions in the form of photos and water quality data.
- Spill Prevention and Response Plan-Additional discussion of this is provided in a separate section below.
- Site-specific inadvertent release plans for HDD crossings (Appendix N).
- Site-specific blasting plans (General Blasting Plan in Appendix F).
- An invasive species management plan that identifies known areas of invasive species populations, addresses site restoration activities, and includes specific protocols to prevent and minimize the spread and introduction of invasive species (Appendix AB).

2.8.2 Construction Monitoring

During construction, the project would be inspected regularly by Enbridge's environmental inspectors (EIs). In its EPP (Appendix D), Enbridge has summarized the responsibilities of the EIs as follows:

> "*Enbridge will provide construction oversight to monitor compliance with the measures of this EPP and requirements of applicable permits. Enbridge's Environmental Inspectors (EIs) will assist the Contractor in interpreting and implementing the requirements of the EPP and verify compliance with these procedures for Enbridge. The EIs will interpret environmental conditions and requirements and will coordinate and consult with Project management staff to address unforeseen situations should they occur in the field. The EI, in consultation with Enbridge Environment staff, will have the authority to stop activities and order corrective mitigation for actions that are not in compliance with the measures in this EPP, landowner agreements, or environmental permit requirements*."

The Construction Site General Permit requires that sites covered under the permit be inspected at least every seven days and within 24-hours after a rainfall event that exceeds 0.5 inches in 24 hours. Erosion and sediment control devices that require maintenance or replacement are required to be addressed within 24 hours.

In addition, an individual permit authorizing waterway and wetland impact would be expected to include as a specific condition a requirement for a third-party independent environmental monitor (IEM). On a project this size, the IEM is typically a consulting firm with multiple staff who can be deployed to active locations in the construction site. The IEM would be selected by the DNR and would report to the DNR to supplement DNR field staff presence (see below). Enbridge would be responsible for the cost of the IEM. The IEM would observe project construction activities and document environmental conditions during the active phases of construction, up to and including temporary or final vegetation planting. Typically, IEMs are not used to inspect restoration efforts unless areas of specific concern are identified. Enbridge's EIs would continue to inspect any areas where IEM monitoring is no longer considered necessary by the DNR, maintain appropriate records to document compliance with permit conditions, and provide inspection reports to the DNR upon request. DNR regional and Office of Energy staff would inspect the construction site periodically during construction based on availability or in response to conditions observed by the IEM. DNR can also supplement on-the-ground inspections with drone or aerial observations when equipment is not in use for fire control purposes.

Conditions encountered during construction could necessitate revisions to environmental plans or permits. Most changes would likely be minor and routine in nature, but some could require formal DNR review.

The IEM could approve certain modifications in the field where the variance meets the intent of the respective permit conditions, based on the following three levels of variances.

Level 1 variances would be minor adjustments that involve interpretation of the requirements of a permit condition or related plan. The adjustments would be of the type that would not affect land outside the temporary construction ROW and additional temporary workspaces except minimally, where no additional impacts to environmental resources would occur, and that typically would not require formal modification or amendment of agency licenses or permits. Level 1 variances could include, but are not limited to, the following examples:

- Changing type and location of erosion controls shown on site-specific drawings to account for site conditions.
- Extending the duration of waterbody crossings by no more than 24 hours.
- Changing the type of stream crossing method if an emergency situation occurs during construction and immediate modification is necessary to avoid or minimize environmental damage.
- Adjustments that would decrease environmental impacts at particular locations.
- Other items identified in consultation with the DNR.

Level 2 variances would be modifications that require amendments to DNR permits, changes that involve land outside of the temporary construction ROW and additional temporary workspaces, or that would result in additional incremental impacts to environmental resources. The IEM would explore means to limit any additional impacts, including consulting with and receiving approval from DNR staff. The IEM would then communicate DNR approval to Enbridge's EI for the variance or amendment. Level 2 variances could include, but are not limited to, the following examples:

- Adjusting the configuration of additional temporary workspaces to accommodate spoil storage needs.
- Extending additional temporary workspaces into a wetland.
- Changing the type of stream crossing method if a site-specific plan for the change was preapproved.
- Changing the type or location of a temporary bridge.
- Temporary reinstallation of construction mats or temporary clear span bridges where access is needed to augment restoration efforts consistent with permit documents.
- Other modifications identified in consultation with the DNR.

Level 3 variances would be major changes to requirements of permit conditions or related plans or changes that are project-wide in nature. This type of modification would involve Enbridge preparing a formal submittal to the DNR for consideration. The IEM would provide information to the DNR during consideration of the variance or amendment request.

For Level 1 variances, Enbridge staff would complete an Onsite Modification Request Form and submit it to the IEM. The IEM would conduct any necessary field reviews or consultations with the DNR and either approve or deny the request. Enbridge staff would prepare and submit requests for Level 2 or Level 3 variances to applicable DNR staff using the Onsite Modification Request Form.

2.8.3 Access Practices & Construction Matting

Enbridge has committed in its EPP (Appendix D) to restricting construction equipment and vehicles to the approved ROW and additional temporary workspaces. In addition, Enbridge has identified the following access-related practices to reduce environmental impacts, including impacts to waterways and wetlands:

- Maximizing the use of existing access roads rather than developing new access roads.
- Marking ROW and work area boundaries. This would limit vegetation removal to the planned areas and help equipment operators stay within established boundaries.
- Posting signage identifying the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area.
- Minimizing the number of potential vehicle crossings of waterways by accessing the ROW on either side of the stream or from adjacent roads.
- Maintaining temporary and permanent access roads.
- Installing matting. During the initial ROW clearing process, matting would be installed where needed to ensure stable work conditions and reduce impacts in environmentally sensitive areas. Timber mats are the most common type of matting used, although new plastic composite mats are also available. Matting helps spread out the weight of construction equipment and could reduce the degree of soil compaction. These mats are portable and can be installed and moved as needed throughout the ROW. Only clean construction mats would be allowable for use within the construction ROW. Mats would be required to be free of loose soil and plant material prior to being transported onto the construction ROW or relocated to another location within the construction ROW. In many cases, these mats would be left in place during all phases of construction to reduce impacts from heavy activity and equipment and would be removed during or after restoration activities.
- Installing temporary clear span bridges, including the following management actions:
    - Installing temporary clear span bridges close to perpendicular to the axis of the stream channel, creating the shortest crossing length.
    - Anchoring temporary clear span bridges to prevent them from washing away during high flow conditions.
    - Marking temporary clear span bridges to alert stream navigators.
    - Designing and maintaining temporary clear span bridges to prevent soil from entering the waterbody. This includes installing sediment control BMPs under and on the sides of temporary clear span bridges.
    - Checking equipment for fluid leaks before crossing temporary clear span bridges or driving across a waterway.
    - Monitoring temporary clear span bridges daily for debris and removing debris as necessary.

2.8.4 Construction Timing Considerations

Unless otherwise permitted by the DNR, Enbridge plans to adhere to the standard timing restrictions for in-water work, including no work in trout streams from September 15 through May 15 and no instream work in all other waterbodies from March 1 to June 15. However, Enbridge has requested timing restriction waivers for waterbody bridge placement and removal at the locations listed in the Timing Restriction Waiver Request Form (Appendix W). Enbridge anticipates clearing of vegetation required to implement the project would be scheduled outside the migratory bird migration and nesting seasons for all birds listed in the DNR Endangered Resources review (i.e., from March 5 to July 31).

Additional construction timing measures to reduce anticipated environmental impacts during construction would include:

- Developing and implementing a construction sequencing plan that minimizes the amount of land disturbed or exposed (susceptible to erosion) at one given time across the project.
- Installing site-specific sediment and erosion control measures (Appendix E) and devices prior to construction activities, including daily inspections and maintenance throughout all construction and restoration phases.
- Revegetating disturbed areas and areas of exposed soil as soon as possible.
- Scheduling construction to avoid disrupting sensitive species.
- Limiting the duration of construction within waterbodies.
- Completing construction activities as efficiently and quickly as practicable to limit the duration of temporary impacts.

2.8.5 Waterway Practices

In addition to the route selection measures discussed in Section 2.1.2 and the waterbody crossing selection measures discussed in Section 2.5.3, Enbridge has included the following practices in its project design documents and EPP (Appendix D) to limit impacts to waterways:

- Leaving existing vegetative buffers undisturbed whenever possible or minimizing vegetation clearing on banks and other riparian zones. This would also facilitate maintaining shaded stream cover.
- Avoiding the use of herbicides near waterways or using only herbicides approved for use in aquatic environments.
- Preparing and implementing dewatering practices to prevent sediment discharges into waterways.
- Avoiding the withdrawal of water from surface waters. If withdrawal cannot be avoided, all pumps and intakes would be floating to minimize sediment intake and be screened to minimize impact to aquatic species.
- Restoring waterway banks as soon as practical after pipeline installation. Restoration would be to pre-existing conditions except where additional bank stabilization measures would be permitted by regulatory agencies (Section 2.8.6).
- Limiting equipment operation within waterbodies to the area necessary to complete the crossing.
- Isolating all soil piles from waterways with perimeter erosion control BMPs.
- Limiting vegetation clearing and stump removal.
- Using tarps or similar coverings below areas of field coating to capture drips/overspray during application.
- Employing environmental inspectors during construction.

2.8.6 Placement of Structures below the Ordinary High-water Mark

Table 2.8-1 lists seven locations where Enbridge is proposing to install additional bank stabilization measures below the ordinary high-water mark as part of the restoration process (Appendix E, Part 9 includes detailed plan designs). According to Enbridge, based on field evaluations of these waterways, native bank material is unlikely to be suitable for bank reconstruction due to soil properties, instability, or significant bank erosion potential. Proposed bank stabilization structures would be installed on one or both banks for the width of the crossing (approximately 100 linear feet workspace). The proposed structures have the potential to alter stream dynamics and impact the waterway upstream, downstream, and within the pipeline crossing area. Installation of bank stabilization structures would need to comply with the requirements in section 30.12, Wis. Stat., and Chapter NR 329, Wis. Adm. Code.

Table 2.8-1 Enbridge's proposed engineered bank stabilization locations.

Waterway crossing	Milepost	Proposed bank stabilization measure(s)
Bay City Creek (WBIC 2891100)	0.6	Riprap, willow stakes, brush layering
Little Beartrap Creek (WBIC 2891500)	2.2	Rootwads
Beartrap Creek (WBIC 2891400)	2.9	Riprap, willow stakes, brush layering, rootwads,
UNT[1] Deer Creek (WBIC 5001917)	5.9	Riprap
UNT Marengo River (WBIC 5002282)	12.8	Biologs
UNT Brunsweiler (WBIC 5002429)	14.7	Willow stakes, brushing layering
UNT Gehrman Creek (WBIC 5002476)	28.6	Biologs

[1] UNT = Unnamed tributary

The DNR requested and received site-specific drawings showing the proposed bank stabilization methods (Appendix E, Part 9). These methods include the installation of riprap, biologs, willow stakes, branches, and rootwads. In some locations, subsurface drains would be installed to improve the stability of steep slopes. DNR permit specialists and resource managers would review Enbridge's site-specific drawings to determine if any modifications would be needed to conform to state permit requirements. If required, revisions would be made prior to issuance of state waterway permits.

The permanent structures would be designed so they would not extend into the waterbody to distances that would obstruct navigation when flow is sufficient to allow a shallow watercraft to navigate the waterbody unobstructed by natural stream obstacles (i.e., narrow channels, tight meandering channels, snags, or downed trees). The stabilization structures would be designed to blend into the banks to the extent practicable while maintaining the stream's original width and depth. Enbridge indicates that since the structures would be blended into the stream banks, flood flow capacity would not be reduced.

2.8.7 Wetland Practices

In addition to the route selection measures discussed in Section 2.1.2 and the waterbody crossing selection measures discussed in Section 2.5.3, Enbridge has included the following practices in its project design documents and EPP (Appendix D) to limit impacts to wetlands:

- Marking avoidance areas such as wetlands with appropriate fencing or flagging and limiting access to only the construction ROW and approved access roads.
- Using low-ground-pressure equipment to limit disturbance to the wetland during clearing. Clearing of extra workspaces in forested wetlands would be minimized as much as practicable and would be conducted in accordance with state and federal permit conditions. Vegetation and trees within wetlands would be cut at ground level, leaving existing root systems intact.
- Using special construction methods in non-farmed wetlands to construct the pipeline. These methods would include:
    - Confining grading activities to the area of the trench and minimizing grading to the extent practicable. Grading outside the trench would only be allowed where required to ensure safety and to restore the construction ROW after backfilling the trench.
    - Installing erosion and sediment control devices prior to clearing activities across the entire construction ROW upslope of the wetland boundary. Where vegetation removal would be required to provide access to install erosion control devices, devices would be installed as soon as adequate access was established.
    - Using clean construction mats (free of oil, soil, and plant material) to facilitate equipment access and pipeline installation except where omission is allowed by permit. This would typically be limited to conditions where the ground would be frozen or dry during the entire duration of construction within the wetland.
    - Using backhoe excavators for trench excavation.
    - Stripping up to one foot of topsoil (organic layer) from the trench line in wetlands without standing water and stockpiling topsoil separately from excavated subsoils to preserve the native seed stock.
    - Segregating as much of the organic layer as possible based on site and saturation conditions in wetlands with standing water.
    - Installing trench breakers in areas where the pipeline trench has the potential to drain or partially drain a wetland, to maintain the current wetland hydrology. Trench breakers would be temporary or permanently installed within the trench to reduce water flow in the trench during and after construction. Trench breakers could be constructed of sandbags or compacted soils.
    - Using “push-pull” or “float” techniques to place pipe in large wetlands with standing water. This technique would include floating a prefabricated section of pipeline by pushing and pulling. When the pipeline is in the correct place, floats would be removed, and the pipeline would sink into position.
    - Backfilling the trench using a backhoe or similar equipment working from construction mats. Subsoil material would be replaced so that it is not mounded.
- Restoring wetlands as near as practicable to preconstruction conditions as described below:

- Completing cleanup and rough grading activities simultaneously beginning as soon as practicable after the trench is backfilled, weather permitting. Cleanup typically involves removing construction debris and replacing fences removed during construction. Rough grading includes restoring original conditions within the disturbed areas and installing or repairing temporary erosion control devices. Timber mats, construction debris, and larger woody vegetative debris would be removed during cleanup of wetlands.
- Backhoes or low-ground-pressure equipment would be used to restore the wetland. Wetlands would be restored as near as practicable to preconstruction conditions, and the contactor would make a reasonable attempt to return the subsoil to its preconstruction density.
- Placing segregated topsoil on top and mounding no more than 12 inches, or as specified in the applicable permits, to allow for minor soil settling within the backfilled ditch. Excess subsoil would be disposed of in an upland area or at an approved disposal site.
- Seeding wetlands without standing water with an unsaturated wetland seed mix to provide temporary cover according to Enbridge's EPP (Appendix D). Fertilizer, lime, and mulch would not be applied in wetlands.

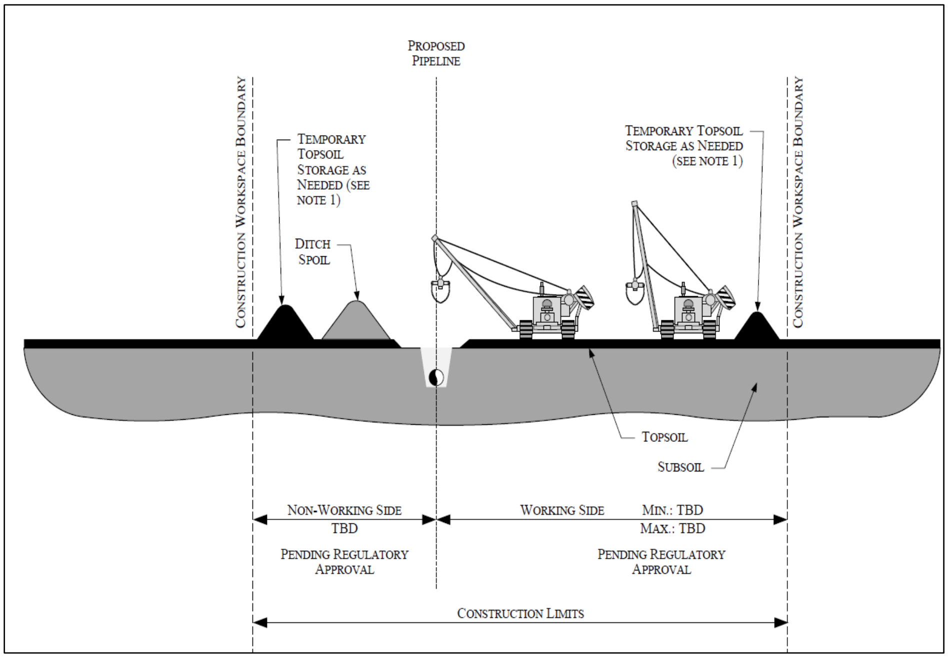

Figure 2.8-1 Typical work area in a wetland.
Note: Construction matting under equipment not shown.
Source: (Enbridge, n.d.) Figure 2

Section 5.8 includes additional discussion on wetlands.

2.8.8 Fugitive Dust Control

Fugitive dust emissions could result from grading, blasting, or vehicle traffic. The amount of dust generated from construction vehicle traffic depends, in part, on moisture content and composition of soils, wind velocity, types of vehicles, and roadway characteristics. Dust emissions are generally greater during drier months and in fine-textured soils. Dust generated from blasting, in general, depends on the strength of the charges and the nature of the rock being blasted. Dust generated from construction activities would be minimized using control practices including wetting soils on the ROW, limiting working hours in residential areas, and/or additional measures as appropriate based on site-specific conditions (Enbridge's EPP, Appendix D). Dust control is a requirement of the Construction Site General Permit (Permit No. WI-S067831-6).

2.8.9 Spill Prevention During Construction

Potential sources of construction-related spills include machinery and equipment failure, fuel handling, transfer (fueling) accidents, and storage tank leaks. Contractors would be required to implement proper planning and preventative measures to minimize the likelihood of spills and to clean up a spill quickly and successfully should one occur. In the event of a construction-related spill, adherence to all applicable federal, state, and local regulations with respect to cleaning up the spill would be required.

As outlined in Enbridge's EPP (Appendix D), contractors would be responsible for implementing, at a minimum, the following construction-related spill prevention measures:

- Locating spills kits containing sufficient absorbent and barrier materials to adequately contain and recover foreseeable spills near fuel storage areas and other appropriate locations.
- Storing petroleum products, refueling, lubricating, and maintaining equipment in upland areas that are more than 100 feet from wetlands, streams, waterbodies (including drainage ditches), and water supply wells.
- Restricting overnight parking of equipment within 100 feet of a wetland or waterbody unless special containment provisions are implemented.
- Storing and disposing all contaminated soils, absorbent materials, and other waste in accordance with all applicable state and federal regulations.
- Recycling hazardous waste, such as motor oil, in areas with an established recycling program.

Enbridge's environmental inspectors would assist by maintaining appropriate records to document compliance with state and federal permit conditions.

All employees handling fuels and other regulated substances would be trained to follow spill prevention procedures and quickly and effectively contain and clean up any spills that occur using equipment located in the construction area. Each construction crew would maintain spill kits including, but not limited to, absorbent pads, straw bales, absorbent clay, sawdust, floor-drying agents, spill containment barriers, plastic sheeting, skimmer pumps, and holding tanks. This equipment would be located near fuel storage areas and other locations as necessary to be readily available to control spills that occur.

Fuels, lubricants, waste oil, and any other regulated substances would be stored in aboveground tanks at contractor yards. A suitable secondary containment structure would be used at each fuel storage site, lined with suitable plastic sheeting, and providing a minimum containment volume equal to 150 percent of the volume of the largest storage vessel. All fueling and other service vehicles would carry materials adequate to control spills including absorbent pads, commercial absorbent material, plastic bags with ties, and shovels. Fuel trucks transporting fuel to onsite construction equipment would travel only on approved access roads and all fuel nozzles would be equipped with functional automatic shutoffs. Personnel would be stationed at both ends of a hose during fueling unless both ends are visible and are readily accessible by one person.

2.8.10 Storm Water, Sediment, & Erosion Control

Temporary erosion control measures are intended to slow the velocity of water to minimize erosion, reduce the movement of sediments, and prevent the deposition of sediments into sensitive resources that could be on or adjacent to the construction ROW. Temporary erosion control measures would be installed before clearing where access permits or after initial clearing where vegetation prevents installation. In both cases, installation would occur before disturbance of the soil at the base of sloped approaches to streams, wetlands, and roads. These temporary erosion control measures would be removed or replaced by permanent erosion controls if required upon the completion of restoration. Temporary erosion and sediment controls include, but are not limited to, slope breakers, perimeter control, storm water diversions, trench breakers, mulch, and revegetation (Enbridge's EPP, Appendix D). Areas at higher risk for erosion are presented in Sections 5.6 (Soils) and 5.7 (Surface Water).

Erosion and sediment control structures would be maintained as required by all applicable permits. Any structures that are found to be no longer providing effective erosion and sediment control would be replaced with functional materials as soon as field conditions allow, but no later than 24 hours after discovery. Temporary stabilization, typically consisting of temporary seeding, mulch, soil stabilizers, or erosion control mats would be required in locations where land disturbance is expected to cease for 14 days or longer. Final stabilization activities would be required to begin once an area reaches final grade.

Erosion control mat would be installed in accordance with DNR Technical Standard 1052, Non-Channel Erosion Mat, on slopes greater than 5 percent that drain to surface waters and that would be exposed over the winter. Installation would be completed before snowfall to ensure maximum protection of exposed slopes prior to spring melt and prior to the frequent winter storms that occur in northern Wisconsin in March and April. Temporary slope interruption devices and diversion berms would be installed to slow and redirect storm water runoff in disturbed areas in accordance with DNR Technical Standard 1056, Perimeter Sediment Control and Slope Interruption, and DNR Technical Standard 1066, Construction Site Diversion, unless otherwise specified in permit conditions. Temporary slope interruption devices and diversion berms could be constructed using earthen subsoil material, silt fence, hay bales, or rocked trenches (in upland, non-agricultural lands only).

As shown in Appendix E (sheet A20), Enbridge proposes installing two sediment basins and 18 sediment traps in areas with concentrated land disturbance, such as temporary staging areas. These features are a type of temporary wet pond and are designed to capture 80% of sediment from runoff entering them. Sediment traps (DNR Technical Standard 1063) serve areas less than 5 acres and generally have rock weir outlets. Sediment basins (DNR Technical Standard 1064) generally serve areas greater than 5 acres and have a more engineered outlet.

Areas where construction trenches would be excavated through fine grained material, such as clayey soils, could require multiple methods to effectively remove sediment from dewatering discharges. Dewatering methods are discussed in Section 2.6.7 (Trench Dewatering) and in Enbridge's EPP (Appendix D). Dewatering methods would follow the DNR Technical Standard 1061, Dewatering Practices for Sediment Control.

As discussed in Section 1.4.3.11, Enbridge's proposed pipeline relocation project would require coverage under the Construction Site General Permit. Enbridge provided additional detail on the erosion and sediment control plan and maps to demonstrate that the performance standards of section NR 151.11, Wis. Adm. Code, are likely to be met. DNR storm water specialists and engineers will review the site-specific drawings (Appendix E) to determine if any modifications would be needed to conform to the Construction Site General Permit as described in Section 1.4.3.11. If required, revisions would be made prior to issuance of coverage under the general permit. During construction, Enbridge would be required by permit and section NR 216.50, Wis. Adm. Code, to amend the plan and maps if there are changes to the construction site that have reasonable potential for the discharge of pollutants and that have not otherwise been addressed in the erosion control plan or if the actions required by the plan fail to reduce the impacts of pollutants carried by storm water runoff.

2.8.11 Invasive Species Management

Invasive species have the potential to cause damage to the environment, economy, or human health. Invasive species are most prevalent in areas of prior surface disturbance like construction sites, agricultural areas, roadsides, existing utility corridors, and wildlife concentration areas. The prevention of the introduction or spread of invasive species is a high priority in Wisconsin.

The potential for establishment of invasive species would be reduced by minimizing the duration between final grading and permanent seeding and by cleaning all construction equipment (e.g., timber mats, vehicles) prior to arrival and when leaving all construction sites. This would be a permit condition where there are known infestations of invasive species. Methods to control and limit the spread of invasive species are included in Enbridge’s EPP (Appendix D) and Invasive and Noxious Species Management Plan (Appendix AB). Enbridge has conducted field surveys along the entire proposed relocation route in both wetlands and upland areas to identify existing locations of invasive species. Additional information on these efforts is included in Section 5.11 and Enbridge’s Invasive and Noxious Species Management Plan (Appendix AB).

2.8.12 Restoration & Revegetation

2.8.12.1 Upland Restoration

Upland portions of the ROW would be reseeded in accordance with Enbridge’s EPP (Appendix D), landowner agreements, and project-specific permit conditions. Wetlands would be reseeded in conformance with USACE and DNR specifications, and in accordance with Enbridge’s EPP, which was developed according to NRCS guidelines. Seeding and restoration and stabilization would occur within 48 hours of final grading of the ROW and the restoration of wetland and waterways.

Temporary revegetation measures would be employed to quickly establish ground cover vegetation and minimize potential soil erosion in construction work areas where 14 days or more would elapse between the completion of final grading at a site and the establishment of permanent vegetation, and/or where there is a high risk of erosion due to site-specific soil conditions and topography. A temporary seed mix has been developed based on recommendations from the NRCS, which consists of equal amounts of oats (in summer) or winter wheat (in fall or spring), and annual ryegrass, annual alfalfa, or slender wheatgrass. Temporary vegetation would be established at any time between April 1 and September 1. Unless specifically requested by landowners or land management agencies, temporary vegetation would not be established in actively cultivated land, standing water wetlands, or other standing water areas.

Temporary seeding could be required sooner than 14 days at site- specific locations near sensitive resource areas and areas prone to wind or water erosion. Straw mulch could be used to help stabilize areas during the establishment of temporary vegetation and shall be anchored according to DNR Technical Standard 1058, Mulching for Construction Sites. Mulch would be free of noxious weeds as listed in applicable state laws and consistent with Enbridge’s EPP. Revegetation outside of this timeframe (i.e., from September 2 to March 31) would be assessed on a site-specific basis.

According to Enbridge's EPP (Appendix D), restoration of equipment travel areas of the ROW would start with subsoil decompaction using a deep tillage device or chisel plow to a depth of 12-18 inches below the topsoil. Typically, this would occur prior to topsoil placement. Subsoil decompaction would not be conducted in areas where stumps and roots were left in place.

In actively cultivated areas, topsoil tillage would be used for seedbed preparation. Enbridge could also direct the use of deep tillage in non-agricultural areas but would not use deep tillage in non-farmed wetlands. The soil would be tilled with a disc, field cultivator, chisel plow, or chisel plow equivalent to a minimum depth of 2 inches for temporary seeding or 4 inches for permanent seeding in accordance with DNR Technical Standard 1059, Seeding for Construction Site Erosion Control. Enbridge would consult with NRCS representatives or review county soil survey information to inform where soil amendments such as fertilizer or lime would be needed for the establishment of non-native vegetation. Phosphate-free fertilizers would be used within 100 feet of a waterway where needed.

Permanent vegetation would be established in areas disturbed within the construction workspace, except in actively cultivated areas that would be returned to active agricultural production, unless requested by landowners. A standard upland seed mix has been developed for restoring disturbed areas affected by the Project (See Appendix B of Enbridge's EPP, Appendix D). The mix includes species that would provide for effective erosion control and revegetation of disturbed areas and would be certified as "noxious weed free." This seed mix would be used as the standard upland mix unless an alternate seed mix acceptable to regulatory agencies is specified by landowners or land management agencies.

Seed would be uniformly applied at specified rates across the prepared ROW by drilling, hand broadcasting, or hydroseeding. Seeding activities would be suspended temporarily in conditions that would cause rutting of the surface in designated seeding areas and would resume as site conditions improve and according to the general seeding timing restrictions. Seeding equipment would be capable of uniformly distributing and sowing seed at the required depth.

Other methods of stabilization (e.g., mulch, erosion control matting) would be used if temporary seeding is not appropriate due to seasonal conditions. In order to terminate coverage under Construction Site General Permit, Enbridge would be required to certify that the entire construction site has reached final stabilization in a notice of termination. The notice of termination form requires photos of the site as an attachment. Final Stabilization, as defined in § NR 216.002 (8), Wis. Adm. Code, "means that all land disturbing construction activities at the construction site have been completed and that a uniform perennial vegetative cover has been established with a density of at least 70% of the cover for the unpaved areas and areas not covered by permanent structures or that employ equivalent permanent stabilization measures."

2.8.12.2 Waterbody Restoration

The stream bottom contours of waterbody crossings would be restored as near as practicable to preconstruction conditions, with no obstructions to normal water flow. The streambank geometries would be restored as near as practicable to preconstruction conditions unless the preconstruction slope was determined to be unstable and eroding. Stream banks determined to be unstable could be reshaped to a stable slope or stabilized with rock riprap or other bank protection, with DNR and USACE approval. Temporary or permanent slope breakers would be installed on all sloped approaches to streams in accordance with spacing requirements. If permanent stabilization must be delayed, a temporary noninvasive seed mix (e.g., annual rye or annual oats) and mulch or erosion control blankets would be spread within a 50-foot buffer on either side of the stream, except for within actively cultivated land. Perimeter control, such as silt fence, meeting the DNR Technical Standard 1070, Silt Curtain, as selected in advance by Enbridge is proposed for installation upslope of the temporary seeding area to reduce erosion.

Following final grading, stream banks would be seeded and stabilized with erosion control BMPs as specified in Enbridge's EPP (Appendix D). The seed mix in Appendix B of Enbridge's EPP would be used to plant stream bank areas unless applicable agencies specify otherwise. Should a waterbody be located within a wetland, the banks would be reseeded with an applicable wetland seed mix from Enbridge's EPP.

The travel lane section of construction ROW would be restored only after it is no longer needed for access. Temporary clear span bridges would be removed during the final cleanup and restoration phase of construction after ROW access is no longer required. Restoration of a bridge area would occur upon bridge removal. Once vegetative cover is established, temporary sediment control devices across the construction ROW would be removed in accordance with permit conditions.

2.8.12.3 Wetland Restoration

Disturbed wetland areas would be reseeded in accordance with USACE and DNR permit conditions, and as described in Enbridge's EPP (Appendix D). As described in Section 2.8.7, Enbridge would not establish temporary vegetation in actively cultivated land, standing water wetlands, or other standing water areas unless specifically requested by landowners or land managing agencies. Specialized approved seed mixes would be used in non-standing water wetlands (Appendix B of Enbridge's EPP). Wetland mitigation to account for permanent wetland fill, permanent conversion of wetland type, and temporal loss of wetland function would be provided by Enbridge in accordance with state and federal permit conditions. Enbridge would provide post-construction monitoring of wetland restoration in accordance with permit conditions. Additional information on anticipated restoration and post-construction monitoring is in Section 5.8.7.

3 EIS PROCESS & SCOPE OF ENVIRONMENTAL IMPACT ANALYSIS

This chapter describes the EIS purpose, scope, and process. It discusses the geographic extent of the analyses as well as the types of effects analyzed. This includes a description of the three route alternatives considered by Enbridge (see Chapter 2 for an overview of Enbridge's proposed Line 5 relocation route), as well as the DNR's "No Action" alternative. Finally, this chapter also briefly notes alternatives that were not considered by the DNR in its analyses and provides the rationale for their exclusion.

3.1 Process Summary

Under the Wisconsin Environmental Policy Act (WEPA; Section 1.4.3.4), the DNR is required to analyze and publicly disclose the environmental impacts of certain department actions, along with reasonable alternatives to those actions. Section 1.11 (2) (c), Wis. Stat., requires a state agency prepare an EIS for major actions that significantly affect the quality of the human environment. The procedures for preparing an EIS are set forth in s. NR 150.30, Wis. Adm. Code.

The purpose of an EIS is to enable an agency to take a hard look at the environmental consequences of a proposed action (Clean Wisconsin v. PSC, 2005, ¶ 189). The EIS is used to inform the public and agency decision-makers on the anticipated effects on the quality of the human environment of a proposed action and alternatives to the proposed action (§ NR 150.30 (1) (b), Wis. Adm. Code). An EIS is an informational tool that does not compel a particular decision by the agency or prevent the agency from concluding that other values outweigh the environmental consequences of a proposed action or project (§ NR 150.30 (1) (b)) (Clean Wisconsin v. PSC, 2005, ¶ 188).

An EIS must address the entire proposed project, all related department actions, alternatives, and anticipated environmental effects, and must do so in a dispassionate manner that does not advocate for a particular position about the proposed action. The Final EIS does not need to be encyclopedic but must provide a level of detail commensurate with the complexity of the action being evaluated (§ NR 150.30 (1) (c), Wis. Adm. Code). The scope of review under WEPA must be reasonable; WEPA does not require an agency to engage in remote, speculative, or fruitless analysis (Clean Wisconsin v. PSC, 2005, ¶ 191).

The EIS process follows the general steps described below.

Notification. As required by s. NR 150.30 (1), Wis. Adm. Code, the DNR must notify an applicant when the DNR determines that it will follow the detailed environmental analysis procedures for an EIS for a proposed project.

> During pre-application discussions with Enbridge in 2019, the DNR indicated to Enbridge that the DNR would prepare an EIS for the proposed Line 5 pipeline relocation before any permitting decisions would be made. In September 2020, the DNR notified Enbridge that Construction Site General Permit coverage would not be conveyed within 14 working days to allow for the EIS process to be completed.

Scoping: The DNR determines the scope of the analysis, potential alternative approaches, potentially affected natural resources, and likely effects of the alternatives on those resources, and identifies incomplete or unavailable information that could be relevant to a reasoned choice among alternatives. The DNR may consult with any state, federal, tribal, or local agency on the scope of the EIS and may also use a public scoping process. Public scoping can consist of comment periods, meetings, hearings, workshops, surveys, questionnaires, interagency committees, or other appropriate methods or activities.

> The DNR used a public scoping process. In June 2020, the DNR issued a public notice announcing a public hearing and comment period on the proposed scope of the EIS, as represented by a draft outline. On July 1, 2020, the DNR held a public hearing on the proposed scope of the EIS and on Enbridge's application for waterway and wetland permits. The DNR made a video recording of the hearing available on its website. The DNR received over 2,100 written comments, which were also made available on the DNR website. The DNR determined the final scope of the EIS analysis based on comments received during the public scoping process and in consultation with tribal governments and federal agencies.

Information Gathering and Analysis: Using information provided by an applicant–including but not limited to an Environmental Impact Report (EIR)–along with other relevant data, documents, and sources of information, the DNR and its consultants analyze the probable positive and negative direct, indirect, and cumulative effects of the proposed project and alternatives to the proposed project on the human environment. The analysis considers the proposal, alternatives, and anticipated effects in a dispassionate manner, and may not advocate a particular position about a proposal.

> In August 2020, Enbridge submitted a Revised EIR as part of its application for DNR waterway and wetland permits. Between November 2020 and August 2021, the DNR held five joint technical meetings with staff from the Bad River, Red Cliff, and Lac du Flambeau Bands of Lake Superior Chippewa, and the GLIFWC, on topics to be included in the Draft EIS. Between November 2020 and October 2021, the DNR made four requests for information from Enbridge for the Draft EIS. The DNR made Enbridge's responses to these information requests available on the DNR website.

Draft EIS: The DNR and its consultants prepare a Draft EIS. The DNR posts the Draft EIS to its website and publicly announces its availability for public comment.

> In August 2020, the DNR contracted with TRC Environmental Corporation to prepare a Draft EIS. In November 2021, the DNR shared advance copies of the Draft EIS with tribal governments, federal agencies, and the GLIFWC. The Bad River Band and Red Cliff Band tribal governments and the GLIFWC submitted preliminary comments in December 2021. On December 16, 2021, the DNR posted the Draft EIS on its web page and initiated a public comment period.

Public Review: The DNR provides a minimum of 30 days after the public announcement that the Draft EIS is available for the public and other agencies to provide comments. The DNR holds one or more public hearings on the Draft EIS.

> On February 2, 2022, the DNR held a public hearing on the Draft EIS. Over 160 individuals testified during the ten-hour hearing. The DNR received more than 32,000 written comments on the Draft EIS during the 120-day public comment period, which ended on April 15, 2022. The DNR made a recording of the hearing and all written public comments available on the DNR website.

Final EIS: Following the public comment period, the DNR considers and summarizes the public comments it received and could revise the Draft EIS accordingly. The Final EIS may include revisions to Draft EIS text or figures and could vary from the Draft EIS in scope based on comments received on the Draft EIS or other pertinent information that becomes known to the department. The DNR posts the Final EIS on its webpage, along with all comments received and a Comment Response document that summarizes the comments along with the DNR's responses.

In May 2022, the DNR met with EPA staff to discuss EPA's comments on the Draft EIS and determine the best approach to addressing them. A follow-up meeting with EPA and USACE staff was held in June 2022. In October 2022, the DNR resumed regular technical meetings with staff from tribal natural resources agencies and the GLIFWC to share information and determine the best approach for addressing tribal comments and concerns. Multiple technical meetings with tribal resource agency staff took place between October 2022 and April 2024.

Following publication of the Draft EIS, Enbridge contracted with RPS Group and DNV GL USA, Inc., to conduct various analyses. These consultants modeled the risk and potential effects of oil spills from the proposed and alternative routes, as well as inadvertent releases of HDD drilling fluids ("frac-outs") and sediment discharged during pipeline construction at stream crossings. In July 2022, Enbridge and its consultants met with the DNR, USACE, and PHMSA to present their general approach to spills analysis. A follow-up meeting was held in December 2022 with these agencies and the EPA to present the analytical methods and preliminary findings. Between January and March 2023, Enbridge and its consultants held three meetings with tribal agencies, GLIFWC, DNR, and federal agencies to present their spills analysis work. The DNR made the consultant's reports available on its website.

In September 2022, Enbridge submitted a Draft Water Quality Monitoring Plan for the proposed relocation project to the DNR and USACE. Between June and November 2023, DNR staff visited numerous sites along Enbridge's proposed relocation route and surrounding area, including the Bad River Reservation, to corroborate information submitted by Enbridge, develop a better understanding of proposed construction activities, and view potentially impacted resources. Staff from the Bad River Band's Mashkiiziibii Natural Resources Department accompanied DNR staff on several of these visits.

Between October 2022 and January 2024, the DNR and USACE made additional formal requests for information from Enbridge for the agencies' respective environmental impact analyses. These requests were coordinated to avoid duplication. The DNR posted the information requests and Enbridge's responses on the DNR website. The DNR also requested information regarding natural and cultural resources from the Bad River Band and the GLIFWC.

In July 2023, Enbridge submitted an update to its Environmental Justice Commitment Plan (Appendix J) that included an Environmental Justice Assessment report and a summary of Enbridge's community outreach completed to date. Between February and July 2024, Enbridge submitted additional information including a revised Water Quality Monitoring Plan (Appendix T), site-specific erosion and sediment control plans and maps (Appendix F), details on proposed temporary clear span bridges (included in Enbridge's EPP; Appendix D), site-specific drawings showing proposed bank stabilization methods/channel remediation (Appendix E, Part 9), a Wetland and Waterbody Restoration and Post Construction Monitoring Plan (Appendix V), and an Invasive and Noxious Species Management Plan (Appendix AB).

The DNR entered into a cooperative agreement with the USGS for technical assistance and review of the erosion, sediment dispersion, and oil spills modeling work. The DNR also obtained the service of a member of the Bad River Band, who is also a former Tribal Historic Preservation Officer (THPO), to review materials the DNR compiled and drafted related to cultural resources and Ojibwe worldviews.

> The DNR considered all public comments and information compiled when preparing this Final EIS. A separate document summarizes public comments received and the DNR's response to the comments.

WEPA Compliance Determination: After satisfying the requirements of WEPA and s. NR 150.30, Wis. Adm. Code, the DNR issues a determination of compliance with WEPA. The compliance determination is publicly announced and includes findings of fact, conclusions of law, and a summary of the procedures and process steps used to achieve compliance with ch. NR 150, Wis. Adm. Code.

> The DNR will issue a compliance determination in accordance with s. NR 150.35(1) and (1m). No permitting decisions will be made until the determination is publicly announced.

3.2 The "Human Environment"

Under WEPA, EISs are required for "major actions significantly affecting the quality of the human environment" (§ 1.11(2)(c), Wis. Stat.). The term "human environment" encompasses what are referred to elsewhere in this EIS as environmental and socioeconomic conditions. Section NR 150.03(12), Wis. Adm. Code, defines "human environment" as:

> *[T]he natural or physical environment, including the components, structures, and functioning of ecosystems, and the relationship of people with that environment, including aesthetic, historic, cultural, economic, social, and human health-related components.*

WEPA does not require state agencies to conduct an all-encompassing analysis of every degree of potential effect on every element of the human environment. Such an analysis is not possible (Clean Wisconsin, Inc. v. PSC 2005, ¶ 191). Table 3.2-1 lists the components and functions of the human environment that were included in the Final EIS analysis. An initial list was assembled by DNR staff and included in a draft outline made available for public review and comment during the public scoping process. The list was revised based on comments received during the public scoping process, and further revised based on public comments received on the Draft EIS.

Certain components of the human environment receive special attention in Chapter 4. As Chapter 4 details, the 1837, 1842, and 1854 treaties between the Bands of Lake Superior Chippewa and the U.S. government maintained the Ojibwe peoples' rights to hunt, fish, and gather many types of terrestrial and aquatic plants and animals within the Ceded Territories of northern Wisconsin, Michigan, and Minnesota. As noted elsewhere, all Line 5 pipeline relocation route alternatives are located entirely within the Ceded Territories. In addition, the existing Line 5 pipeline crosses the Bad River Reservation. The river and stream crossings along Enbridge's proposed pipeline relocation route range from 1.3 river miles to 8.6 river miles upstream of the Bad River Reservation (Figure 4.1-3). The Red Cliff Reservation is also located on Lake Superior downstream of the proposed pipeline crossings. Furthermore, the Ojibwe and other tribal nations have unique historic, cultural, religious, and ceremonial connections to water (Nibi) and other components of the human environment (Section 4.2.1), which they consider to be relatives (Odinawemaaganag). Lastly, Ojibwe tribal governments have historically faced–and continue to face–unique challenges to protecting and maintaining the health and safety of their peoples. Thus, tribal leaders have expressed concerns during government-to-government interactions and communications that federal and state agencies must adequately consider their worldviews and reliance on natural resources when implementing environmental laws. For these reasons, and in response to comments on the Draft EIS, the DNR has gathered additional information from tribal sources on these topics and has incorporated it into Chapter 4.

Table 3.2-1 Components and functions of the Human Environment included in the EIS analysis.

Physical	Ecological	Socioeconomic & Institutional
Noise	Natural Communities	Socioeconomics
Air quality	Ecological landscapes	Demographics
GHG emissions	Natural communities	Regional economy
Climate	Climate sensitive species	Cultural resources
Global	State Natural Areas	Burial sites
National	State Wildlife Areas	Archaeological sites
State	State Fisheries Areas	Historic structures
Ceded Territories	Endangered species	Cultural practices
Geology & groundwater	Threatened species	Tribal lands
Bedrock	Wildlife	Reservations
Aquifers	Birds	Ceded Territories
Wells	Mammals	Forestry
Soils	Amphibians	Agriculture
Steep slopes	Reptiles	Transportation
Geohazards & fluvial erosion	SGCN	Public lands
Lake Superior	Invasive species	Environmental justice
Bad River watershed	Aquatic communities	Authorities & required approvals
Surface water quality	Community types	Federal
Temperature	Fish & fisheries	Tribal
Turbidity	Macroinvertebrates	State
Public Health & Safety	Wetlands	Local
Trespass	Wild rice waters	Consistency with plans
Blasting		Federal
Climate Change impacts	**Proposed Project-related**	Tribal
Oil spill impacts	Line 5 materials & products	State
	Transported products	Local
	Refined end products	Degree of controversy
	Current & projected demand	Potential for precedent
	Probability of spills	Risk & uncertainty

3.3 Types of Effects Analyzed

Under WEPA, an agency preparing an EIS must consider more than just the short-term effects of a proposed project within its immediate vicinity. The types of environmental effects analyzed for this EIS included direct, indirect, temporary, and long-term effects, as well as cumulative impacts.

3.3.1 Direct Effects

Direct effects are those effects that are directly caused by a proposed action or project and occur at the same time and place as the action or project (Wisconsin's Env't Decade, Inc. v. PSC 1977, 429). For example, a direct effect of this proposed project includes the removal of vegetation from the construction ROW during pipeline installation. Direct effects can include temporary as well as long-term effects. The placement of construction matting in wetlands during construction would constitute a temporary direct effect, whereas the conversion of forested wetland to emergent wetland within the permanent ROW would constitute a long-term direct effect.

All direct effects of Enbridge's proposed pipeline relocation would be caused by Enbridge's pipeline installation and construction-related activities, such as clearing trees, trenching, blasting, and horizontal directional drilling. Not all construction-related impacts, however, would be direct. For example, proliferation of invasive species within a forested ROW would constitute an indirect effect.

3.3.2 Indirect or Secondary Effects

Indirect effects or secondary effects are reasonably foreseeable effects caused by a proposed action or project that are later in time or farther removed in distance, including induced changes in the pattern of land use, population density, or growth rate and related effects on the human environment. Indirect effects can include temporary as well as long-term effects (§ NR 150.03(24), Wis. Adm. Code); (Applegate-Bader Farm, LLC v. DOR 2021, ¶ 20). Increased noise in the general area of pipeline construction would constitute a temporary indirect effect, whereas an increase in forest fragmentation and edge habitat would constitute a long-term indirect effect.

The effects of pipeline operation (i.e., the continued transportation of oil and NGLs via a relocated Line 5) constitute indirect effects. This includes the risk and anticipated effects of pipeline spills (Chapter 6) as well as the economic and climate impacts of the production, transport, refinement, and consumption of the petroleum and NGLs transported via Line 5 (Chapters 7 and 8).

3.3.3 Cumulative Effects

Cumulative effects are compounding effects resulting from repeated or other proximal actions, activities, or projects (§ NR 150.03(4), Wis. Adm. Code). Cumulative effects include the direct and indirect effects of the proposed action and its alternatives when added to the aggregate effects of past, present, and reasonably foreseeable future actions (Wisconsin's Env't Decade, Inc. v. PSC 1977, n.17). Cumulative effects could arise from single or multiple actions and could result in additive or interactive effects. Cumulative effects analysis necessarily involves assumptions and uncertainties, but need only include what is reasonably known or foreseeable. The selection of actions to include in the cumulative effects analysis, like any environmental impact assessment, depends on whether they affect the human environment (i.e., it is not practical or reasonable to analyze the cumulative effects of all actions on the entire universe).

3.3.4 Other Issues & Considerations

Under WEPA, an "EIS shall emphasize environmental issues relevant to the evaluation of the action and provide a level of detail commensurate with the complexity of the action" (§ NR 150.30 (2), Wis. Adm. Code). In addition to the description of the proposed project, reasonable alternatives, affected environment, and anticipated effects, an EIS should also include statements regarding:

- Consistency with plans or policies of local, state, federal, or tribal governments.
- The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitments of resources.
- The potential to establish a precedent for future actions or to foreclose future options.
- The degree of risk or uncertainty in predicting environmental effects or effectively controlling anticipated deleterious environmental impacts, including those relating to public health or safety.
- The degree of controversy over the effects on the quality of the human environment.
- Identification of information that is incomplete or unavailable and a description of the relevance of such information.

These items are discussed in Chapter 5.

3.4 Geographic Scope of Analysis

Broadly speaking, the geographic scope of analysis for this EIS is the state of Wisconsin, including the maritime zones of the Great Lakes within the legal boundaries of the state. The geographic scope of the component analyses conducted for this EIS varied according to the type of effect (direct, indirect, or cumulative) and the alternative being considered. All alternatives considered–including the 'No Action' alternative–would have varying degrees of environmental and socioeconomic effects in areas outside of Wisconsin–in some cases, outside the United States. Such effects were analyzed only to the extent that they *also* affect the human environment in Wisconsin. Effects that would only occur outside of Wisconsin are beyond the scope of this EIS.

3.4.1 Area of Direct Effect (Project Area)

The geographic scope of the directly affected environment includes the areas of land and water crossed by the ROWs for Enbridge's proposed Line 5 relocation route and route alternatives (Section 3.5.1) and any associated access roads and temporary workspaces. Details on the location of the proposed relocation route and route alternatives are provided in Sections 2.1 and 3.5, and Appendix A includes maps of each route alternative. A description of the affected environment and anticipated impacts from each route alternative is provided in Chapter 5. The area of direct impact includes three aquifers, ten watersheds, and three different ecological landscapes. Enbridge determined that each mile of replacement pipeline would directly affect approximately 15 acres of land during construction. In addition to the geologic, terrestrial, and aquatic environments, the scope of the directly affected environment includes the local climate. The scope of the directly affected environment also includes the socioeconomic and environmental justice elements of the communities along the existing, proposed, and alternative routes, including tribal lands and the Ceded Territories (Section 4.1.4). The counties and county subdivisions along the routes are summarized in Section 1.4.4 and Table 3.4-1. Table 2.1-1 provides the township, range, and section locations for Enbridge's proposed Line 5 relocation route.

The area of direct impact for cultural resources and environmental justice considerations includes the Bad River and Red Cliff Reservations and the Ceded Territories, throughout which the members of several tribes have reserved rights to hunt, fish, and gather (Section 4.1.4).

Table 3.4-1 Communities along Enbridge's existing Line 5 ROW, Enbridge's proposed Line 5 relocation route, and route alternatives.

Route	Counties	County subdivisions (cities, towns, villages)	Native American reservation
Existing Route	Ashland, Iron	Gurney, Sanborn, Gingles	Bad River Reservation
Proposed Route	Ashland, Iron	Saxon, Gurney, Anderson, Morse, Mellen (buffer only), Ashland (town), Marengo, White River, Gingles Ashland (city, buffer only)	None
Route Alternative #RA-01	Ashland, Iron	Gurney, Anderson, Morse, Sanborn (buffer only), Ashland (town), Marengo, White River, Gingles	Bad River Reservation (buffer only)
Route Alternative #RA-02	Ashland, Bayfield, Iron	Kimball, Hurley, Montreal, Pence, Knight, Anderson, Morse, Mellen (buffer only), Ashland (town), Marengo, White River, Kelly, Lincoln (buffer only), Eileen	None
Route Alternative #RA-03	Ashland, Bayfield, Iron	Kimball, Hurley (buffer only), Montreal, Pence, Knight, Carey (buffer only), Jacobs, Gordon, Shanagolden (buffer only), Namakagon, Cable, Drummond, Barnes, Hughes, Oulu	None

3.4.2 Areas of Indirect & Cumulative Effects

The geographic scope of the indirectly affected environment is a broader area than the directly affected environment and includes those areas that are affected by a proposed action later in time or are farther removed in distance from the proposed action.

3.4.2.1 Cultural Resources & Environmental Justice

As noted in Section 3.2, Ojibwe worldviews informed the cultural resources analysis and, as such, the geographic scope of the analysis extended beyond the project and alternative ROWs to encompass the Bad River and Red Cliff Reservations and the entirety of the Ceded Territories.

The geographic scope of the environmental justice portions of the DNR's analysis included, but was not limited to, block groups (the smallest unit for which Census data are available) that are either crossed by or are partially within a half-mile distance of the existing Line 5 route, Enbridge's proposed relocation route, or one of the route alternatives. As discussed in Chapter 4, the DNR took a hybrid approach to evaluating the anticipated environmental justice effects of the proposed project, including an analysis of Census data, background research on the Missing and Murdered Indigenous Women crisis, and a series of discussions with tribal members and staff (Sections 4.3 and 4.4). This approach did not require a strictly defined, overall geographic scope.

3.4.2.2 Aquifers

An aquifer is a geological formation lying below the ground surface that is partially or entirely saturated with water and permeable enough to allow water to be extracted from a well. The Copper Falls Aquifer is that fraction of the Copper Falls Formation that is saturated by groundwater and is capable of sustaining water supply wells (Section 5.5.1.2). The water in aquifers is sustained, in part, by the recharge from precipitation into the ground that reaches the aquifer. Enbridge's proposed Line 5 relocation route and all the route alternatives cross through the geographic areas where the Copper Falls Formation is the uppermost geological unit or where it is close to the surface, and as such, crosses through areas that help to supply water to the Copper Falls Aquifer and the hydrologically connected Lake Superior Sandstone Aquifer. Areas where the routes cross through the Copper Falls Formation could have a direct effect on the Copper Falls Aquifer. Those areas of aquifer that are hydrologically down gradient from the recharge areas crossed by route alternatives are within the geographic scope of the possible indirect effects. Groundwater flow could carry contaminants from locations of spills or releases within recharge areas to other parts of aquifers that are down flow from a spill or release. Similarly, groundwater recharged by waterways could be impacted by a spill or release carried downstream along the waterway to an area where surface water enters the groundwater system.

The Lake Superior Sandstone occurs north of the Penokee Hills and is generally buried beneath glacial sediments. Due to its depth of burial, the Lake Superior Sandstone Aquifer is beyond the geographic scope of direct effects, although the aquifer could be impacted by indirect effects.

In those areas where the glacial sediments are thin or absent and where the Lake Superior Sandstone aquifer is not present, such as areas along the Penokee Hills, the only available aquifer is the fractured crystalline rock. RA-01 does not extend into the area where fractured crystalline rock is the only aquifer. The proposed route, RA-02, and RA-03 cross through areas limited to the fractured crystalline rock.

3.4.2.3 Watersheds

The scope of the environmental review includes a review of effects to surface waters that are crossed by Enbridge's proposed Line 5 relocation route and route alternatives (Sections 5.7 and 5.8). The watersheds crossed by Enbridge's proposed route include Fish Creek, the Bad River, Marengo River, Potato River, Tyler Forks, White River, and Montreal River watersheds Figure 3.4-1). RA-01 crosses the same watersheds as Enbridge's proposed relocation route but does not extend into the Fish Creek Watershed. RA-02 is located in the same watersheds as Enbridge's proposed relocation route. RA-03 is located outside of the Bad River watershed within the Montreal River, Bois Brule River, and Iron River watersheds of the Lake Superior Basin, the East Fork Chippewa River and West Fork Chippewa River watersheds of the Upper Chippewa River Basin, and the Upper Namekagon River, Totagatic River, Upper St. Croix and Eau Claire Rivers watersheds of the St. Corix River Basin. The latter two river basins drain to the Mississippi River. Surface waters that are hydrologically downstream from the proposed route and route alternatives, including any wetlands hydrologically connected to them, are within the geographic scope of the possible indirect effects. This includes the Bad River and Kokagon Sloughs and Lake Superior, which are culturally significant resources for the Ojibwe people (Sections 4.2.1.4 and 4.2.1.5).

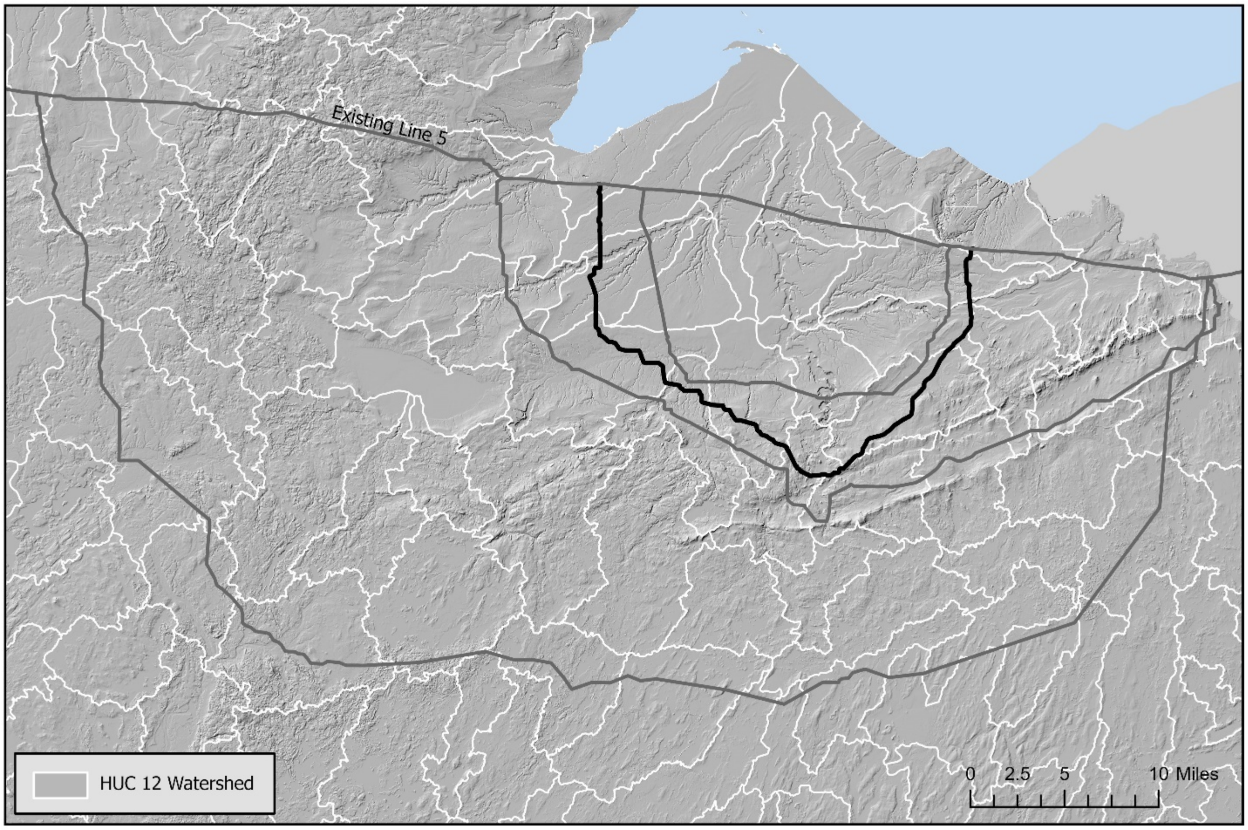

Figure 3.4-1 Watersheds crossed by Enbridge's proposed Line 5 relocation route and route alternatives.

3.4.2.4 Habitats & Ecological Landscapes

Enbridge's proposed Line 5 relocation route, RA-01, and RA-02 would cross through the Superior Coastal Plain and the North Central Forest ecological landscapes. RA-03 would cross through the North Central Forest Ecological Landscape and an associated pump station and project storage would be located in the Northwest Sands Ecological Landscape (Figure 3.4-2). These ecological landscapes could be directly affected by construction and operation of the relocated pipeline. Areas within these landscapes that are ecologically connected to the ROWs could be indirectly affected by the project. These ecological landscapes, which are briefly described below, are part of the geographic scope of indirect effects (DNR, 2015a). Section 5.9 includes additional information on the effects to ecological landscapes.

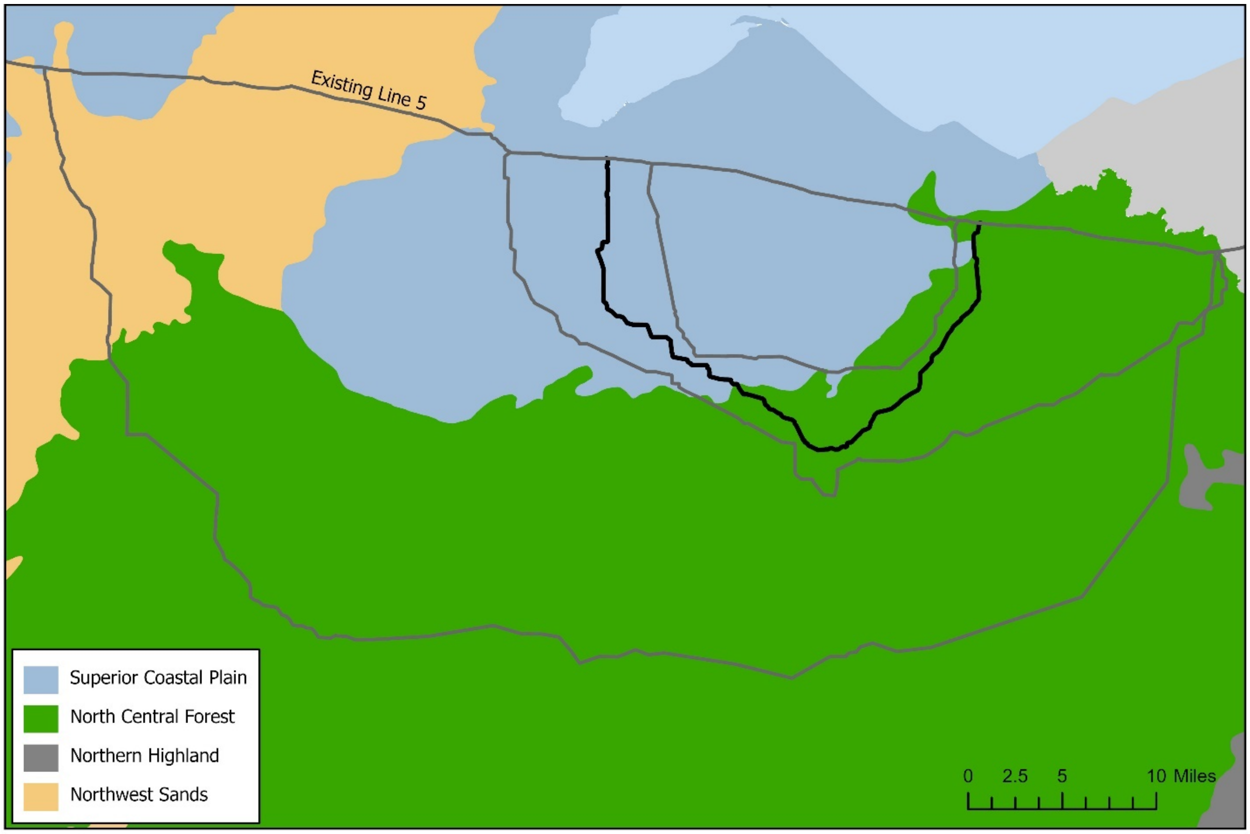

Figure 3.4-2 Ecological landscapes crossed by Enbridge's proposed Line 5 relocation route and route alternatives.

3.4.2.5 Superior Coastal Plain

Lake Superior has a strong influence on the climate, soils, and hydrology of the region. The soils of the Superior Coastal Plain are unique to this ecological landscape within Wisconsin. These soils are described as deep, reddish lacustrine clays containing lenses of sand or coarse textured tills. These soils give context to the historic vegetation and composition of the Superior Coastal Plain boreal forests, which are characterized by older forests and conifers such as eastern hemlock, eastern white pine, white spruce, balsam fir, and northern white cedar. Clay deposits are erosion prone, especially when they are cut by streams. The slopes of many of the area rivers were damaged during historic logging periods, and unstable slopes still occur, resulting in turbidity. Organic soils are infrequent except in coastal lagoons or in basins underlain by impermeable clay tills. Rivers flow generally south to north. Inland lakes are rare in the landscape; there are only 19 named lakes in the Superior Coastal Plain. Wetlands are relatively common and account for 12% of the area. Aspen-dominated boreal forests are abundant. In some areas, white spruce, balsam fir, and eastern white pine, all dominant prior to extensive harvest, are fragmented as a result of fields and pastures. Large coastal wetlands occur within the landscape and are mosaics of coniferous and deciduous forests, shrublands, wet meadows, and marsh (DNR, 2015b). The climate of the Lake Superior Coastal Plain is typical of northern Wisconsin and has an average growing season of 122 days. In general, areas located away from Lake Superior have shorter growing seasons. Summers are cool and deep snows accumulate in winter. Level plains slope gently toward the lake. Section 5.9.1 includes additional information on the Superior Coastal Plain Ecological Landscape.

3.4.2.6 North Central Forest

Landforms in the North Central Forest Ecological Landscape include glacial ground moraines, end moraines, and bedrock-controlled ridges and hills. Bedrock is igneous and metamorphic at depths of less than five feet to over 100 feet below grade. Soils are generally sandy and organic soils are common in lowlands having shallow water tables. Waterways and springs are common within this landscape. Approximately 75 percent of the landscape is covered by forests, with the dominant forest cover type being mesic northern hardwoods. This type of forest is characterized by sugar maple, basswood, and red maple, including areas of scattered hemlock, yellow birch, and eastern white pine. The climate of the North Central Forest Ecological Landscape is typical of northern Wisconsin and has an average growing season of 115 days. Summers are cool and snowfall increases toward Lake Superior or in the topographically higher Penokee-Gogebic Iron Range. The cool summers and shorter growing season are not conducive to row-crop agriculture (DNR, 2015c). Section 5.9.1 includes additional information on the North Central Forest Ecological Landscape.

3.4.2.7 Northwest Sands

The Northwest Sands Ecological Landscape has two major geomorphic components, and these are a large outwash plain and a former spillway from Glacial Lake Duluth, which preceded Lake Superior during retreat of continental glaciation. Soils in uplands are primarily sandy or loamy sands. These soils tend to be droughty due to rapid drainage of the underlying sandy sediments. There are a large number of kettle lakes that are typically groundwater fed. Approximately 5 percent of the area is covered by lakes. The land cover in the Northwest Sands Ecological Landscape is a mix of dry forest, barrens, grassland, and agriculture. The growing season averages 121 days (DNR, 2015d). Section 5.9.1.3 includes additional information on the Northwest Sands Ecological Landscape.

3.4.2.8 Climate

The weather we experience in our day-to-day lives changes over short time-scales; i.e., daily, weekly, monthly, and seasonally. Broader patterns appear over longer periods of time (i.e., decades) and larger geographic scales. These patterns, referred to as climate, determine things like what types of plants and animals can survive in an area, the growing seasons and agricultural practices for different types of crops, and engineering standards for infrastructure. Chapter 7 provides an overview of Wisconsin’s climate, including trends and projections for the state as a whole and the Ceded Territories, along with national and global projections. The scope of analysis for this Final EIS included Wisconsin’s climate, both as a potential endpoint of environmental effects (i.e., climate change) and as a contributing factor in determining other environmental effects, such as storm water runoff (Section 5.7.9.1) and impacts on climate-sensitive species (Section 5.10.11).

3.5 Alternatives Considered

Under WEPA, a state agency preparing an EIS must consider the effects to the human environment of not only a proposed action, but also of alternatives to the proposed action. Alternatives include other actions or activities which may be reasonably available to achieve the same or altered purpose of the proposed action or project, including an alternative of no action (§ NR 150.03(2), Wis. Adm. Code). The agency must include reasonable alternatives, but need not discuss unreasonable alternatives, such as alternatives that fall outside the agency’s authority or alternatives that do not accomplish the purpose of the action (Clean Wisconsin v. PSC 2005, ¶¶ 205, 210).

For this Final EIS, the DNR analyzed the effects of Enbridge's proposed Line 5 relocation route, the three alternative Line 5 relocation routes considered by Enbridge, and the DNR's No Action alternative. All five of these alternatives were analyzed according to the different types of effects described in Section 3.3. The environmental and socioeconomic effects associated with the various route alternatives are discussed in Chapters 4, 5, and 6. Chapter 8 describes the effects associated with the No Action alternative.

3.5.1 Route Alternatives

As detailed in Chapter 1, pipeline companies determine the routes for their pipelines; acquire the ROWs to build, operate, and maintain them; engineer the actual system designs; and construct the lines. No federal or state agency has general authority for identifying the need for or siting of petroleum pipelines in Wisconsin. As such, the DNR relied on Enbridge to identify reasonable alternatives to the company's proposed pipeline relocation route. The following route alternatives were included in the Final EIS analysis (Figure 3.5-1; Appendix C):

- Enbridge's Proposed Line 5 Relocation Route
- Route Alternative 1 (RA-01)
- Route Alternative 2 (RA-02)
- Route Alternative 3 (RA-03)

Enbridge evaluated the four route alternatives based on minimizing the length of the pipeline to the extent practicable, while also minimizing the environmental impacts to natural and cultural resources. In general, Enbridge determined that each mile of constructed pipeline would affect approximately 15 acres during construction. While Enbridge would seek to avoid sensitive resources to the extent practicable, impacts to all resources cannot be completely avoided if the project is constructed due to the linear nature of the proposed project and the extent and prevalence of resources in the region. Enbridge's analysis involved review of potential routes that would avoid the Bad River Band's Reservation, considering potential tie-in locations for the replacement segment, and lessening the length of the pipeline segment while limiting impacts to the human environment. Figure 3.5-1 depicts Enbridge's proposed Line 5 relocation route and route alternatives. Figure 1.1-2 provides a more detailed map of Enbridge's proposed relocation route. Appendix C includes maps of each route alternative. Section 2.1.1 describes the proposed relocation route and Sections 3.5.1.1 to 3.5.1.3 briefly describe each route alternative. Effects on the human environment associated with the various route alternatives are presented in Chapters 4, 5, and 6.

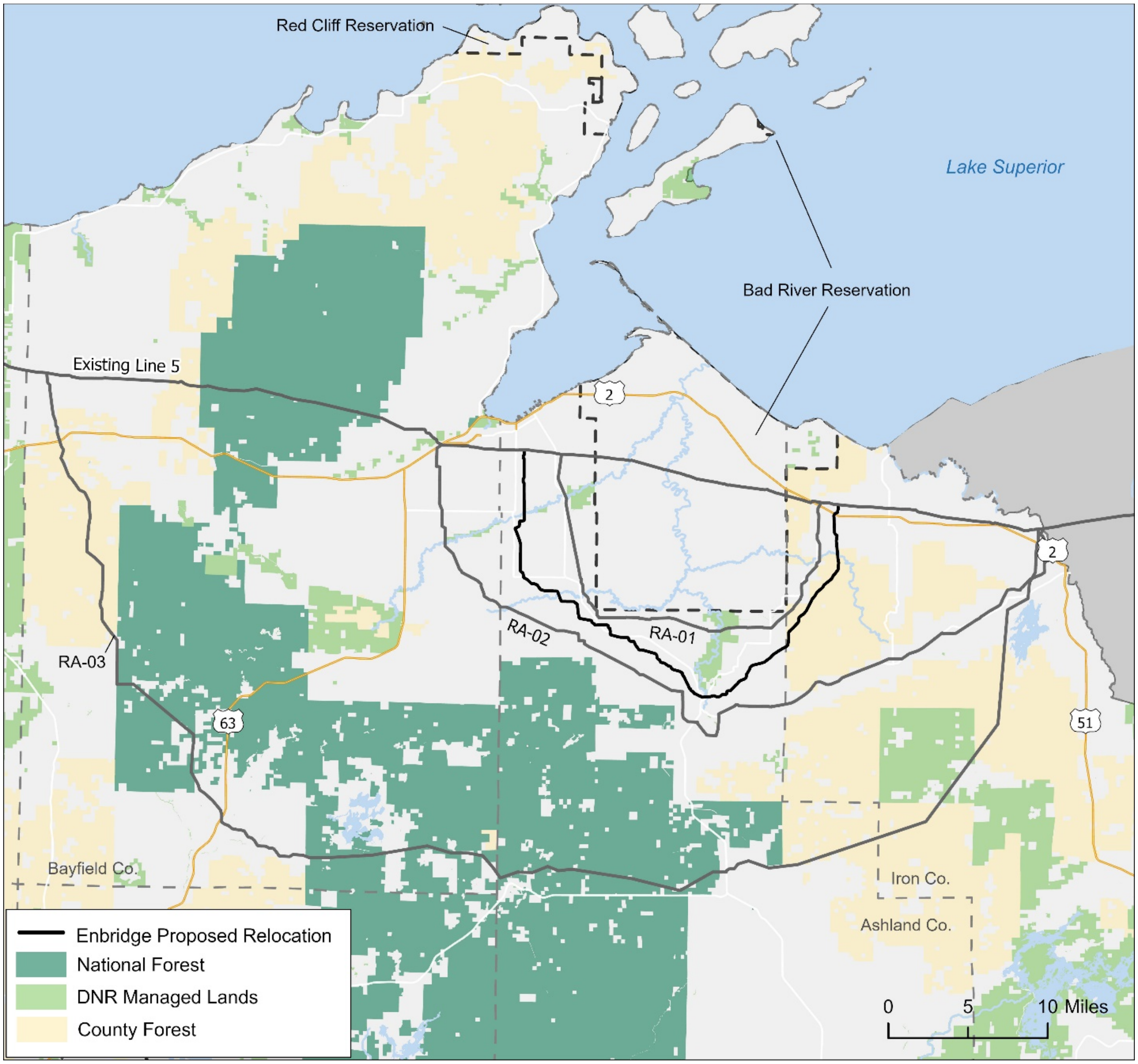

Figure 3.5-1 Overview of Enbridge's proposed Line 5 relocation route and route alternatives.

3.5.1.1 Route Alternative 1 (RA-01)

Route Alternative 1 (RA-01) would be located outside the Bad River Reservation, but near the exterior boundary (Figure 3.5-1; Appendix C). As shown in Figure 1.1-2, RA-01 begins in Ashland County at the existing Line 5 to the east of State Highway 13 and west of the western boundary of the Bad River Reservation. The route runs south, crosses the White River, and roughly parallels Highway 13 until it crosses the Marengo and Brunsweiler rivers and then turns to the east. The route continues generally east, crossing Trout Brook, Silver Creek, Billy Creek, and the Bad River south of the Reservation, until it crosses Feldcher Creek just west of the Iron County border. The route then angles northeast and continues roughly paralleling State Highway 169, crossing the Tyler Forks, Potato River, and Vaughn Creek, before ending at the existing Line 5 just north of U.S. Highway 2. RA-01 ends east of the eastern border of the Bad River Reservation and just to the west of where Enbridge's proposed relocation route would rejoin the exiting Line 5.

Among the various route alternatives considered by Enbridge, RA-01 would be the shortest route that would avoid crossing the Reservation; RA-01 is 31.4 miles long, approximately 9.7 miles shorter than Enbridge's proposed Line 5 relocation route. RA-01 is located in the same ecological landscapes (Figure 3.4-2) and watersheds (Figure 3.4-1) as Enbridge's proposed relocation route, but RA-01 would cross 13 fewer waterbodies than Enbridge's proposed relocation route. RA-01 would cross approximately 0.5 miles of Copper Falls State Park, portions of which have been designated as an Area of Special Natural Resource Interest (ASNRI) and a State Natural Area (SNA). In addition, RA-01 would potentially cross through a portion of the park that is listed on the National Register of Historic Places and Wisconsin Register of Historic Places. RA-01 would cross Iron County Forest land on the eastern end of the route. RA-01 would cross 37 roads and two railroads. Enbridge estimates the cost associated with RA-01 to be approximately $95.8 million less than what it would cost for the proposed route.

Overall, RA-01 would meet the Enbridge's stated purpose and need for the route relocation and would be a technically and economically feasible alternative. However, Enbridge concluded that even though less expensive, RA-01 did not have any significant environmental advantage over the proposed route. Additionally, RA-01 would introduce additional environmental impacts to state owned lands that the proposed route would avoid. Based on this, Enbridge rejected this route from further consideration.

During its review of Enbridge's Clean Water Act (CWA) permit application, the USACE asked Enbridge to evaluate minor variants of RA-01 that could reduce the effects on public lands and potentially reduce the overall project length and associated environmental disturbance. The USACE evaluated the additional information and concluded that the variants would be closer to the Bad River Reservation, result in greater impacts to wetlands, and did not convey an environmental advantage over Enbridge's proposed relocation route (USACE, 2024b).

3.5.1.2 Route Alternative 2 (RA-02)

Route Alternative 2 (RA-02) identified by Enbridge is farther away from the Bad River Reservation boundary than RA-01 and Enbridge's proposed relocation route (Figure 3.5-1; Appendix C). As shown in Figure 1.1-2, RA-02 begins in Bayfield County, southwest of Ashland, near where the existing Line 5 crosses U.S. Highway 2. The route extends south, crosses the White River, and then angles southeast. The route continues to the southeast, crosses the Marengo River near the Bayfield/Ashland-county line and the Brunsweiler River, Trout Brook, Billy Creek, and Silver Creek south of Highway 13. RA-02 continues southeast to Krause Creek, just east of the Chequamegon-Nicolet National Forest, where it then turns sharply and runs south until it crosses Montreal Creek. The route then shifts to the east, crosses Highway 13, angles southeast until it reaches City Creek, where it then runs north and crosses Devils Creek. North of Devils Creek, the route angles northeast, roughly paralleling Highway 77, continues to the northeast and crosses Tyler Forks and the Potato River. RA-02 then continues northeast and ends in Iron County, north of U.S. Highway 2 near where the existing line crosses the Montreal River.

RA-02 is approximately 58 miles in length, or approximately 16.9 miles longer than the proposed route. RA-02 is located in the same ecological landscapes (Figure 3.4-2) and watersheds (Figure 3.4-1) as RA-01 and Enbridge's proposed relocation route. RA-02 does not pass-through Copper Falls State Park but does cross Iron County Forest land. RA-02 would cross 50 roads and one railroad. Enbridge estimates the construction cost for RA-02 to be approximately $134 million more than the costs for the proposed relocation route due to the alternative route's longer length.

Even though Enbridge concluded RA-02 would meet the project objectives and could be technically feasible to construct, Enbridge rejected this route from further consideration due to the higher costs and the fact that this route did not have a significant environmental advantage when compared to the proposed route or route alternatives.

3.5.1.3 Route Alternative 3 (RA-03)

The Bad River Band of Lake Superior Chippewa has called for the removal of Line 5 from not only the Bad River Reservation, but from the Bad River watershed (Section 4.1.6). Route Alternative 3 (RA-03) is located almost entirely outside of the Bad River Watershed (Figure 3.5-1; Appendix C). As shown in Figure 1.1-2, RA-03 begins at the existing Line 5 east of the Douglas/Bayfield-county line near where the existing pipeline crosses Reefer Creek. The line runs south-southeast from the connecting point, crossing Muskeg Creek, until intersecting County Highway A west of the Chequamegon-Nicolet National Forest. The route then basically parallels County Highway A to the south until turning east at County Highway N, and then southeast through the National Forest to U.S. Highway 63. RA-03 then continues southeast, crosses the Namekagon River and Cap Creek, shifts east and continues generally east north of the Bayfield/Sawyer-county line, and crosses the West Fork of the Chippewa River, the Bayfield/Ashland-county line, and Dingdong Creek. The route then angles northeast just before crossing Highway 13, continues northeast across Meters Creek, Magee Creek, Augustine Creek, and Pleasant Lake Outlet, and then turns north. The route continues north, crossing Highway 77, and ending at the exiting Line 5 north of U.S. Highway 2 between the Kaari Creek and Montreal River crossings in Iron County.

RA-03 is approximately 101.6 miles in length, approximately 60.5 miles longer than Enbridge’s proposed relocation route. RA-03 is located in the same ecological landscapes as Enbridge’s proposed relocation route and the other route alternatives (Figure 3.4-2). RA-03 crosses the Montreal River, Bois Brule River, and Iron River watersheds of the Lake Superior Basin, the East Fork Chippewa River and West Fork Chippewa River watersheds of the Upper Chippewa River Basin, and the Upper Namekagon River, Totagatic River, Upper St. Croix and Eau Claire Rivers watersheds of the St. Croix River Basin (Figure 3.4-1). The latter two river basins drain to the Mississippi River. To reconnect with the existing Line 5 within Wisconsin, an approximately 19-mile stretch of RA-03 cuts across the Bad River watershed at the eastern end of the route, but the area does not drain to the Bad River. RA-03 crosses Iron County Forest land and has the potential to cross the Island Lake Hemlocks ASNRI and the Namekagon River, which is a Wild and Scenic River. RA-03 would cross 98 roads and one railroad. Enbridge estimates RA-03 would cost approximately $479.1 million more to construct that the proposed relocation route due to its longer length. Due to the additional pipe length, RA-03 would also require the construction of an additional pump station and associated appurtenances and decommissioning of the Ino pump station.

Although Enbridge found RA-03 would be technically feasible to construct and could meet the project objective, Enbridge determined that RA-03 did not convey a significant environmental advantage over the proposed route or other route alternatives. Based on this, as well as the potential for RA-03 to cause significant environmental impacts, and constructability and operational costs, Enbridge rejected RA-03 as its proposed route.

3.5.2 No Action Alternative

Under WEPA, the ‘No Action’ alternative analyzes the effect of the agency taking no action, rather than the proposed action. For this Final EIS, the No Action alternative is that the DNR would not issue permits to Enbridge under the state permitting authorities listed in Section 1.4.3, which are required to proceed with the proposed rerouting of the pipeline.

There are numerous possible outcomes of the No Action alternative. It is uncertain and outside of the DNR’s control as to which outcome would occur if the No Action alternative were selected. Some possible outcomes could result in the decommissioning of Line 5, while other possible outcomes of the No Action alternative could result in the continued use of Line 5 or an alternative pipeline route.

As described in Section 1.2.2, there is ongoing federal litigation involving the continued operation of the existing pipeline. The Federal District Court for Western Wisconsin ruled that Enbridge must terminate operation of the existing pipeline through the Bad River Reservation. If this ruling stands, the outcome of the No Action alternative could be the decommissioning of Line 5. However, the District Court decision is appealed and pending a decision in the 7th Circuit Court of Appeals. It is possible that an appellate court could allow temporary or long-term continued operation of the existing Line 5 pipeline through the Bad River Reservation. In this case, the No Action alternative could result in the continued use of the existing Line 5.

Another outcome of the No Action alternative could be that Enbridge modifies or reapplies for permits and addresses concerns identified in a permit denial. Enbridge could also pursue an alternative route or alter its proposed construction or operation. Enbridge could make business decisions that alter or eliminate the need for Line 5 construction in Wisconsin.

Although the DNR does not control the outcome of the No Action alternative, this EIS examined the outcome that the No Action alternative results in the decommissioning of Line 5. This provides the most comprehensive analysis, given that other portions of the EIS considered outcomes for continued operation of a pipeline. In analyzing the anticipated effects of decommissioning Line 5 as the outcome of the No Action alternative (Chapter 8), the DNR assumed that consumers would substitute the petroleum and NGLs currently transported via Line 5 with a combination of the same products transported by other means, different products (e.g., alternative energy), and/or improvements in energy efficiency (alternatives that are beyond the scope of this Final EIS, Section 3.6). Regardless of how they come about, these substitutions would have their own effects on the quality of the human environment, which in turn could offset or compound the direct, indirect, and cumulative effects of the No Action alternative over time. Of particular interest to public commenters on the Draft EIS are the effects on GHG emissions and climate change.

3.6 Alternatives Outside the Scope of the EIS

Under WEPA, agencies preparing an EIS are required to consider a range of reasonable alternatives to a proposed action or project. For this Final EIS, the DNR considered the effects of Enbridge's four alternative relocation routes and the DNR's No Action alternative described in Sections 2.1 and 3.5. As noted in Section 3.5, WEPA does not require discussion of unreasonable alternatives that fall outside the agency's authority or do not accomplish the purpose of the action (Clean Wisconsin v. PSC 2005, ¶¶ 205, 210). The alternatives that are briefly described below were determined to be beyond the scope of this EIS because they were determined to be either impracticable or impossible for either Enbridge or the DNR to unilaterally implement. These alternatives include:

- Constructing or Repurposing an All-Canadian Pipeline to Replace Line 5
- Switching to Other, Existing Pipelines to Carry Line 5 Products
- Transporting Line 5 Products by Other Modes
- Entirely replacing Line 5 Products with Alternative Energies
- Entirely offsetting the Demand for Line 5 Products through Conservation and Efficiency

Importantly, the DNR does not have the ability to implement any of these alternatives–nor does it have the authority to require others to implement them. Only the first two alternatives are within Enbridge's purview, and the company has determined them to be infeasible. The last three alternatives listed above are already occurring to lesser degrees and were accounted for in the analysis of the environmental and socioeconomic effects of the proposed route, route alternatives, and the No Action alternative.

3.6.1 Construct or Repurpose an All-Canadian Pipeline

Numerous public comments on the Draft EIS suggested that Enbridge could or should transport the oil and NGLs that are currently transported via Line 5 to Sarnia, Ontario, through a pipeline that is entirely within Canada. To achieve the same purpose as Enbridge's existing Line 5 system, including the same product delivery and receipt points, a new pipeline or multiple pipelines would likely be required. Enbridge has stated that constructing such a pipeline is not feasible and did not propose a new pipeline as an alternative in its EIR (Appendix AJ). However, as part of an alternatives analysis prepared for the State of Michigan on the segment of Line 5 that crosses the Straights of Mackinac, Dynamic Risk (2017) evaluated the costs and benefits of constructing an entirely new pipeline system, including a 1,264-mile route around Lake Superior and Lake Huron, through Minnesota and Ontario. Such alternatives would cause greater direct and indirect environmental impacts than replacing a segment of the existing Line 5 due to the much larger addition of ROW, pump stations, valve sites, access roads, etc. In addition, the terrain along this northern route is mostly forested Precambrian Shield–one of the most challenging pipeline construction terrains in North America due to the hard rock and deep muskegs found throughout (Dynamic Risk Assessment Systems, 2017). As such, Enbridge did not consider constructing an entirely new all-Canada pipeline for further analysis.

Aside from building a new pipeline, some public comments suggested using existing Canadian pipelines. TransCanada owns and operates the Canadian Mainline, a high-pressure natural gas transmission system, consisting of six parallel tubes (pipelines), that extends 8,763 miles from Empress, Alberta (near the Saskatchewan border) across Saskatchewan, Manitoba, and Ontario to the Quebec-Vermont border (Figure 3.6-1). The Canadian Mainline connects to various downstream Canadian and international pipelines, can transport as much as 7.0 billion cubic feet/day (bcf/d) of natural gas, and has storage capacity of 400 billion cubic feet. However, the flow of natural gas in the Mainline significantly declined from a high of 6.8 bcf/d in 2000 to just 2.4 Bcf/d in 2012 (Fielden, 2013); the Mainline system was underused, operating below fifty percent of its capacity. In 2013, TransCanada proposed its Energy East project which would convert parts of the underused Mainline system from gas to oil transportation. Conversion of one pipeline would allow the company to transport between 500,000 and one million barrels of heavy crude oil per day from Alberta and Saskatchewan to eastern Canada (Cattaneo, 2012). The refineries in eastern Canada, however, are configured to process light sweet crudes, which is what Line 5 transports, so TransCanada's Energy East project would only supply heavy crude oil for export from eastern Canada.

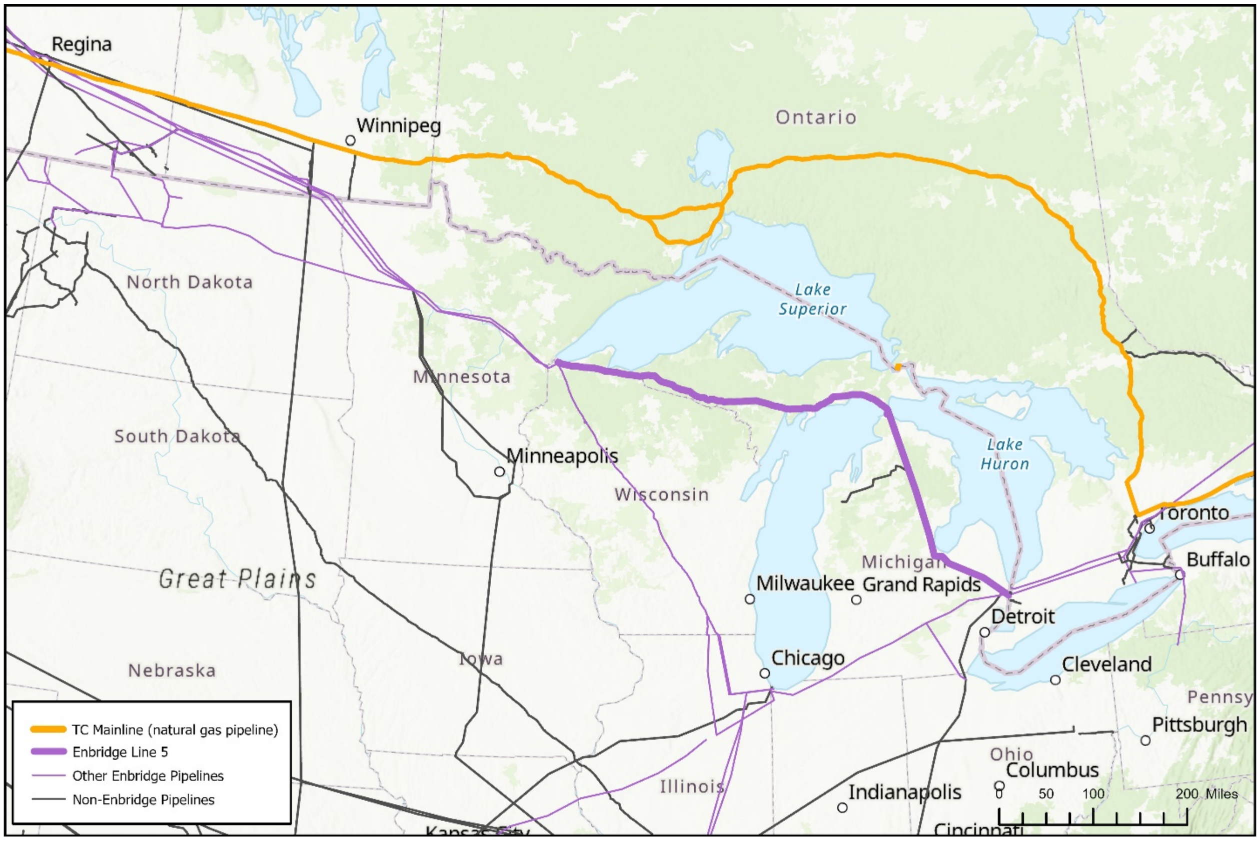

Figure 3.6-1 Existing long-distance pipelines in the Upper Midwest and Canada.
Sources: DNR; U.S. Energy Information Administration (EIA), Pipeline and Hazardous Materials Safety Administration (PHMSA), Canada Energy Regulator

TransCanada's Energy East project construction was expected to begin in 2016 and the Energy East line was anticipated to be in service in late 2017 or early 2018 at a cost of $12.5 billion (TERA Environmental Consultants, 2014). The project faced regulatory hurdles and fierce opposition from some indigenous groups and communities living along the pipeline's route. As a result, the TransCanada abandoned the Energy East project in October 2017 (BBC, 2017).

Although building a new all-Canadian pipeline or using existing Canadian pipelines may be alternatives within Enbridge's purview, the company has determined such alternatives to be infeasible. The DNR is not able to evaluate the feasibility of such alternatives and has no authority to require Enbridge to consider them further; therefore, the use of a new or existing all-Canadian line is beyond the scope of this Final EIS.

3.6.2 Switch to Other Existing Pipelines

Enbridge's Line 5 is designed to transport 540,000 barrels per day (bpd) of oil and NGLs from Superior to receipt and delivery points in Michigan and Sarnia, Ontario. According to Enbridge, the total quantities of oil and NGLs that are transported via Line 5 from Superior to points in Michigan and Sarnia cannot be transported on any of the company's existing pipeline due to geographic considerations, capacity limitations, and infeasibility of reconfigurations to transport the additional Line 5 volumes of light crude and NGLs. These points are discussed below.

First, there is no other existing Enbridge pipeline that is geographically situated to serve all the receipt and delivery points that are served by Line 5's routing from Superior, through the Upper and Lower Peninsulas of Michigan, to Sarnia (Figure 1.1-1). Line 5, for example, delivers NGLs to Rapid River, Michigan in the Upper Peninsula, where Line 5 product is converted to propane, which is used for home and commercial heating as well as other uses. Line 5 also receives Michigan-produced oil from points in the Lower Peninsula of Michigan and makes deliveries of crude oil at other points in Michigan before transporting remaining volumes to its terminus in Sarnia. No existing Enbridge pipeline is routed in a manner to transport Line 5 quantities of oil and NGLs to and from these points in Michigan (Figure 1.1-1). For this reason alone, no existing Enbridge pipeline can serve as a feasible alternative to Line 5.

Second, capacity constraints on existing Enbridge pipelines cause them to be infeasible alternatives for the transport of Line 5 volumes from Superior to Sarnia. Specifically, only one other existing Enbridge pipeline, Line 78, terminates in Sarnia. Line 78 originates at the Enbridge Flanagan Terminal in Pontiac, Illinois extending through Indiana and into the Lower Peninsula of Michigan to Sarnia, Ontario (Figure 1.1-1). Line 78's capacity is, however, finite. Based on existing Line 78 demand, Enbridge estimates Line 78 could currently transport a small percentage (perhaps approximately 10%) of Line 5 volumes. However, Line 78 demand is historically at or near the full 500,000 bpd capacity of the line south of Stockbridge, at which point Line 78 would not be able to transport any Line 5 volumes as well as the volumes it normally transports. More importantly, any light crude diverted from Line 5 to Line 78 would mean reducing the amount of heavy crude carried on Line 78. Accordingly, the total volumes that can be carried on Line 78 are limited–moving Line 5 crude to Line 78 would displace those products currently transported on Line 78 and create other shortages to delivery points on Enbridge's system.

Third, no existing Enbridge pipeline can serve as a feasible alternative to transport any of the NGLs that are transported on Line 5. Pipelines are generally operationally configured to transport NGLs or crude oil, but not both. For example, the transport of NGLs requires specific facilities to allow operations, such as station placement based on hydraulics, pumps specified to operate on their curve, and software (gaskets/seals) on valves and equipment. Terminals to which pipelines connect must also be configured with three-sided shelters, tandem pump seals, flare pits, and seals on equipment. Line 5 is relatively unique in that the pipeline has installed equipment to allow it to transport both crude oil and NGLs, and Line 5 stations are configured with the required equipment. Because Line 5 transports both crude and NGLs, it must be a steady-state operation pipeline, meaning that it is specifically designed, operated, and maintained to minimize frequency of start-stops and flow rate changes to maximize reliability. Failure to have the necessary equipment and operate a dual-product line in a steady-state could result in excessive fatigue of pipeline steel, and wear on motors, pumps, seals, and other equipment.

Only one other existing Enbridge pipeline is configured to transport NGLs–Line 1. Line 1, however, extends from Edmonton, Alberta, to Superior, providing Line 5 with NGLs for further delivery in Michigan and to Sarnia (Figure 1.1-1). Line 1 does not extend beyond Superior and thus does not serve as an alternative to Line 5. Further, Line 78 (the only other Enbridge line that serves Sarnia), and the stations it connects to, are not designed to transport NGLs. Enbridge also states that it is infeasible to reconfigure Line 78 and associated stations to transport NGLs, given that demand requires the pipeline to be slated for 100% crude oil service. The loss of the Line 5 NGL supply at Sarnia, given the absence of pipeline alternatives to transport those NGLs, would result in economic dislocations. Sarnia facilities today produce propane and butane from the Line 5 NGLs to meet the energy-industry needs for those products in the Midwest and elsewhere. The loss of the Sarnia-produced propane and butane would cause shortages that could not be readily addressed.

3.6.3 Alternative Modes of Transport

The Draft EIS and Enbridge's EIR discussed "system alternatives," that is, alternative modes of transporting oil and NGLs such as tanker trucks, barges, and rail cars. The current share of crude oil received in the Midwest is heavily dominated by pipelines with 1.39 billion barrels moved in 2022. The next largest transportation mode was truck at 7.99 million, then barge and tanker at 758,000 barrels, and rail at zero barrels (Figure 3.6-2). Enbridge evaluated these options and concluded they are not feasible alternatives to the continued operation of Line 5 (discussion below). The DNR does not have the ability to implement any of these alternatives. Nor does it have the authority to require others to implement them. As a result, alternative modes of transporting oil and NGLs are beyond the scope of this Final EIS. The DNR did, however, consider the effects of alternative transportation modes in the event of a Line 5 shutdown (i.e., a result of the No Action alternative; Chapter 8).

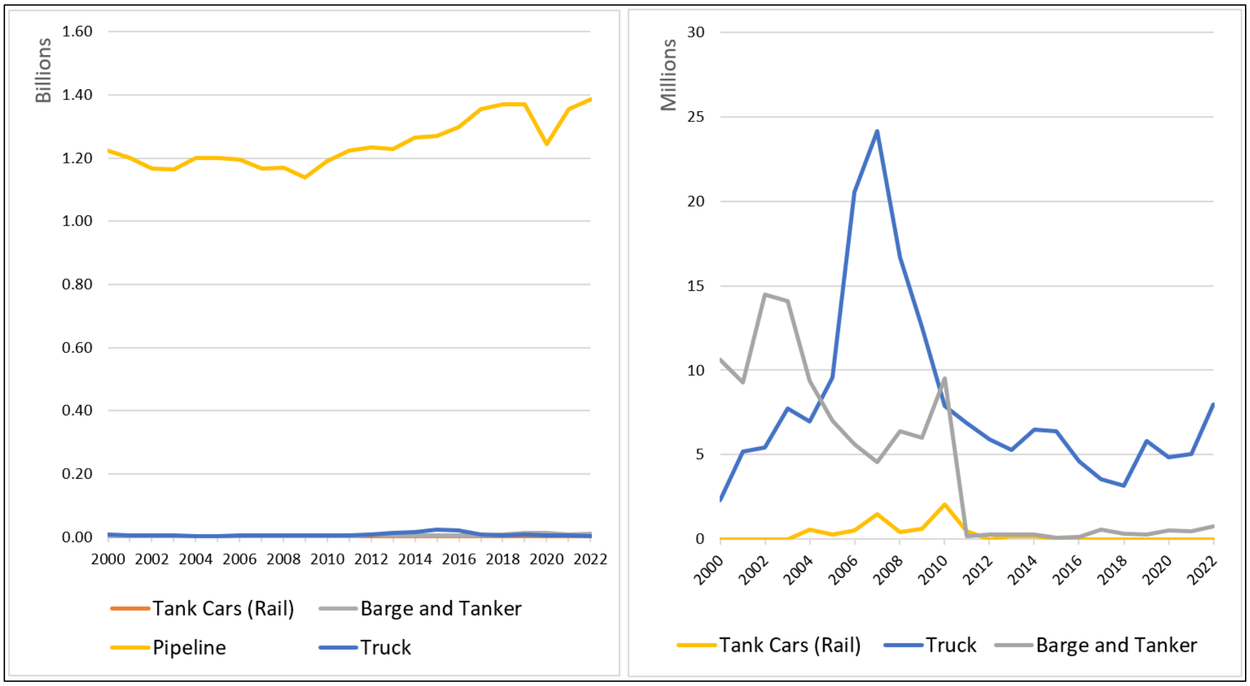

Figure 3.6-2 Midwest crude oil refinery receipts by mode of transport.
Source: (U.S. EIA, 2024a), See Appendix AI Lifecycle Emissions Calculations

3.6.3.1 Rail

Enbridge evaluated the alternative of transporting products currently being transported via Line 5 using railroad. At present, there are no existing railroad routes that connect Enbridge's Superior Terminal to delivery locations, such as the Plains Midstream Depropanization Facility in Rapid River, Michigan, or receipt locations, such as the Lewiston, Michigan facility. Additional rail lines and siding facilities would be required at each location. There would be a need for construction of new lateral rail service lines that would consequentially cause additional risk and impact to landowners and the public. For this alternative, Enbridge would also need to construct rail car loading and off-loading facilities near Enbridge's Superior Terminal and at other receipt/delivery locations along the Line 5 pipeline system.

In terms of capacity, North American railroads transport crude oil and NGLs in specialized tank cars that hold 658 barrels of crude oil or 802 barrels of NGLs. Approximately 669 rail tank cars would be required daily to transport the Line 5 daily crude volume of 430,000 bpd, and approximately 112 rail tank cars would be required on a daily basis to transport the Line 5 daily NGL volume of 75,000 bpd. To allow for the continuous daily transport of Line 5 volumes, a total of 3,092 rail tank cars would be necessary. This assumes a four-day travel time for the rail cars, which, could be as much as six to 10 days. Taking the travel time into account would then require adding more rail tank cars so that daily trips can be taken. In other words, a total of more than 3,000 rail tank cars would be required because around 800 rail cars would have to leave each day for a multi-day round trip. While those rail tank cars are in transit, an addition 800 rail cars would be loaded and start to travel the next day. Assuming the transit time (to Sarnia and back) is only four days, then at least 800 cars per day for four days would have to be readily available to not miss a day. Therefore, 800 per day for four days is approximately 3,200 rail cars. On the fifth day, the first set of 800 rail cars would be back to fill up so that they could be sent back to Sarnia. Experts retained by Enbridge believe that a four-day turnaround is highly optimistic, and a six- to 10-day turnaround is more feasible, requiring between 4,400 and 6,600 rail tank cars. Given this, Enbridge concluded rail is not a feasible means of replacing Line 5.

3.6.3.2 Truck

Enbridge evaluated the alternative of transporting materials and products currently being transported via Line 5 using tanker trucks. North American tanker trucks designed to transport hazardous liquids have the capacity to transport 172 barrels of crude oil or 218 barrels of NGLs. An estimated 3,000 loaded trucks and 3,000 empty trucks would be needed to fulfill the daily (24-hour) transport of Line 5 volumes. These trucks would need to travel on the highways and roads in Wisconsin, Michigan, Illinois, Indiana, and Canada. Assuming that the large number of trucks and drivers would be available, a dedicated fleet would need to be acquired as Enbridge does not operate such a fleet. As such, Enbridge concluded truck transport is not a feasible means of replacing Line 5.

3.6.3.3 Barge

Enbridge evaluated the alternative of transporting products currently being transported via Line 5 using barges. In the early 1950s, oil was shipped across the Great Lakes. However, the weather-shortened shipping season on the Great Lakes made the use of tankers impractical as a long-term solution. As a result, Line 5 was constructed in 1953. The issues that made shipping crude oil across the Great Lakes challenging in the 1950s have not changed. Indeed, although one could assume that approximately five 120,000-barrel articulated tug-barge vessels could be used per day to attempt to transport Line 5's crude and NGL volume across the Great Lakes (totaling approximately 1,606 loaded vessel trips per year and an equal number of empty return trips). Given this, Enbridge concluded shipping is not a feasible means of replacing Line 5.

3.6.4 Alternative Energy Sources & Conservation & Efficiency

As noted in Section 1.3.2, renewable energy is projected to be the fastest growing source of energy in the United States, although petroleum and natural gas remains the most consumed source of energy (U.S. EIA, 2022). Solar and wind energy are considered the cheapest available sources of new electricity generation and account for the increased reliance on renewables, largely because of continuing declines in the capital costs. Until 2030, energy demand growth of almost 1% per year is expected to be largely met by renewables (IEA, 2022).Until 2030, energy demand growth of almost one percent per year is expected to be largely met by renewables (World Energy Outlook, 2022). Electrification is projected to displace combustion fuels in the demand sectors. Domestic natural gas consumption for electricity generation is predicted to decrease by 2050 relative to 2022 as electricity generation shifts to using more renewable and battery sources. Wisconsin's Clean Energy Plan (Section 1.4.3.5) seeks to have all electricity consumed within the state to be 100 percent carbon-free by 2050. Enbridge has indicated that the company is committed to achieving net-zero GHG emissions from its operations by 2050 and suggested its "existing energy transmission and distribution assets will be a critical platform to achieve societal climate ambitions," noting that "existing assets are also critical to allow Enbridge to fund renewable projects" (Enbridge, 2020d). However, the transition to renewable energy sources will not be sufficiently developed to entirely replace the consumer demand within the time needed to replace the products transported through Line 5. Similarly, conservation efforts alone would not be sufficient to eliminate entirely the consumer demand for the products transported through Line 5. Because of this, entirely replacing or eliminating the need for Line 5 through alternative energy and conservation is not a feasible alternative.

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4 NATIVE AMERICAN NATIONS, TREATY RIGHTS, CULTURAL RESOURCES, & SECURITY

Native American[1] peoples have traveled, lived, hunted, fished, gathered, settled, and traded throughout the western Great Lakes region for many generations. The entirety of the existing Line 5 pipeline, Enbridge's proposed pipeline relocation route, and all three alternative pipeline routes are within the homelands of several Native American tribes and within territories ceded through various treaties between individual sovereign tribes and the United States government. This chapter describes the Native American nations present in Wisconsin today and summarizes the nature and scope of their inherent sovereignty and treaty rights. It overviews Ojibwe cultural perspectives, discusses cultural resources in the project area, and outlines tribal concerns for these resources. Finally, the chapter discloses the DNR's analysis of impacts to tribes and their cultural and treaty resources, the exercise of treaty rights, and the environmental justice implications of Enbridge's proposed pipeline relocation and route alternatives.

4.1 Native American Nations in Wisconsin

In the United States, the federal government recognizes 574 Native American entities as independent and sovereign nations that have a formal government-to-government relationship with the United States. Historic treaties and recent federal laws provide a framework for these intergovernmental relationships. Today, there are eleven federally recognized Native American tribes in Wisconsin. These include:

- Bad River Band of Lake Superior Chippewa
- Red Cliff Band of Lake Superior Chippewa
- Lac Du Flambeau Band of Lake Superior Chippewa
- Lac Courte Oreilles Band of Lake Superior Chippewa
- St. Croix Chippewa Indians of Wisconsin
- Sokaogon Chippewa Community (Mole Lake)
- Stockbridge-Munsee
- Forest County Potawatomi Community
- Menominee Indian Tribe of Wisconsin
- Oneida Nation of Wisconsin
- Ho-Chunk Nation

Collectively, tribal nations manage about 5% of Wisconsin's land base and six tribal nations have reserved off-reservation treaty rights for natural resource harvesting which may be exercised on certain lands located in approximately the northern one-third of the state (i.e., the Ceded Territories, Section 4.1.4; Figure 4.1-1). Section 4.1.2 briefly discusses each of these eleven federally recognized Native American nations, their communities, lands, and reservations. Some non-federally recognized tribes also have a presence in Wisconsin. Several tribes located outside of Wisconsin have treaty rights in the Ceded Territories.

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[1] The collective term "Native American" is used in this EIS to refer to all descendants of indigenous people who inhabited land within the current exterior boundaries of the United States prior to the continent being inhabited by European settlers and colonists, including all U.S. American Indian and Alaska Native tribal entities which have been federally recognized. The EIS uses this term solely for the purposes of readability. The DNR recognizes that each sovereign Native American nation has its own unique peoples, languages, governments, treaties, and cultural and spiritual practices.

4.1.1 Tribal Sovereignty & Governance

Native American people are both United States citizens, citizens of the state in which they have established residency and, if enrolled members, citizens of their respective tribes. Article 1, Section 8 of the U.S. Constitution recognizes tribal sovereignty: “The Congress shall have power...To regulate Commerce with foreign Nations, and among the several States, and with the Indian Tribes.” The tribes present in Wisconsin possess the power to self-govern their territories and people, and each abides by its own constitution. Hundreds of treaties, along with the Supreme Court, President, and Congress, have repeatedly affirmed that tribal nations retain their inherent powers of self-government. Wisconsin Executive Order #18, issued in 2019, also affirms the sovereignty of the federally recognized tribal governments and the government-to-government relationship that exists between the State and the tribes in Wisconsin.

Treaties, court decisions, executive orders, and laws form a fundamental contract between tribes and the U.S. government. The U.S. Supreme Court has characterized tribal governments as “domestic dependent nations” to whom the federal government has essentially a fiduciary relationship. In most cases, a Tribal Council provides government leadership to the tribe and maintains the government-to-government relationship with the U.S. government and the State of Wisconsin. Tribal governments determine their own governance structures, pass laws, and enforce laws through police departments and tribal courts. Each tribe also establishes its own criteria and rules for who can be a citizen (i.e., member) of the tribe. Tribal governments provide various programs and services for their people, including, but not limited to, education, health services, social programs, first-responder services, workforce development, energy, and land and natural resources management. The tribal governments also build and maintain infrastructure including roads, bridges, and public buildings, and operate various tribal enterprises. Additional information on tribal sovereignty and governance can be found on the National Congress of American Indians’ website (www.ncai.org/section/policy) and the U.S. Bureau of Indian Affairs’ website (www.bia.gov/).

4.1.2 Native American Communities, Tribal Lands, & Reservations

The Native American peoples in Wisconsin represent diverse nations that flourished in North America for thousands of years before the arrival of people of European descent. The Dakota, Ho-Chunk, Menominee, Ojibwe, and Potawatomi peoples are among the original human inhabitants of Wisconsin (Figure 4.1-1). Each tribe has its own unique peoples, languages (Table 4.1-1), governments, spiritual beliefs, and cultural practices. Traditional beliefs and cultural practices remain prominent in many Native American communities and are often central to individual and tribal identities (Section 4.2.1).

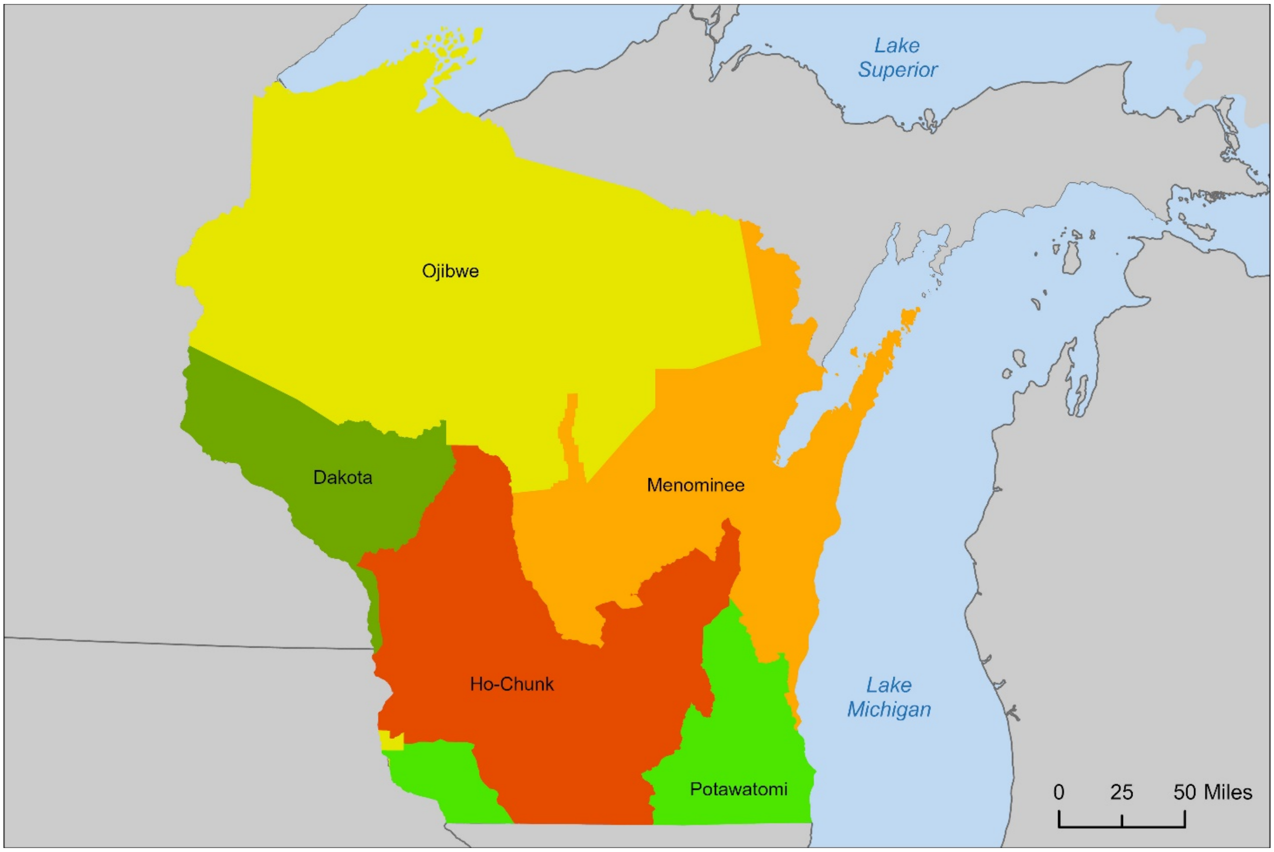

Figure 4.1-1 Native American ancestral lands in Wisconsin, circa 1800.
Source: Wisconsin Historical Society

Table 4.1-1 Native American tribes, languages, and language families in Wisconsin.

Tribe/Band	Language	Language family
Bad River	Ojibwe	Algonquian
Lac Courte Oreilles	Ojibwe	Algonquian
Lac du Flambeau	Ojibwe	Algonquian
Red Cliff	Ojibwe	Algonquian
St. Croix	Ojibwe	Algonquian
Sokaogon (Mole Lake)	Ojibwe	Algonquian
Potawatomi	Potawatomi	Algonquian
Menominee	Menominee	Algonquian
Stockbridge-Munsee	Mohegon, Munsee, Lenape	Algonquian
Oneida	Oneida	Iroquoian
Ho-Chunk	Ho-Chunk	Siouan

Note: Languages within the same language family, though not necessarily mutually intelligible, share similar roots and features.

Native American peoples continue to have a strong presence in Wisconsin, which has one of the largest concentrations of Native American tribes east of the Mississippi River. According to the U.S. Census, Wisconsin's population of Native American[2] people totaled more than 141,570 in 2020 (about 2.5% of the total population). Some tribal leaders, however, have expressed concerns that the latest Census may not provide an accurate picture of tribal communities as the Covid-19 pandemic added to already existing challenges that the Census has faced with counting Native American people (Kaeding, 2021). As of 2020, Native American people made up 10% or more of the populations in Ashland, Bayfield, Forest, Menominee, Sawyer, Shawano, and Vilas counties.

As with all groups of people, Native American communities reflect differences in social, economic, and geographic conditions. The sections that follow briefly overview Native American lands and reservations and describe the eleven federally recognized tribes, their communities, and reservations in Wisconsin. These narratives provide concise descriptions of the tribes present in Wisconsin rather than all-encompassing characterizations. Information included in the sections that follow comes primarily from the publication "Tribes of Wisconsin" (Wisconsin Department Administration, 2023), the Wisconsin Department of Public Instruction's "Tribal Nations in Wisconsin" website (Wisconsin Department of Public Instruction (DPI), 2023), various tribal government websites, and the U.S. Census. In addition to these brief descriptions, Wisconsin Public Television has developed a series of half-hour programs that present histories of each tribe as well as tribal storytellers sharing cultural and oral traditions that have shaped their communities across generations (see https://pbswisconsin.org/watch/tribal-histories/).

4.1.2.1 Native American Lands & Reservations

Reservations are areas of land "reserved for a tribe or tribes under treaty or other agreement with the United States, executive order, or federal statute or administrative action as permanent tribal homelands, and where the federal government holds title to the land in trust on behalf of the tribe" (Bureau of Indian Affairs (BIA), 2023). Figure 4.1-2 depicts the locations of the primary Native American reservations present in Wisconsin.

Native American tribes, as well as Native American individuals, can own or have a legal interest in land both on and off reservations. These lands, referred to broadly in this document as Native American lands, consist of a mix of trust lands, restricted fee lands, and fee lands. Trust lands are lands owned by the federal government and held in trust for the benefit of a tribe as a whole or individual tribal members. Trust lands are exempt from state and local property taxes and cannot be sold or conveyed without federal authorization. Restricted fee lands are owned by a tribe or tribal member, but restrictions are in place against alienation or encumbrance. In the context of Native American lands, fee lands are lands owned by a tribe or a tribal member which can be alienated or encumbered without federal approval. Outside of a reservation, fee lands owned by tribes or tribal members have the same legal status as fee lands owned by non-tribal members. Although most land to which a tribe has a legal interest is trust land, not all such land is held in trust. Congress or the Secretary of the Interior can accept fee land into trust.

While Native American lands may be located within a reservation, that is not always the case and not all property within the reservation may be Native American lands. Lands held in simple fee title by both tribal members and non-tribal members as well as non-Native American government lands exist within

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[2] The U.S. Census Bureau uses the term "American Indian or Alaska Native." The federal Office of Management and Budget's standard defines an American Indian or Alaska Native individual as a person having origins in any of the original peoples of North and South America (including Central America) and who maintains tribal affiliation or community attachment. As noted elsewhere, this EIS uses the term "Native American" as a synonym for American Indian solely for the purposes of readability.

the exterior boundaries of reservations due to massive land losses suffered by the tribes during the "Allotment Era." This means that a tribe may at times not control all land within its reservation. In addition, there are several off-reservation allotments across the area of the proposed pipeline (LaRonge, 2024).

Individual ownership of Native American lands includes ownership of three types of land: allotted trust land, restricted fee land, and fee lands. Allotted trust lands are lands that were conveyed to tribal members under the General Allotment Act of 1887 (also known as the Dawes Act). These lands are held in trust for use by an individual Native American (or his or her heirs); the federal government holds the legal title and the individual (or his or her heirs) holds the beneficial interest (BIA, 2023). Individual Native Americans can also hold legal title to restricted fee lands, however, legal restrictions require approval from the Secretary of the Interior to sell or transfer such properties. Other restrictions prevent burdens, obstructions, or impediments on property that lessens its value or that can restrict the owner's ability to transfer title to the property (BIA, 2023).

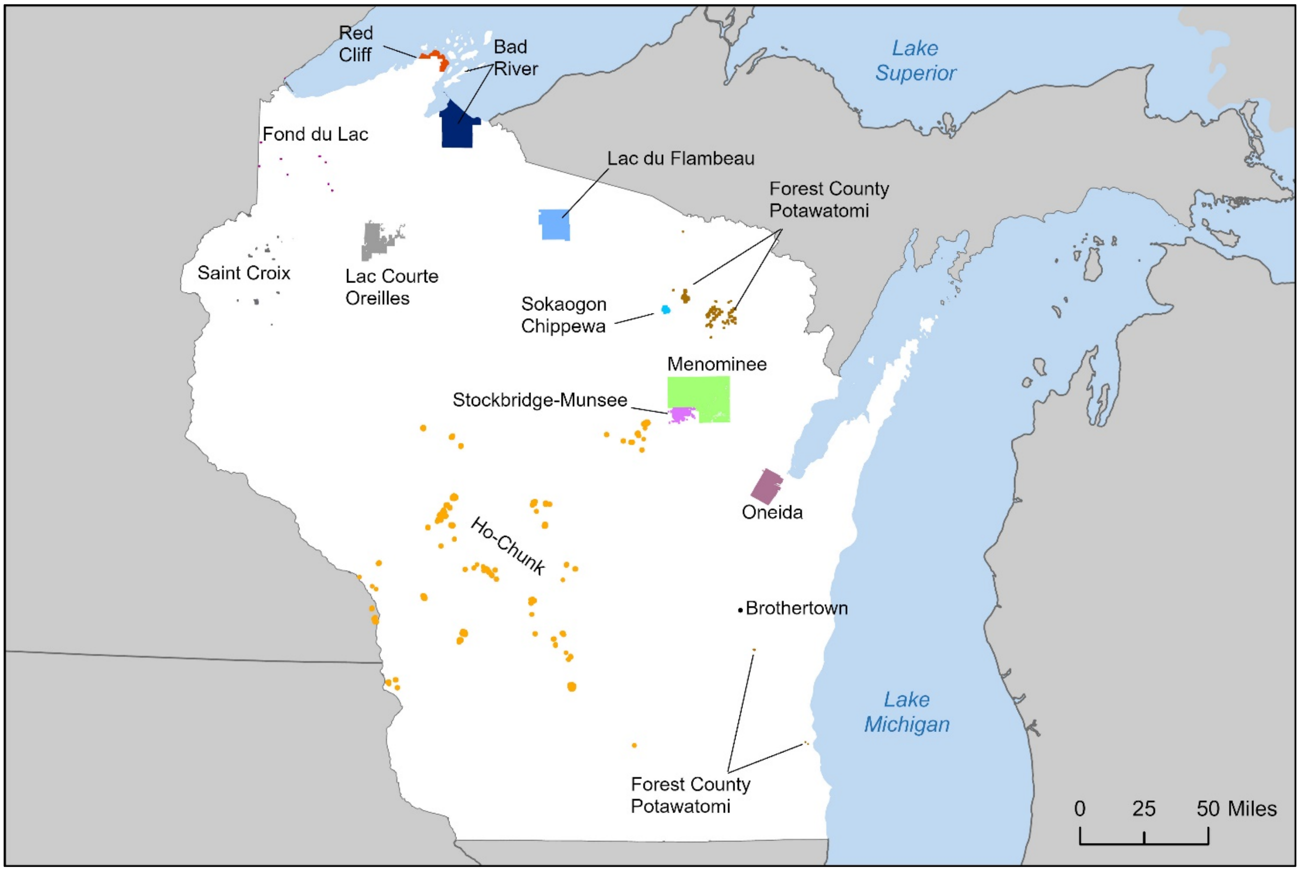

Figure 4.1-2 Native American communities present in Wisconsin.
Source: Wisconsin State Cartographer and Wisconsin Historical Society

Within the boundaries of a Native American Reservation, a tribe may exercise its sovereign tribal powers over Native American lands, tribal members, and, under limited circumstances, non-tribal members. Except where preempted by federal or tribal laws, the state may also exercise its inherent sovereign authority. The state may additionally exercise authorities delegated to it by Congress. Tribal and state jurisdiction may be exclusive of or concurrent with one another as well as federal jurisdiction. Outside the reservation, a tribe may exercise property rights over its tribal lands, but state laws apply to tribal lands not held in trust.

4.1.2.2 Bad River Band of the Lake Superior Chippewa

The Bad River (Mashkiiziibii, Medicine River) people are one band of the large Ojibwe Nation[3] that originally occupied the upper eastern woodlands area of the North American continent (Turtle Island). The Bad River Reservation, the largest Ojibwe reservation in Wisconsin, occupies approximately 124,654 acres of primarily undeveloped and wilderness land within the Bad River watershed along the south shore of Gichiigaming (Lake Superior) in Ashland and Iron counties. In addition, an 1854 Treaty set aside 200 acres for traditional "fishing grounds" on Madeline Island. Within the reservation, about 57,884 (46.4%) acres are tribally owned, 34,051 acres (27.3%) are considered fee land, 26,813 acres (21.5%) are considered other fee land, and 2,970 acres (2.3%) are considered municipal properties. Tribal members retain rights, as recognized by various treaties, to hunt, fish, and gather within the Ceded Territories (Section 4.1.4).

There are approximately 6,950 Bad River tribal members. According to the U.S. Census, the Bad River Reservation was home to about 1,550 residents in 2020. Odanah, the Ojibwe word for town, is the main village and the tribe's seat of government. The seven-member elected Tribal Council governs the tribe, with the Council Chairperson serving as the chief executive officer for tribal administration. The tribal government is divided into departments managed by professional administrators (Bad River Band of Lake Superior Chippewa, 2023a). The Bad River Band operates several wendiziyaang (tribal enterprises), including the Bad River casino, restaurant, lodge, and conference center, Bad River Smoke and Gift Shop, Moccasin Trail Center convenience store and gas station, and Gichigami Island Properties on Madeline Island (Bad River Band of Lake Superior Chippewa, 2023b). The tribe also provides high speed internet services on the reservation. The Bad River Band, including its enterprises, is the largest employer in Ashland County, with nearly 500 employees.

In 2001, the Bad River Band's Mashkiiziibii Natural Resources Department (NRD) finalized an Integrated Resources Management Plan (IRMP) that provides for the conservation, preservation, and sustainable use of all the natural resources of the Bad River Reservation now and for seven generations (Bad River Band of Lake Superior Chippewa, 2001). Of particular note, the Bad River Reservation has an abundance of water resources that are central to the tribe's identity and life ways (Section 4.2.1.3). In brief, the reservation borders 38 miles of Gichiigaming (Lake Superior) and includes nearly 500 miles of rivers and streams. Several rivers from upstream watersheds – the Potato, Tyler Forks, Upper Bad, Marengo, and White rivers – flow downstream into the Lower Bad River watershed (DNR, 1999). The Bad, White, Potato, Marengo, Brunsweiler, and Tyler Forks rivers, as well as Beartrap and Vaughn creeks and many smaller tributaries also flow through the Bad River Reservation. The reservation holds more than 30,000 acres of wetlands, including the Kakagon and Bad River Sloughs, a National Natural Landmark and Wetland of International Importance (Section 5.7.3.4).

The current Line 5 pipeline crosses the Bad River Reservation (Section 1.1), and Enbridge's proposed Line 5 relocation route and route alternatives are located outside the perimeter of the reservation within the Bad River watershed (Figure 4.1-3) and Ceded Territories (Section 3.5.1). Because of the location of the current pipeline operation and geographic proximity of the proposed pipeline relocation route to the reservation, the Bad River Band has raised considerable concerns regarding anticipated impacts to its reservation, local waterways, Lake Superior, the Band's traditional lifeways and cultural resources, community safety, and the exercise of the Band's treaty rights in the Ceded Territories. The Bad River Band provided extensive comments on the Draft EIS, which were made publicly available on the DNR website and

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[3] The names "Ojibwe" and "Chippewa," which meant "puckered up," were likely drawn from either the Ojibwe traditional moccasins with a puckered seam across the top or the Ojibwe custom of writing on curled up birch bark. The variants "Ojibwa" and "Ojibway" are sometimes used. Although Ojibwe and Chippewa are often used interchangeably, Ojibwe is used in this EIS to refer to the tribal nations living in northern Wisconsin.

considered by the DNR in preparation of the Final EIS. The DNR held numerous technical meetings with staff from the Mashkiiziibii Natural Resources Department while developing this EIS.

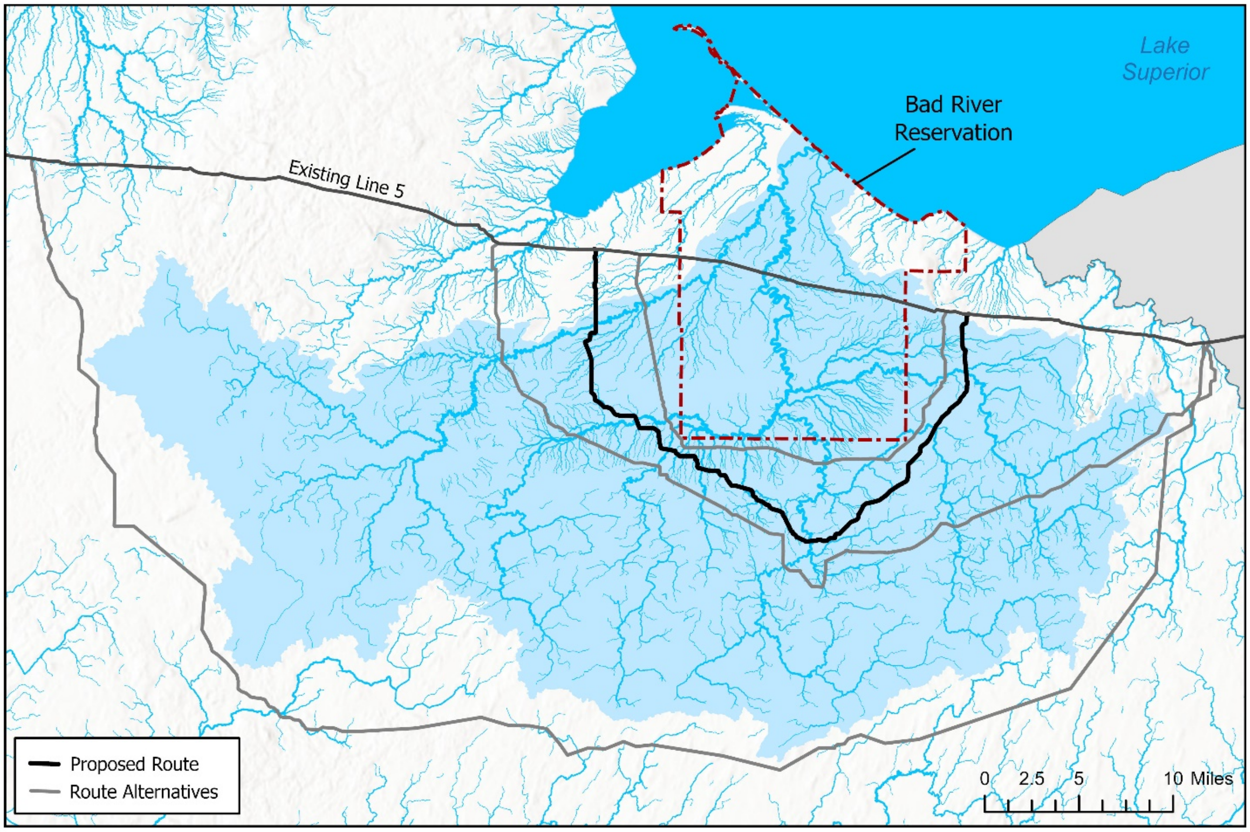

Figure 4.1-3 The Bad River watershed, Bad River Reservation, and Enbridge's proposed Line 5 relocation route and route alternatives.
Source: DNR

4.1.2.3 Red Cliff Band of Lake Superior Chippewa

The Red Cliff (Miskwaabekong) people are one band of the large Ojibwe Nation that originally occupied the upper eastern woodlands area of the North American continent. The Red Cliff Band was originally part of the LaPointe Band, the primary village of Chief Great Buffalo, a tribal leader known for his role as peacemaker in the formation of the Treaty of LaPointe in 1854. The Red Cliff Reservation, approximately one mile wide and 14 miles long, occupies 14,541 acres of primarily undeveloped land at the extreme northern-most point of Wisconsin on Zhaagawaamikong Neyaashi (the Bayfield Peninsula). Tribal members retain rights, as recognized by various treaties, to hunt, fish, and gather within the Ceded Territories (Section 4.1.4). Within the Red Cliff reservation, about 6,404 acres (44%) are tribally owned, 1,917 acres (13%) are individually allotted, and 6,220 acres (43%) are considered fee land.

There are about 7,825 enrolled members of the Red Cliff Band. Approximately 2,513 (32%) tribal members live on Red Cliff tribal lands. In 2020, the reservation was home to about 1,400 residents. Additionally, large numbers of tribal members live in the City of Bayfield and the Belanger Settlement. A nine-member elected Tribal Council governs the tribe. The village of Red Cliff, the location of the tribal offices and businesses, is three miles north of Bayfield adjacent the Apostle Islands National Lakeshore.

The tribe's government programs are structured into five divisions: Health, Human/Family Services, Treaty Natural Resources, Protective Services, and Public Works. In addition, there are Administrative, Compliance, Early Childhood, Education, and Planning departments (Red Cliff Band of Lake Superior Chippewa, 2023a). Red Cliff enterprises include the Legendary Waters Resort and Casino, the Red Cliff Fish Company, a gas station, and a self-storage facility (Red Cliff Band of Lake Superior Chippewa, 2023b). The tribe bolsters food sovereignty through its Red Cliff Fish Company and 35-acre Mino Bimaadiziiwin Gitigaanin (Return to the Good Life) Farm. The Red Cliff Band, including its enterprises, is the largest employer in Bayfield County, employing around 300 people. Commercial fishing is one of the largest economic drivers of the Red Cliff community.

Red Cliff's Treaty Natural Resources Division oversees the protection, sustainable management, and enhancement of natural resources. Programs include water and air quality monitoring, riverbank restoration, wild rice reseeding, and hazardous waste disposal. Red Cliff Tribal Fish Hatchery staff raise brook trout in hopes of restoring populations to past levels in Gichiigaming (Lake Superior). They also rear walleye to increase populations in inland lakes. The Red Cliff Band employs an environmental justice specialist to monitor outside projects that could affect treaty rights.

The tribe's Frog Bay Tribal National Park—the first tribal national park in the United States—and associated Frog Bay Conservation Management Area protect 300 acres of at-risk boreal forest, over a mile of riparian corridor, nearly 120 acres of wetlands and freshwater estuary habitat, and almost 4,000 feet of undeveloped Gichiigaming shoreline. In 2019, Frog Bay Tribal National Park was awarded the Wisconsin Governor's Tourism Award for Stewardship, recognizing the park's impact on tourism and its efforts to promote sustainability (Red Cliff Band of Lake Superior Chippewa, 2023a).

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located south and east of the Red Cliff Reservation within the Ceded Territories. Because of the location of the proposed pipeline relocation route, the Red Cliff Band has raised considerable concerns regarding anticipated impacts to local waterways, Lake Superior, the Band's traditional life ways and cultural resources, community safety, and the exercise of the Band's treaty rights in the Ceded Territories. The Red Cliff Band provided extensive comments on the Draft EIS, which were made publicly available on the DNR website and considered by the DNR in preparation of this Final EIS. The DNR held numerous technical meetings with staff from the Red Cliff Band's Environmental Department while developing this EIS.

4.1.2.4 Lac du Flambeau Band of Lake Superior Chippewa

The Lac du Flambeau (Waaswaaganing) people are one band of the large Ojibwe Nation that originally occupied the upper eastern woodlands area of the North American continent. The band has inhabited the Wasswagani-Sagaigan (Lac du Flambeau) area since 1745 when Chief Keeshkemun led the band to the area. The Lac du Flambeau Reservation, established by treaties in 1837 and 1842, occupies approximately 86,600 acres in Iron and Vilas counties, 12 miles northwest of Woodruff and Minocqua. Within the Lac du Flambeau reservation, 39,403 acres (46%) are tribally owned, 18,532 acres (21%) are individually allotted, and 28,665 acres (33%) are fee land. Tribal members also retain rights, as recognized by various treaties, to hunt, fish, and gather within the Ceded Territories (Section 4.1.4).

In 2019, the Lac du Flambeau reservation was home to about 3,400 residents. A 12-member elected Tribal Council governs the tribe. Tribal enterprises include a campground/marina, gas station/convenience store, smoke shop, museum, Simpson Electric, and the Lake of the Torches casino, hotel, lodge, and convention center (Wisconsin Department of Public Instruction (DPI), 2021a). The Lac du Flambeau tribal government, including its enterprises, is the largest employer in Vilas County, employing approximately 800 people.

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located approximately 40 miles northwest of the Lac du Flambeau Reservation within the Ceded Territories. Because of the location of the proposed pipeline relocation route, the Lac du Flambeau Band has raised concerns regarding anticipated impacts to local waterways, regional biological diversity, the Band's traditional life ways and cultural resources, and the exercise of treaty rights in the Ceded Territories. The Lac du Flambeau Band provided comments on the Draft EIS, which were made publicly available on the DNR website and considered by the DNR in preparation of this Final EIS.

4.1.2.5 Lac Courte Oreilles Band of Lake Superior Chippewa

The Lac Courte Oreilles people are one band of the large Ojibwe Nation that originally occupied the upper eastern woodlands area of the North American continent. They first arrived in the modern-day Hayward area around 1745. The Lac Courte Oreilles Reservation, established by the 1854 Treaty of LaPointe, occupies 76,465 acres, mostly in Sawyer County, about 11 miles southwest of Hayward. Within the Lac Courte Oreilles Reservation, approximately 24,365 acres (32%) are tribally owned, 23,652 acres (31%) are individually allotted, and 6,072 acres (8%) are fee land. The Lac Courte Oreilles Band has additional trust land located in Burnett County near Rice Lake and Washburn County near Rocky Ridge Lake. Tribal members also retain rights, as recognized by various treaties, to hunt, fish, and gather within the Ceded Territories (Section 4.1.4).

Around 7,000 individuals are enrolled members of the Lac Courte Oreilles Band. Approximately 2,300 tribal members live on the Lac Courte Oreilles Reservation, trust, or fee lands along with about 700 non-tribal members, divided into several communities including Chief Lake, Little Round Lake, New Post, Northwoods Beach, and Reserve. Additionally, large numbers of tribal members live in Minneapolis, Milwaukee, and Chicago. A seven-member elected Governing Board governs the tribe. Tribal enterprises include the Lac Courte Oreilles casino, lodge and convention center, Lac Courte Oreilles Cranberry Marsh, Lac Courte Oreilles Development Corporation, Grindstone Creek Casino, Big Fish Golf Club, Chippewa Wood Crafters, Lac Courte Oreilles Federal Credit Unit, Pineview Funeral Services, WOJB-FM Community Radio, and several grocery, liquor, gas, smoke, fireworks, and convenience shops. The Lac Courte Oreilles Band is the only Wisconsin Ojibwe band with its own college. With approximately 900 employees, the Lac Courte Oreilles Band is the largest employer in Sawyer County.

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located approximately 40 miles northeast of the Lac Courte Oreilles Reservation within the Ceded Territories. A member of the Lac Courte Oreilles Tribal Council provided comments on the Draft EIS, which were made publicly available on the DNR website and considered by the DNR in preparation of this Final EIS.

4.1.2.6 St. Croix Chippewa Indians of Wisconsin

The St. Croix Chippewa people are one band of the large Ojibwe Nation that originally occupied the upper eastern woodlands area of the North American continent. The St. Croix Reservation occupies 4,689 acres, mostly in Burnett County. The five major reservation communities are Sand Lake, Danbury, Round Lake, Maple Plain, and Gaslyn. Within the reservation, 2,126 acres (45%) are tribally owned, and 2,563 acres (55%) are considered fee land. The St. Croix Band also has trust land in Barron, Burnett, and Polk counties. Tribal members retain rights, as recognized by various treaties, to hunt, fish, and gather within the Ceded Territories (Section 4.1.4).

The St. Corix band currently has about 1,000 tribal members. Approximately 740 tribal members live on or near the St. Croix reservation, trust, or fee lands. A five-member elected Tribal Council governs the tribe. Tribal enterprises include the St. Croix Casino Turtle Lake, St. Croix Turtle Lake Hotel, St. Croix Casino Danbury, St. Croix Casino Danbury Hotel, St. Croix Lodge Hotel Danbury, Eagles Landing Campground, St. Croix Casino Hertel Express, St. Croix Casino Express Convenience Store, St. Croix Tribal Smoke Shop, Fourwinds Market, and Fourwinds Express Convenience Store as well as several commercial rental properties including Southwinds Plaza in Siren. With about 2,500 employees, the St. Croix Band is the largest employer in Burnett County and the second largest employer in Barron County.

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located approximately 80 miles northeast of St. Croix Chippewa Reservation lands within the Ceded Territories. The St. Croix Band did not submit public comments on the Draft EIS.

4.1.2.7 Sokaogon Chippewa Community

The Sokaogon (Post in the Lake) Chippewa people are one band of the large Ojibwe Nation that originally occupied the upper eastern woodlands area of the North American continent. The legal title to the tribe's 12-square-mile reservation from the 1854 Treaty of LaPointe was lost in a shipwreck on Lake Superior. It was not until 1934, under the provisions of the Reorganization Act, that 1,745 acres of land in southwestern Forest County, near Crandon, were purchased for the Mole Lake Reservation. The Sokaogon Chippewa Community's current land holdings include 1,930 acres of reservation land, 1,320 acres of trust land, and 1,654.2 acres of fee land. Tribal members also retain rights, as recognized by various treaties, to hunt, fish, and gather within the Ceded Territories (Section 4.1.4).

There are currently about 1,400 Sokaogon Chippewa Community tribal members, with 468 enrolled members residing on the Mole Lake Reservation. The tribe is governed by a six-member Tribal Council. Tribal enterprises include Mole Lake Casino and Bingo and an associated hotel, Mole Lake New Business Incubator (Niijii), Sokaogon Chippewa Community C-Store, and Café Manoomin Restaurant. The Sokaogon Chippewa Community, with more than 235 employees, is among the 15 largest employers in Forest County.

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located approximately 100 miles northwest of the Sokaogon Chippewa Reservation within the Ceded Territories. The Sokaogon Chippewa Community provided comments on the Draft EIS, which were made publicly available on the DNR website and considered by the DNR in preparation of this Final EIS.

4.1.2.8 Stockbridge-Munsee Band of Mohican Indians

The Stockbridge-Munsee Band of Mohican Indians is descended from a group of Muh-he-con-ne-ok ("people of the waters that are never still") and a band of the Delaware Indians known as the Munsee. The Mohicans and the Delaware, closely related in customs and traditions, originally inhabited large portions of what is now the northeastern United States. Under the terms of an 1856 treaty, the band moved to its present site in Shawano County. The General Allotment Act of 1887 resulted in the loss of a great deal of land by the Stockbridge-Munsee. In the Great Depression, the tribe lost yet more land. The Secretary of the Interior affirmed the reservation in 1937, which now totals 22,139 acres. Within the reservation, 16,255 acres (73%) are held in trust and 5,884 acres (27%) are fee land.

There are approximately 1,600 Stockbridge-Munsee tribal members. A seven-member elected Tribal Council governs the Stockbridge-Munsee Tribe. Tribal enterprises include the Mohican North Star Casino and Bingo, Little Star Convenience Store, and Mohican RV Park, Many Trails Banquet Hall, and Pine Hills Golf Course and Supper Club. The Stockbridge-Munsee Tribe employs about 740 people and is the largest employer in Shawano County.

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located approximately 125 miles northwest of the Stockbridge-Munsee Reservation. The Stockbridge-Munsee Band did not submit public comments on the Draft EIS.

4.1.2.9 Forest County Potawatomi Community

Around 1880, groups of Potawatomi people settled near Blackwell, Carter, Crandon (or Stone Lake), and Wabeno and have lived in the area since. The Forest County Potawatomi Reservation is located primarily in Forest County and totals approximately 12,000 acres. In 2019, the Forest County Potawatomi Reservation had approximately 655 residents. There are an estimated 1,400 enrolled Forest County Potawatomi tribal members. An elected General Council and Executive Council govern the tribe. The Tribe's enterprises include Potawatomi Bingo and Casino, Northern Light Casino, a farm, a newspaper, a hotel and conference center, a convenience store and gas station, and the Potawatomi Business Development Corporation (DPI, 2021b). The Potawatomi Tribe is the largest employer in Forest County and among the largest in Milwaukee County, where it operates Potawatomi Casino and Resort, the largest gaming facility in Wisconsin. Roughly 700 of the Tribe's 2,700 employees work in Forest County, with 1,900 employed in Milwaukee County. The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located approximately 100 miles northwest of the Forest County Potawatomi Reservation.

4.1.2.10 Menominee Indian Tribe of Wisconsin

The origin story of the Menominee Indian Tribe, an Algonkian-speaking people, indicates they have always lived in Wisconsin and traces their people's roots to the mouth of the Menominee River (Keesing, 1987). The tribe's 235,524-acre reservation was created by the 1854 treaty with the United States. The Menominee Reservation and Menominee County share nearly identical boundaries, with the area known as Middle Village being the exception. Approximately 98 percent of the acreage is trust land and two percent of the acreage is fee land. The Menominee Tribe has no additional trust land outside of the reservation's contiguous boundaries. The reservation contains roughly 223,500 acres of heavily forested lands, representing the largest single tract of virgin timberland in Wisconsin (DPI, 2021c). The Menominee Forest was among the first to be certified by the Forest Stewardship Council after its formation in 1993 (Pearce, 2023).

The Menominee tribe currently has about 8,720 tribal members. The nine-member elected Tribal Legislature governs the tribe. The tribe operates four chartered businesses: Menominee Tribal Enterprises, Menominee Casino, Bingo & Hotel, Kenosha Gaming Authority, and Menominee Economic Development Authority. The Menominee Chamber of Commerce is a 501(c)3 non-profit organization with about 46 member businesses. The Menominee people have also chartered the College of the Menominee Nation, a land grant institution of higher education that infuses learning with Native American culture, language, and scholarship. With around 700 employees, the tribe is the largest employer in Menominee County.

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located approximately 120 miles northwest of the Menominee Reservation within the Ceded Territories. The Menominee Indian Tribe of Wisconsin provided comments on the Draft EIS, which were made publicly available on the DNR website and considered by the DNR in preparation of this Final EIS.

4.1.2.11 Oneida Nation of Wisconsin

The 1784 Treaty of Fort Stanwix established the government-to-government relationship between the Oneida people and the United States. During the 1820s, the Oneida people relocated to what would become the State of Wisconsin to establish new homelands. The Oneidas purchased 5 million acres of land from the Ho-Chunk and Menominee Tribes for the purpose of preserving their sovereignty as a self-governing nation. The tribe's final treaty with the United States in 1838 established the present-day Oneida Reservation boundaries in northeast Wisconsin. The Dawes Allotment Act of 1887 divided Oneida lands into individual parcels resulting in a significant reduction of tribal land within the Reservation's external boundaries. The current Oneida Reservation, located in Brown and Outagamie counties, totals 65,400 acres. Within the reservation, about 23,122 acres are tribally owned, 12,208 acres are fee land, and 10,904 acres are tribal trust land.

There are approximately 17,000 Oneida Nation tribal members. A General Tribal Council governs the tribe. Tribal enterprises include the Oneida Casino, Oneida One Stops, Thornberry Creek at Oneida golf course, Tsyunhehkwa Retail (traditional foods grocery), Oneida Apple Orchards/Farm, Oneida Seven Generations Corporation (property management/real estate), Oneida Total Integrated Enterprises (engineering, construction, and security), and Bay Bank. With about 3,085 employees, the Oneida Nation is the fifth largest employer in Brown County and the fourteenth largest employer in Outagamie County.

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located approximately 170 miles northwest of the Oneida Nation Reservation.

4.1.2.12 Ho-Chunk Nation

The Ho-Chunk (People of the Sacred Voice) oral tradition places their origin in Wisconsin at Móogašuc (Red Banks). Ho-Chunk ancestral lands stretched from Green Bay to the Mississippi River, down to the Rock River and into northern Illinois and west through Minnesota, Iowa, and Missouri. Tribal territory at the time of the Treaty of 1825 consisted of about 5.5 million acres. Today, the Ho-Chunk Nation does not have a reservation in Wisconsin, but its scattered land holdings include 3,535 acres of trust land and 5,328 acres of fee simple acreage that hold "reservation" status. Counties where Ho-Chunk Nation trust lands are located include Adams, Clark, Crawford, Dane, Eau Claire, Jackson, Juneau, La Crosse, Marathon, Monroe, Sauk, Shawano, Vernon, and Wood. This unique configuration results from the many failed attempts between 1832 and 1874 to forcefully move the Ho-Chunk from Wisconsin and Illinois into what would become Minnesota, Iowa, and Nebraska. Some Ho-Chunk people refused to leave and many others who were removed returned to their homelands. Ho-Chunk people then used the 1862 Homestead Act to purchase land in their ancestral territory. Ho-Chunk oral tradition states, "we have always been here." Today, all Wisconsin Ho-Chunk tribal lands are lands they once owned but had to purchase.

There are approximately 6,600 Ho-Chunk tribal members. Large numbers of tribal members live in Minneapolis, Madison, Milwaukee, and Chicago. The Ho-Chunk Nation's government is headquartered in Black River Falls and includes executive, legislative, and judicial branches and a General Tribal Council, based on the tribe's constitutions of 1963 and 1994. The Ho-Chunk Nation also has a traditional government system based on a chief and clan system. Twelve clans, or family groups, make up the Nation. The clans make up two tribal subdivisions: those who are above (Thunder, Warrior, Eagle and Pigeon) and those who are on Earth (Bear, Buffalo, Deer, Wolf, Elk, Fish, Water Spirit, and Snake). Each clan has distinct responsibilities such as judicial matters, health and safety, and civic governance. The tribe's business enterprises include casinos, bingo halls, hotels, C-stores, and campgrounds (Ho-Chunk Nation, 2023). With approximately 3,100 employees, the Ho-Chunk Nation is the largest employer in Sauk and Jackson counties.

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located north of Ho-Chunk's current homelands. The Ho-Chunk Nation Legislature provided comments on the Draft EIS, which were made publicly available on the DNR website and considered by the DNR in preparation of this Final EIS.

4.1.2.13 Brothertown Indian Nation

The Brothertown Indian Nation came together in Brothertown (Eeyamquittoowauconnuck) in the 1700s to support the common culture and identity of Christian Native Americans from the Mohegan, Montaukett, Niantic, Narragansett, Pequot (western), Pequot (eastern), and Tunxis tribes from Connecticut, Rhode Island, and Long Island. Although not a federally recognized tribe, the Brothertown Indian Nation operates under a constitutional government with four elected officers and five general Council members. Brothertown leadership also includes divisions (e.g., Administrative, Cultural, Economic Development, Land Management, Environment and Natural Resources), as well as a judicial system consisting of five elected Peacemakers (Brothertown Indian Nation, 2024). The Tribe's office is located in the Brothertown Indian Nation Community Center in the town of Fond du Lac, near the original reservation land in current Calumet County, including the town of Brothertown.

The Brothertown Indian Nation filed a letter of intent to petition for federal recognition in April 1980. Ten years later, the Department of Interior suggested the congressional act in 1839 that gave tribal members citizenship and allowed them to stay on reservation land was not an act of termination. In 2012, however, the Department of Interior concluded in its Final Determination that the congressional act was an act of termination and that, as a result, Department of Interior lacked the authority to recognize the Brothertown. The Brothertown Indian Nation continues its long-standing effort to gain federal recognition and a government-to-government relationship.

The current Line 5 pipeline, Enbridge's proposed Line 5 relocation route, and the three route alternatives are located north and west of the Brothertown Indian Nation. The Brothertown Indian Nation provided comments on the Draft EIS, which were made publicly available on the DNR website and considered by the DNR in preparation of this Final EIS.

4.1.2.14 Tribes in Neighboring States with Ceded Territory Treaty Rights

Several Ojibwe tribes with reservations outside of Wisconsin have retained treaty rights to hunt, fish, and gather in the Ceded Territories in Wisconsin (Section 4.1.4). These include the Fond du Lac, Grand Portage, and Mille Lacs Bands in Minnesota and the Lac Vieux Desert Band and Keweenaw Bay Indian Community in Michigan. In addition, the Little Traverse Bay Bands of Odawa Indians and the Bay Mills Indian Community (Gnoozhekaaning) reserved rights in Michigan in an 1836 Treaty. The Lac Vieux Desert and the Little Traverse Bay bands and the Bays Mills Community provided comments on the Draft EIS, which were made publicly available on the DNR website and considered by the DNR in preparation of this Final EIS.

4.1.3 Intertribal Organizations

4.1.3.1 Great Lakes Inter-Tribal Council

The Great Lakes Inter-Tribal Council, Inc. (GLITC) is a consortium of federally recognized tribes in Wisconsin and the Upper Peninsula of Michigan. The GLITC functions as a non-profit, non-stock corporation under state and federal laws and is recognized as a tribal organization under the Indian Self-Determination and Education Act (GLITC, 2023). GLITC supports its member tribes in expanding self-determination efforts and advocates for the improvement and unity of tribal governments, communities, and individuals. GLITC supplements its member tribes' own efforts through development and operation of health and human service programs, education programs, and economic development programs in the reservation communities it serves (GLITC, 2023). All eleven federally recognized tribes in Wisconsin are GLITC members. The tribal chairperson or president (or their delegate) of each member tribe serves on GLITC's Board of Directors.

4.1.3.2 Wisconsin Inter-Tribal Repatriation Committee

The 1990 Native American Graves Protection and Repatriation Act (NAGPRA) requires institutions that receive federal funding to inventory Native American human remains and cultural items and to consult with Native American tribes toward the potential repatriation of those remains and artifacts. The Great Lakes Inter-Tribal Council formed a sub-committee, the Wisconsin Inter-tribal Repatriation Committee (WITRC), in 1995 to act as a unified voice to help repatriate and re-inter both identified and un-identified ancestral remains and to work together to ensure proper procedures are followed to prevent the desecration of burials. The WITRC works closely with the tribal historic preservation officers (THPOs) and state historical preservation officer (SHPO). The DNR consulted with WITRC during the development of the Final EIS.

4.1.3.3 Great Lakes Indian Fish & Wildlife Commission

The Great Lakes Indian Fish and Wildlife Commission (GLIFWC) represents eleven Ojibwe tribes in Minnesota, Wisconsin, and Michigan who reserved hunting, fishing, and gathering rights in the 1836, 1837, 1842, and 1854 Treaties with the United States government. Established by the tribes in 1984, GLIFWC provides natural resource management expertise, conservation law enforcement, legal and policy analysis, and public information services in support of the exercise of treaty rights (GLIFWC, 2023). GLIFWC is guided by its Board of Commissioners along with two standing committees, the Voigt Intertribal Task Force and the Great Lakes Fisheries Committee, which advise the Board of Commissioners on policy.

4.1.3.4 Voight Intertribal Task Force

The eleven-member Voigt Intertribal Task Force recommends policy regarding inland harvest seasons, resource management issues, and budgetary matters to the GLIFWC Board of Commissioners (GLIFWC, 2023). The Task Force addresses matters that affect the treaty rights of the member tribes in the Ceded Territories. The Task Force recommends harvest seasons and regulations for each inland season. Those recommendations are then taken to the respective tribal councils for ratification prior to becoming an ordinance.

4.1.3.5 Great Lakes Indian Fisheries Committee

The Great Lakes Indian Fisheries Committee, also referred to as the Lake Committee, provides recommendations to the GLIFWC Board of Commissioners regarding quotas, harvest levels, fishing units, and seasons for the commercial treaty fishery in Lake Superior (GLIFWC, 2023). Five representatives from GLIFWC member tribes comprise the committee.

GLIFWC provided extensive comments on the Draft EIS, which were made publicly available on the DNR website and considered by the DNR in preparation of this Final EIS. The DNR shared information and held numerous technical meetings with staff from GLIFWC and various tribal resource agencies during the development of this EIS.

4.1.3.6 Midwest Alliance of Sovereign Tribes

The Midwest Alliance of Sovereign Tribes (MAST) is an intertribal organization that represents the 36 federally recognized tribes and four inter-tribal organizations in Minnesota, Wisconsin, Michigan, Indiana, and Iowa. MAST's mission is to “advance, protect, preserve, and enhance the mutual interests, treaty rights, sovereignty, and cultural way of life of the sovereign nations of the Midwest.” The MAST provided comments on the Draft EIS. The DNR made the comments publicly available on its website and considered the comments in preparation of this Final EIS.

4.1.4 Treaties & Treaty Rights

From 1777 to 1871, Native American relations with the United States government were negotiated largely through legally binding agreements called treaties. These documents include various articles containing the agreed-upon stipulations and reserved rights. The “chiefs and headmen” or “chiefs and delegates” of the tribes and U.S. Presidents signed the treaties, and the U.S. Senate ratified each treaty. GLIFWC’s Ojibwe Treaty Rights publication (GLIFWC, 2022; see Appendix H) includes an historical review of treaties, as well as the text of several treaties involving the Ojibwe tribes.

The 1825 Treaty of Prairie du Chien established peace and demarcated boundaries between the “Great Chippewa Nation,” the “Great Sioux Nation,” and European settlements. The treaty included over 40 Ojibwe signatures, indicative of the fact that the distinct bands did not have a single, central leader. In the treaty, the United States government recognized that the Ojibwe peoples owned vast acres of what are now Minnesota, Wisconsin, and Michigan. Due to the disbursement of the Ojibwe Nation, the 1825 Treaty included a stipulation for a follow-up council in the Lake Superior region to ensure the Ojibwe bands agreed with the provisions and boundaries established in the treaty. The 1826 Treaty at Fond du Lac affirmed the 1825 Treaty. An 1827 Treaty at Butte des Morts established a border between the Menominee and Ojibwe tribes referred to in future treaties.

Ottawa and Ojibwe tribes signed an 1836 Treaty in Washington, DC, that ceded large portions of what is now northern Michigan and the eastern portion of Michigan’s Upper Peninsula to the United States (Figure 4.1-4). In subsequent treaties in 1837 and 1842, several Ojibwe bands ceded portions of territories in east-central Minnesota, northern Wisconsin, and Upper Michigan (Figure 4.1-4). These agreements ceded land for mining and logging but were contingent on the Ojibwe people retaining their rights to hunt, fish, and gather on the newly ceded territory. These rights guaranteed by treaty are referred to as usufructuary rights, which means the right to use property.

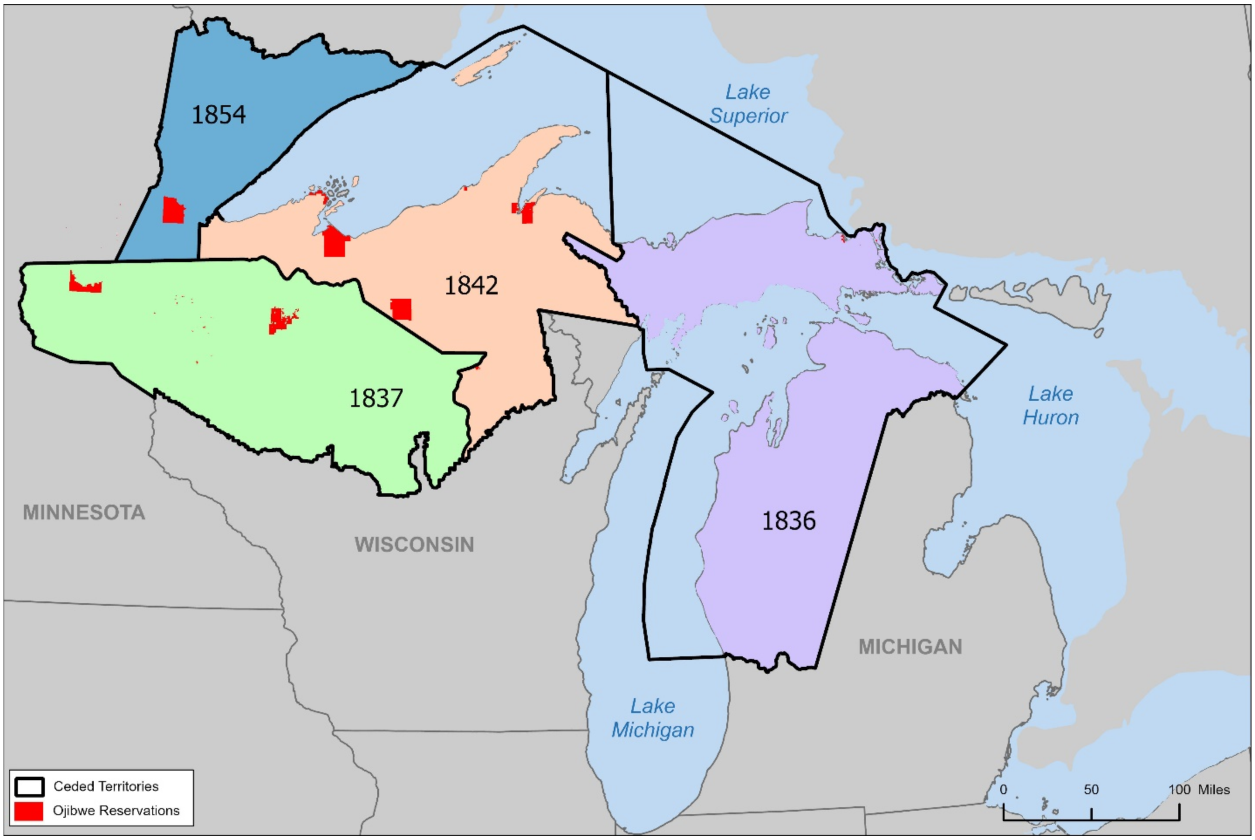

Figure 4.1-4 Territories ceded by the Ojibwe under the 1836, 1837, 1842, and 1854 Treaties.
Source: GLIFWC

Pressures from non-Native American settlement in the region in the late 1840s led to federal government attempts to force the removal of Ojibwe people from the Ceded Territories, including issuance of a Presidential Executive Order. The removal effort was abandoned in 1852 in the face of widespread opposition from Native Americans and non-Native Americans alike (GLIFWC, 2022). Federal courts have since declared the Executive Order for removal to be invalid.

In 1854, the Treaty of LaPointe formally abandoned the U.S. government's removal policy and established reservations for the Bad River, Lac Courte Oreilles, Lac du Flambeau, and Red Cliff bands in the Ceded Territories, and again reserved rights to hunt and fish on ceded lands. The reservations provided places free from non-Native American intrusion and further threats of forced removal. The Ojibwe also ceded territory in Minnesota at this time (Figure 4.1-4). The St. Croix and Sokaogon bands were not recognized by the federal government as part of the 1854 negotiations. Neither band retained land as part of the treaty. It was not until after the Indian Reorganization Act in 1934 that the St. Croix and Sokaogon bands were able to establish reservations and formalize their tribal governments.

These treaties between sovereign tribal governments and the United States transferred and created property rights as well as service obligations that remain in place today. The tribal nations that ceded land retained ongoing self-governance on their own lands. Additionally, the treaties and subsequent federal laws create a federal "trust responsibility" to protect both tribal lands and tribal self-government and to provide for federal assistance to ensure the success of tribal communities. The Ojibwe tribes retained their usufructuary rights to hunt and fish on the Ceded Territories.

4.1.4.1 Off-Reservation Rights

The Ceded Territories in Wisconsin include 22,400 square miles in the Forest Transition, Northwest Lowlands, Northwest Sands, North Central Forest, Northern Highland, Northeast Sands, and Superior Coastal Plain ecological landscapes (Figure 4.1-5). Portions of Lake Superior as well as 2,300 lakes larger than 25 acres are within the Ceded Territories.

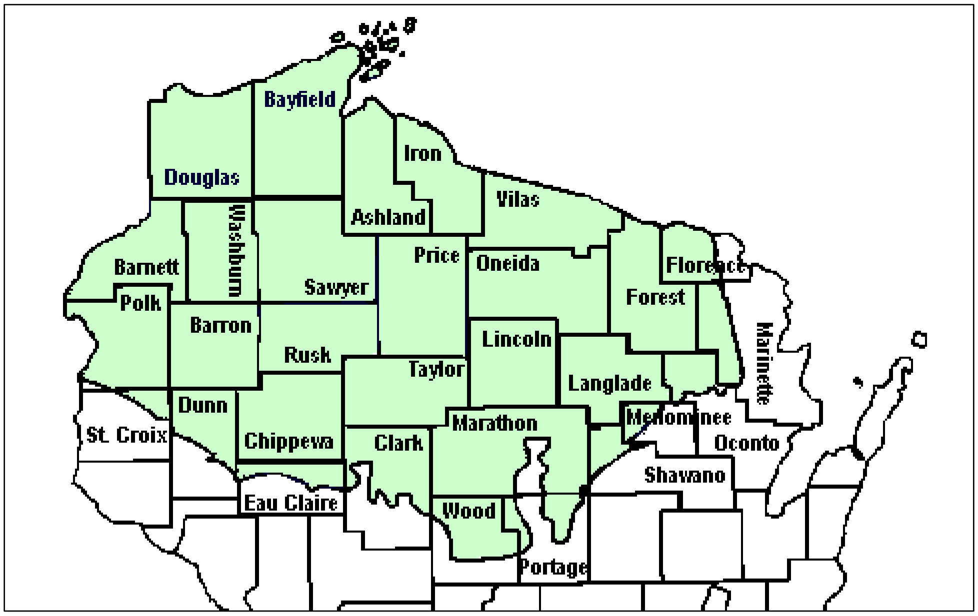

Figure 4.1-5 The Ceded Territories in northern Wisconsin.
Source: DNR

Most treaties were signed prior to the formation of the states of Michigan, Wisconsin, and Minnesota, when there were no state regulations over hunting, fishing, and gathering activities. As the territories became states and populations grew, the state governments passed laws governing hunting, fishing, and gathering activities and enforced them against the Ojibwe people (GLIFWC, 2022). In 1974, two Lac Courte Oreilles tribal members were spearfishing on the Chippewa Flowage in a portion that is off the Lac Courte Oreilles Reservation. These brothers were cited by the State of Wisconsin for spearfishing, a practice prohibited by state fishing regulations.

The Lac Courte Oreilles Tribe challenged the State and initiated a lawsuit in federal district court. The Lac Courte Oreilles Tribe's complaint sought: (1) a court ruling that the 1837 Treaty between the United States and the Ojibwe Bands reserved the rights of tribal members to hunt, fish, and gather on Ceded Territory lands, and (2) an injunction against state regulation of such activities by tribal members. The federal district court initially ruled against the tribe, deciding that the 1854 treaty that established the Lac Courte Oreilles Reservation ended their off-reservation hunting, fishing, and gathering rights.

The Lac Courte Oreilles Tribe appealed to the 7th Circuit Court of Appeals, which overturned the district court. The Court of Appeals ruled that in the treaties of 1837 and 1842, the Ojibwe bands reserved their rights to hunt, fish, and gather in the Ceded Territories and the 1854 treaty did not extinguish or end those treaty rights. In 1983, after the U.S. Supreme Court declined to review the Court of Appeals' decision, the other five Ojibwe bands who also signed the treaties of 1837 and 1842 joined the lawsuit. In 1985, the Court of Appeals reaffirmed that the State of Wisconsin, like the federal government, was obligated to honor tribal off-reservation rights to hunt, fish, and gather on lands within the Ceded Territories that are not privately owned. On remand from the 7th Circuit, the district court conducted further proceedings on the nature and extent of Ojibwe treaty rights, the extent to which the state could regulate those treaty rights, and whether the tribes were entitled to damages for the State's infringement on their rights.

The GLIFWC (2023) explains that while the language of individual treaties may vary, there are common principles, called canons, that courts use when interpreting treaty provisions. Canons derive from contract law and recognize that there are instances in which parties to a contract are not equal, as might be the case where the language of the contract is not spoken by one of the parties, or where the drafters of the contract can slant the language to their advantage. As articulated by the U.S. Supreme Court, the canons of treaty construction are that: (1) ambiguous expressions must be resolved in favor of the Native American parties concerned, (2) Native American treaties must be interpreted as the Native Americans themselves would have understood them at the time the treaties were signed, and (3) Native American treaties must be liberally construed in favor of the Native Americans. The courts that upheld the treaty rights of the Ojibwe tribes used these canons, as well as historical records and information from the times the treaties were signed, to discern the tribes' understanding of the treaties. They found that the tribes intended to preserve and continue to practice their traditional lifeways using Ceded Territory resources.

In 1987, the district court ruled that the Ojibwe bands continued to hold rights to all forms of animal life, fish, and vegetation within the Ceded Territories; that they could use all the methods of harvesting employed in treaty times and those developed since. With respect to the state's authority to regulate tribal members' exercise of treaty rights, the court ruled the state could regulate Ojibwe off-reservation rights only in the interest of conservation and in the interest of public health and safety. If the tribes enacted their own harvest regulations that were reasonable and effective for conservation and safety purposes and had the capacity to enforce those regulations, then similar state laws would not apply to tribal members.

In 1989, the district court considered issues involving tribal regulation of members' harvest of fish, defining a "safe harvest level" as the number of fish that could be taken from any lake without depleting the population. In 1990, the court considered tribal hunting and trapping rights, ruling the Ojibwe were entitled to an allocation of 50 percent of the harvestable surplus of each species in a particular harvesting area. Later that same year, the court ruled that the 11th Amendment to the U.S. Constitution provided immunity to the state and prevented the bands from collecting damages for infringement of their treaty rights. Further, in 1991, the court ruled the harvest of timber resources was not a "usual and customary" Ojibwe activity, and that the Ojibwe did not reserve a treaty-based right to harvest trees to be taken "to the mill" in the Ceded Territories.

Later in 1991, the court issued a Final Decision summarizing the decisions the court had made and incorporating into the final judgment the stipulations the parties had agreed to during the case. The state and the tribes declared that neither would appeal the LCO v. Wisconsin (sometimes called the "Voigt" or "LCO") decision and the decision remains in effect today. The tribes that are parties to the case are all members of GLIFWC, which assists them in regulating the harvest of off-reservation treaty resources.

In 2001, the state and tribes jointly requested the court establish a process to allow the parties, by mutual agreement, to modify certain stipulations that were incorporated in the final judgment. The court agreed and issued an order setting forth the requirements for any agreed-upon modifications. In accordance with the Amended Judgment, the Ojibwe bands and the state have established a process for review of stipulations agreed to during the case so that new issues can be addressed, and management adapted to changing conditions. For example, elk have been successfully reintroduced into Wisconsin, and as part of this process, tribes have enacted regulations to govern their members' harvest of elk. The Ojibwe bands and the state work closely to ensure that shared resources are effectively managed and appropriately conserved for the benefit of all.

Court decisions regarding the implementation of Ojibwe treaty rights in Wisconsin hold that usufructuary rights can be exercised on public lands. The exercise of these rights was and continues to be fundamental to the tribes' culture and way of life. Large contiguous tracts of publicly accessible lands in the Ceded Territories are important for the exercise of treaty rights.

4.1.4.2 Regulated Tribal Treaty Resources

The treaties represent a reservation of rights by each tribe individually, but also held in common by all the signatory tribes collectively. Each tribe continues to authorize and regulate its members in the exercise of their off-reservation Ceded Territory rights. These rights, however, are also shared intertribally and are managed by GLIFWC on behalf of the eleven member tribes. GLIFWC (2022) describes how the tribes' off-reservation conservation codes are one part of a larger, tribal Ceded Territories management system. The elements of this system are:

> ***"Chippewa Intertribal Co-management Agreement:*** *This is formally called the Chippewa Intertribal Agreement Governing Resource Management and Regulation of Off-Reservation Treaty Rights in the Ceded Territory. Through this agreement, the tribes pledge to work together to make sure that they comply with the LCO case rulings. The tribes recognize that they share the treaty rights and that intertribal cooperation is necessary."*
>
> "***Natural Resource Management Plans:*** *The tribes adopted Ceded Territory management plans for walleye, muskellunge, deer and bear. These plans lay out the tribes' shared management goals and set forth a common understanding of the types of regulations necessary to meet biological requirements."*
>
> "***Harvest Declaration Protocols:*** *The tribes adopted harvest declaration protocols for fish (walleye and muskellunge), antlerless deer, bear, otter, fisher and migratory birds. The protocols require the tribes to tell the WDNR what the tribes intend to harvest in the upcoming seasons. If necessary, the state can then adjust state harvests to make sure that total harvest stays within biologically safe levels."*
>
> "***Conservation Codes:*** *As part of the LCO case, the tribes adopted a model, off-reservation conservation code that contains the required regulations. The model code outlines the minimum level of regulation that the tribes must adopt to comply with the court's rulings. Each tribe must enact its own code that is no less restrictive than the model code. A tribe can choose to be more restrictive."*
>
> "*Tribal off-reservation harvest for any resource is governed by these conservation codes. The codes set seasons, define allowable harvest gear and methods, impose permit requirements, and set bag limits. They also impose a variety of other restrictions important for conservation of the resources, for public health and safety, and for meeting tribal needs."*

In addressing how tribes can preempt state regulation of their Ceded Territory rights, courts have said that the tribes must be able to effectively regulate themselves and protect legitimate state conservation, health, and safety interests. The 1842 Treaty guarantees that the Wisconsin Ojibwe bands are entitled to an equal share of all harvestable treaty resources in the Ceded Territories unless a different proportion of the harvestable share of a specific species is agreed upon by the state and the bands. This necessarily involves an aspect of co-management—communication and coordination—with non-tribal governments that exercise management authority within the Ceded Territories (GLIFWC, 2023).

4.1.5 Tribal Assumption of Federal Laws (Treatment as a State)

Several federal environmental laws authorize the EPA to treat eligible federally recognized tribes in a similar manner as a state for implementing and managing certain environmental programs. Such “treatment as a state” is expressly provided for under the Clean Air Act (CAA), Clean Water Act (CWA), and Safe Drinking Water Act. Though separate from treatment as a state, other federal laws provide opportunities for tribal participation. The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) states that tribes shall be given “substantially” the same treatment as a state, which EPA has interpreted to allow tribes to enter cooperative agreements and receive financial assistance under the statute. Similarly, the Federal Insecticide, Fungicide, and Rodenticide Act authorizes EPA to enter into cooperative agreements with tribes for specific purposes under the act.

The basic requirements for applying for treatment as a state are that the tribe must:

- be federally recognized,
- have a governing body carrying out substantial governmental duties and powers,
- have appropriate authority, and
- be capable of carrying out the functions of the program.

Under treatment as a state provisions, tribes may implement and manage certain CWA programs including water quality standards (Section 303(c)), water quality certification (Section 404), National Pollutant Discharge Elimination System (NPDES) permitting (Section 402), dredge and fill permitting (Section 404), and impaired waters listing (Section 303(d)). The EPA has granted treatment as a state status for water quality standards program under the CWA to the Bad River Band, Lac du Flambeau Band, and Sokaogon Chippewa Community.

Tribes have the opportunity (even without their own permitting program) to get treatment as a state for CAA Section 505(a)(2). This means that state and local permitting authorities need to treat the tribe as an affected state and follow notice requirements: “The permitting authority shall notify all States -- whose air quality may be affected and that are contiguous to the State in which the emission originates, or (b) that are within 50 miles of the source.” The Bad River Band and Forest County Potawatomi Community have received EPA approval for treatment as a state under Section 505(a)(2). In many cases pollution is transported from upwind sources. Treatment as a state for CAA Section 126 allows tribes to be treated as a neighboring state and to petition EPA to review upwind state implementation plans. The Forest County Potawatomi Community have received EPA approval for treatment as a state under Section 126.

4.1.5.1 Bad River Band Water Quality Standards

EPA granted the Bad River Band treatment as a state when it approved the Band’s application to administer a water quality standards program under CWA Section 303(c) and to issue water quality certifications under CWA Section 401 in June 2009. EPA approved the Band’s water quality standards in September 2011.

The Bad River Band’s water quality standards prescribe minimum water quality requirements for all surface waters located within the exterior boundaries of the Bad River Reservation to ensure compliance with section 303(c) of the Clean Water Act. Additionally, the water quality standards are intended to protect public health and welfare, enhance the quality of water, and serves the purposes of the CWA. In describing the territory covered by the standards, the water quality standards document states:

> “*Tribe notes that waters upstream of the Bad River Reservation can affect the waters of the Bad River Reservation. It is the Tribe’s intent that these Tribal water quality standards be applied to the fullest extent of the Tribe’s jurisdictional control and to protect the waters of the Bad River Reservation from any impacts regardless of the location of the source of those impacts.*”

The Band’s water quality standards specify designated uses and specific classifications for each waterbody or segment (e.g., cultural, wild rice, wildlife, aquatic life and fish, cold-water fishery, cool-water fishery, recreational, commercial, navigation, wetland), whether or not the identified uses are being attained currently. The water quality standards include both narrative and numeric criteria. At the boundary between waters of different classifications, the water quality standards specify that criteria applied to the most sensitive classification shall prevail.

For the purposes of the tribe’s antidegradation policy, waters on the Bad River Reservation are categorized as follows:

- “Outstanding Tribal Resource Water” (Chi minosingbii; “best waters”) – a water considered to be largely pristine and constitute a significantly important cultural and ecological resource. These waters are important for the cultivation of wild rice or the spawning of lake sturgeon, or have other special resource values. This classification is roughly equivalent to EPA’s Tier 3 classification under its antidegradation policy, though this classification may be more protective than EPA’s policy.

- “Outstanding Resource Water” (Chi minosibii; “large good river”) – a water considered to be of high quality and culturally important for the fisheries and ecosystems they support. This classification is more stringent than EPA’s Tier 2 classification and could be described as a Tier 2.5 water under EPA’s antidegradation policy.

- “Exceptional Resource Water” (Anishinaabosibiing; “good watering place”) – a water considered to be of high quality and culturally important for the ecosystems they support. This classification is roughly equivalent to EPA’s regulatory definition of a Tier 2 water under its antidegradation policy, though this classification may be more protective than EPA’s policy. Any surface water not specifically classified as an Outstanding Tribal Resource Water or Outstanding Resource Water is classified as Exceptional Resource Water.

4.1.6 Formal Tribal Government Actions on Enbridge Line 5

Chapter 4.07 of the Bad River Band’s Tribal Court Code governs rights-of-way and service line agreements, relating to the transmission of energy products, over tribal Lands. The purposes of this ordinance, which became effective in June 2018, are:

> *“1. to take advantage of opportunities for greater self-determination presented by the BIA’s 2016 revision of ROW regulations.”*
>
> *“2. to strengthen Tribal sovereignty and increase Tribal control over Tribal lands and resources.”*
>
> *“3. to provide rules governing eligibility [for] the issuance of rights-of-way and service line permits over Tribal Lands.”*

The ordinance assigns the Tribal Council responsibility for approving or disapproving all realty-related interests authorized by the ordinance and adopting rules, policies, forms, and procedures, consistent with the ordinance, governing the issuance of rights-of-way and service line agreements. The ordinance establishes procedures for the administrative and environmental review of applications, establishes security document requirements, includes mandatory provisions for ROW agreements, identifies categorical exclusions, provides for compensation of the tribe, requires public notice and comment, and specifies enforcement provisions.

The Bad River Band's Tribal Council resolved in 2017 and reaffirmed in 2019 to not renew the Line 5 easements and directed tribal staff to take all lawful action to remove Line 5 from the reservation as well as the Bad River watershed (Bad River Band of Lake Superior Chippewa, 2017; 2019b).

As discussed in Section 1.2.2, the Bad River Band filed a lawsuit in the U.S. District Court for the Western District of Wisconsin in 2019 (Case no. 19-cv-602-wmc) alleging trespass and unjust enrichment for Enbridge's continued pipeline operation across the Bad River Reservation without valid easements, public nuisance, ejectment, and a violation of Bad River Band's regulatory authority. In its opinions and orders from September 7, 2022, and June 16, 2023, the court held that the 20-year easements had expired, Enbridge's continued use of Line 5 on those parcels constituted trespass, a rupture on Line 5 would constitute a public nuisance, and that Enbridge was unjustly enriched by the continued operation of Line 5. The court ordered Enbridge to adopt a more protective monitoring and shutdown plan, pay a monetary award to the Bad River Band, and issued an injunction prohibiting Enbridge from operating Line 5 after three years of the order (June 16, 2026). Both Enbridge and the Bad River Band have appealed the District Court ruling to the 7th Circuit Court of Appeals (Case no. 23-2309). Oral arguments in the 7th Circuit were held on February 8, 2024.

4.1.7 Tribal Relations with the State of Wisconsin

Relations between tribal governments are governed by the U.S., State and Tribal Constitutions, ratified treaties, federal, state, and tribal laws, and various court decisions. In addition, two Wisconsin Governors have issued executive orders that affirm the sovereignty of the 11 federally recognized tribal governments in Wisconsin, commit to the government-to-government relationship that exists between the State and the tribes, and establish a State-Tribal Consultation Initiative.

Wisconsin Executive Order #39, issued by Governor Jim Doyle in 2004, established the State-Tribal Consultation Initiative. This executive order:

1. Directs cabinet agencies to recognize the unique legal relationship between the State of Wisconsin and Native American tribes, respect fundamental principles that establish and maintain this relationship, and accord tribal governments the same respect accorded other governments;

2. Directs cabinet agencies to recognize the unique government-to-government relationship between the State of Wisconsin and Native American tribes when formulating and implementing policies or programs that directly affect Native American tribes and their members, and whenever feasible and appropriate, consult the governments of the affected tribe or tribes regarding state action or proposed action that is anticipated to directly affect a Native American tribe or its members;

3. In instances where the State of Wisconsin assumes control over formerly federal programs that directly affect Native American tribes or their members, direct cabinet agencies, when feasible and appropriate, to consider tribal needs and endeavor to ensure the tribal interests are taken into account by the cabinet agency administering the formerly federal program; and

4. Directs cabinet agencies to work cooperatively to accomplish the goals of the Executive Order.

Wisconsin Executive Order #18, issued by Governor Tony Evers in 2019, affirmed the sovereignty of the 11 federally recognized tribal governments in Wisconsin and the government-to-government relationship that exists between the State and the tribes. This executive order directs each cabinet agency to:

1. Recognize the State of Wisconsin's unique legal relationship with Native American tribal nations and engage them with the respect accorded to other governments;
2. Engage tribal governments, on a government-to-government basis, in developing policies or programs that directly impact Native American tribal nations or their members, and appropriately consult tribal governments on matters that could indirectly impact Native American tribal nations or their members;
3. Develop an updated consultation policy that does the following:
    a. Ensures the state government workforce is educated on Native American tribal nations and sovereignty;
    b. Strengthens the day-to-day working relationships between Native American tribal and state government agencies;
    c. Provides for at least annual consultation meetings with Native American tribal and state leaders; and,
    d. Identifies at least one agency staff member to serve as a liaison between the agency and the Native American tribal nations;
4. Ensure impacted Native American tribal governments and interests are represented and respected when managing federal programs.

4.1.7.1 Government-to-Government Consultation

In May 2020, the DNR invited leaders of each of the federally recognized tribal nations in Wisconsin to participate in consultations. Two tribes, the Bad River Band of Lake Superior Chippewa and the Red Cliff Band of Lake Superior Chippewa, requested consultations in response to the invitation. The DNR Secretary’s office, administrators, and tribal liaison met with leadership from these two tribes on several occasions. As part of the consultations, tribal leaders indicated tribal technical staff possessed an abundance of knowledge and expertise pertaining to the proposed project site, had completed some technical analyses related to the proposal, and were interested in a forum for sharing this information with the DNR. The DNR Secretary committed to making department staff available for technical meetings with staff from the natural resources, environmental, and historic preservation departments of the interested tribes and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC). Between August 2020 and June 2021, DNR staff met with staff from the Bad River and Red Cliff Bands, as well as the Forest County Potawatomi Community and Lac du Flambeau Band of Lake Superior Chippewa, and GLIFWC for a series of six technical discussions to further inform the development of the Draft EIS. The DNR also held two listening sessions with tribal staff and tribal members in September 2021 on the topics of environmental justice and murdered and missing indigenous people (Section 4.3). These technical meetings and associated informational exchanges were part of the EIS process.

A second formal consultation meeting with tribal leadership was held in November 2022. Multiple technical meetings with tribal resource agency staff took place between October 2022 and April 2024. Topics of discussion included tribal comments on the Draft EIS, sediment transport models, oil spill models, potentially affected species and habitats, cultural resources, environmental justice concerns, etc. Bad River Band staff accompanied DNR staff during field site visits in July, October, and November 2023. The DNR also obtained the service of a member of the Bad River Band, who is also a former THPO, to review materials the DNR compiled and drafted related to cultural resources and Ojibwe worldviews.

4.1.8 Enbridge Tribal Relations

Enbridge has an Indigenous Peoples Policy and operates an Indigenous Engagement Program. The following sections briefly overview the company's policy and recent events and activities related to the company's tribal engagement activities.

4.1.8.1 Shareholder Proposal to Annual General Meeting

The not-for-profit Shareholder Association for Research and Education (SHARE) and a Council member from the Standing Rock Sioux Tribe in North Dakota presented a shareholder proposal at Enbridge's 2017 Annual General Meeting seeking information about Enbridge's due diligence process (Enbridge, 2017; SHARE, 2017):

> *RESOLVED that the Board of Enbridge, Inc. prepare a report to shareholders, at reasonable cost and omitting proprietary information, detailing the due diligence process used by Enbridge, its affiliates and subsidiaries to identify and address social and environmental risks, including Indigenous rights risks, when reviewing potential acquisitions. Such a report will consider:*
>
> - *which committees, departments and/or managers are responsible for review, oversight and verification;*
> - *how Indigenous rights and concerns are identified and assessed;*
> - *how environmental and human rights risks are identified and assessed;*
> - *which international standards are used to guide the company's human rights and environmental due diligence procedures; and,*
> - *how this information informs and is weighted in acquisition decisions.*

SHARE encouraged Enbridge shareholders to vote for the proposal (SHARE, 2017). Enbridge management responded in its proxy circular (Enbridge, 2017) noting that Enbridge had developed a new Indigenous Peoples Policy and expanded its Indigenous Engagement Program. Enbridge also committed to provide enhanced transparency about how the company implements its Indigenous Peoples Policy (Section 4.1.8.3) and how indigenous sensitivities are integrated into internal processes for investment review. Enbridge also stated its intention to include additional information regarding indigenous consultation, engagement, and inclusion in the company's 2017 Corporate Social Responsibility (CSR) and Sustainability Report, emphasizing that the company believed the "CSR and Sustainability Report sets out a more comprehensive report on challenges and performance in a broad range of important CSR and sustainability related topics" than the report requested by the shareholder proposal. Enbridge's Board of Directors recommended shareholders vote against the proposal. SHARE argued the company's response failed to fully address the proposal and referred to Enbridge's commitment as "limited and vague" and "misaligned with the importance of this issue" (SHARE, 2017). The proposed resolution received support from over 30 percent of shareholders but failed to pass. Enbridge has since provided an annual overview of the company's plans, commitments, and outcomes with respect to indigenous inclusion in each of its annual Corporate Sustainability Reports beginning in 2018. The company augmented those reports with an update on indigenous engagement and inclusion in 2022 (Enbridge, 2022b).

4.1.8.2 Indigenous Rights & Relationships Discussion Paper

In 2018, Enbridge released a discussion paper on *Indigenous Rights and Relationships in North American Energy Infrastructure* (Enbridge, 2018) as a follow-up to the commitments the company made in response to the shareholder resolution (Section 4.1.8.1). The report's preface explained the content of the report was "derived from practices and procedures in place for engaging with Indigenous nations and groups where [Enbridge's] activities can affect Indigenous rights and relationships." The company stated that "While the substance of this report reflects learning from our ongoing engagement with Indigenous Peoples in North America, we have not directly engaged on this report itself with Indigenous Nations and groups." Section 5 of the discussion paper provides a comprehensive overview of implementation of the company's Indigenous Peoples Policy (Section 4.1.8.3).

Throughout the second half of 2018, Enbridge introduced the discussion paper to indigenous leaders from over 20 nations in Canada with an invitation to review and provide input about its contents (Enbridge, 2018). The company also solicited input through an online survey. According to Enbridge (2018), most of the feedback received related to indigenous rights, Enbridge's investment review process, employee awareness about indigenous cultures and practices, and inclusion of indigenous perspectives throughout the company's business. Enbridge used the discussion paper to better define the company's thinking and approach to lifecycle engagement with indigenous nations and groups (Enbridge, 2018).

First Peoples Worldwide at the University of Colorado Boulder's Center for Native American and Indigenous Studies reviewed the discussion paper. First Peoples Worldwide (2018) indicated the "discussion paper demonstrates that [Enbridge] took the shareholder resolution [Section 4.1.8.1] seriously and that they have given thoughtful consideration as to how their operations impact indigenous peoples." First Peoples Worldwide further concluded the discussion paper "represents a step forward in addressing the concerns of indigenous peoples as they intersect with Enbridge's investments and operations. However, there are still several critical steps that need to be taken. Neither the discussion paper nor the Indigenous Peoples Policy proactively identifies what actions the company will take should indigenous peoples withhold consent, as is their right under the identified international standards." First Peoples Worldwide (2018) also concluded "Enbridge's commitment to addressing the concerns of indigenous peoples is too general and the policies in the paper lack the specificity necessary to demonstrate a true acknowledgment of their responsibility to indigenous peoples' rights throughout the lifecycle of an investment."

4.1.8.3 Indigenous Peoples Policy

In 2022, Enbridge published its updated Indigenous Peoples Policy (Enbridge, 2022c); Appendix I). This policy recognizes "the diversity of Indigenous peoples who live where we work and operate" and further states that the company understands "certain laws and policies—in both Canada and the United States—have had destructive impacts on Indigenous cultures, languages, and the social and economic well-being of Indigenous peoples." Enbridge's policy also states that the company recognizes the importance of advancing reconciliation between Native Americans and broader society and commits the company "to building positive and sustainable relationships with Indigenous peoples, based on trust and respect, and focused on finding common goals through open dialogue" (Enbridge, 2022c).

Enbridge's Indigenous Peoples Policy indicates that Enbridge seeks to build long-term, respectful, and constructive relationships with Native American communities near Enbridge's projects and operations throughout the lifecycle of the company's activities (Enbridge, 2022c). To foster such relationships, the policy calls for the company, its affiliates, employees, contractors, joint venture partners, and others to conduct business in a manner that reflects three principles:

- Respect for Indigenous rights and knowledge.
- Promoting equity and inclusion.
- Fostering awareness through education.

The policy includes a statement that Enbridge "will provide ongoing leadership and resources to ensure the effective implementation of these principles, including the development of implementation strategies and specific action plans, and report its Indigenous reconciliation efforts—including engagement and inclusion outcomes—through its annual Sustainability Report" (Enbridge, 2022c).

First Peoples Worldwide (2018) praised Enbridge's policy for its acknowledgement of the United Nations Declaration on the Rights of Indigenous Peoples and inclusion of relevant international standards like the Voluntary Principles on Security and Human Rights, the United Nations Global Compact, and various frameworks for sustainable development established by groups that set a minimum standard for respecting human rights and indigenous rights. The review also found that "one of the strongest ways that Enbridge has demonstrated their commitment to indigenous peoples is by prioritizing knowledge building on indigenous peoples' issues at the highest levels of the company." First Peoples Worldwide (2018) also offered several suggestions for ways Enbridge could continue to develop policies in line with best practices to create lasting partnerships with indigenous peoples.

4.1.8.4 Environmental Justice Commitment Plan

Enbridge prepared an Environmental Justice Commitment Plan in August 2021 to address goals in both its Corporate Social Responsibility and Indigenous Peoples policies. Enbridge submitted this plan to the DNR as part of its permit application. In April 2022, Enbridge submitted a revised Environmental Justice Commitment Plan as part of the company's comments on the Draft EIS. The revised plan included the sentence: "Enbridge plans to spend $46 million dollars with Native owned businesses and contractors, and have Native Americans make up at least 10% of the project workforce." Additionally, Enbridge's comment letter stated, "Enbridge will make its best efforts to accommodate requests for access to the ROW for all such lawful activity [hunting, fishing, and gathering rights], and will identify a point of contact to coordinate access locations and timing to ensure public safety."

In July 2023, Enbridge submitted an update to the Environmental Justice Commitment Plan (Appendix J) that included an Environmental Justice Assessment report and a summary of Enbridge's community outreach completed to date. The Environmental Justice Assessment identified potential communities with EJ concerns, or communities which could disproportionately feel impacts from Enbridge's operations. Enbridge's consultants used CEQ's Climate and Economic Justice Screening Tool (CEJST), EPA's EJ Screen Tool, U.S. Census Bureau data, and Wisconsin Department of Health data to identify the potential EJ communities.

4.1.8.5 Indigenous Reconciliation Action Plan

Enbridge released its first Indigenous Reconciliation Action Plan in 2022 (Enbridge, 2022d; Appendix K). The plan includes a statement from the company's President and CEO stating, Enbridge released its first Indigenous Reconciliation Action Plan in 2022 (Enbridge, 2022d; Appendix K). The plan includes a statement from the company's President and CEO stating,

> "*... we recognize the deep and meaningful connections that Indigenous nations have to water, land and the environment. We've learned not to walk into Indigenous communities with all the answers, but rather to listen carefully to concerns and ask questions... We instill trust by listening carefully and working together—and delivering on the promises we make.*"

The Indigenous Reconciliation Action Plan is organized into six pillars that represent Enbridge's priorities:

- People, employment and education.
- Community engagement and relationships.
- Economic inclusion and partnerships.
- Environmental stewardship and safety.
- Sustainability, reporting and energy transition.
- Governance and leadership.

The Indigenous Reconciliation Action Plan refers to these pillars as "a cornerstone of our commitment to reconciliation, each collaboratively developed with the input of Indigenous individuals and groups." For each pillar, the Indigenous Reconciliation Action Plan specifies commitments (a total of 22) and outlines details, targets/goals, and timelines for each. The Indigenous Reconciliation Action Plan indicates "while the commitments may evolve over time, we expect each pillar will remain stable and consistent." The Indigenous Reconciliation Action Plan also indicates "Enbridge will develop tools and mechanisms to support and execute on these commitments… publicly report on our progress… starting with an update on our progress in our 2023 Sustainability Report."

Enbridge's 2023 Sustainability Report indicated the company had "achieved 10 of the 22 IRAP commitments, with the remaining 12 well on track to completion." The report highlighted the company's work in the areas of talent attraction and recruiting, talent experience and development, cultural support programs, learning and awareness, feedback mechanisms, community engagement and relationships, Indigenous financial partnerships, and a thought leader roundtable. An appendix provided additional details on the company's "ongoing journey of progress in 2023" (Enbridge, 2023c).

4.1.8.6 Open Letters to Members of the Bad River Band

Between October 2023 and March 2024, Enbridge published six open letters to members of the Bad River Band. The company also published two "advertorials," primarily in local community papers around Enbridge operations in northern Wisconsin. Among other things, these communications focused on:

- Purported economic benefits to Native American communities and the state from Line 5 and the proposed Line 5 relocation project.
- The Company's explanation for why it is appealing the Western District Court's 2023 decision.
- An outline of the history of Line 5's operational safety.
- Enbridge's proposals for addressing erosion at the Meander[4] and urging solutions to keep the current Line 5 operating.

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[4] The Bad River meanders and changes naturally over time. Upstream of Lake Superior 15.8 miles, where Line 5 crosses the Bad River, the river is working to carve a new river channel through the neck of an oxbow. Bank erosion along the river has accelerated in recent flooding events threatening to expose the pipeline in this area.

These communications include the following statements with respect to tribal relations:

- “We don’t intend to operate on the Bad River Reservation a day longer than it takes to finish the relocation.”
- “Enbridge is prepared to discuss complete resolution of all issues arising from the litigation, including renewing our proposal to pay substantially more than the court award.”
- “We are prepared to make substantial payments to the Band and its members far and above the sums ordered by the court—funds that could no doubt be put to good use.”

In March 2024, Enbridge published a letter on its website to the Bad River Band offering $80 million to settle past disputes and stating its commitment to work with the Band to find solutions (Enbridge, 2024c). In an online response, Bad River Chairman Robert Blanchard stated, “Our homeland, our treaty rights, and our way of life are not for sale” (Blanchard, 2024).

4.1.8.7 Notification of Tribes of an Accidental Release of Oil or Drilling Fluids

One concern raised during the public comment period for the Draft EIS was regarding the notification of tribal governments in the event of an accidental release of oil or drilling fluids. In an October 2022 Information Request, the DNR asked Enbridge to describe how the Bad River Band of Lake Superior Chippewa would be notified if such an event occurred upstream from the Bad River Reservation. The DNR also asked Enbridge to explain how Enbridge would coordinate with the Mashkiiziibii Natural Resources Department, including obtaining permission to enter lands within the Bad River Reservation.

In its November 30, 2022, response to the DNR Information Request, Enbridge indicated,

> *“Should an incident occur either during construction or operation of the pipeline that resulted in an accidental release of reportable quantities of oil or drilling fluid upstream of the Bad River Reservation, Enbridge would follow the notification process as outline in Section 29 of its Environmental Protection Plan (EPP). Notifications will be made to federal, state, and local agencies as applicable (see Appendix E of the EPP).”*

Enbridge also indicated the company “will notify the director of the Mashkiiziibii Natural Resources Department and the Tribal Council of any release of oil or drilling fluid within a wetland or waterway after the federal, state, and local notifications are made. In the event that access to the Reservation is required, Enbridge will follow the Bad River Band’s Access Permit process” (Enbridge, 2022e).

4.2 Cultural Resources within Proposed Route & Route Alternatives

Many indigenous people continue to live within their ancestral homelands, both on and off reservations, and maintain the reciprocal act of caring for Creation as considered through their spiritual practices. The diverse landscapes, flora and fauna, ancient places of continued cultural and spiritual practices, archeological resources, burial sites, and all beings continue to be valued by tribal peoples. Today these diverse features have come to be known euphemistically as “cultural resources.” Each tribe’s cultural resources provide vital connections to tribal identities, traditional lifeways, and ancestral stories. Tribal nations have long faced many challenges in protecting and preserving their cultural resources including from the compounding effects of forced removal, land dispossession through treaties, discriminatory land and resource management policies, extensive timber harvest, industrial pollution, encroaching development, and climate change (Cohen, 1988; Chang et al., 2020; Tsosie, 2015; Wiggins Jr., 2022a; Whyte et al., 2023). Tribal leaders shared some of these challenges with DNR administration and staff during government-to-government meetings, through public hearing testimony, and in written comments submitted in response to the Draft EIS (e.g., Boyd, 2022a; Chiriboga, 2022; Wiggins Jr., 2022a).

This EIS addresses cultural resources from both traditional Ojibwe and state and federal regulatory perspectives, acknowledging a broader understanding of cultural resources. State and federal historic preservation and burial site protection laws accord some protections to a subset of cultural resources. Under these laws, "cultural resources" are defined as physical remains of human activity. They include places of religious and cultural significance, as well as archeological and historic resources such as objects, structures, buildings, sites, districts, and landscapes (NRCS, 2021; USFWC, 2020a). The Council for Environmental Quality (CEQ) and the Advisory Council for Historic Preservation have defined a "cultural resource" as covering "a wider range of resources than simply 'historic properties,' such as sacred sites, archaeological sites not eligible for the National Register of Historic Places, and archaeological collections" (CEQ and ACHP, 2013). In addition, § NR 150.03(12), Wis. Adm. Code, defines "Human environment" to include "the relationship of people with that environment, including aesthetic, historic, cultural, economic, social, and human health-related components." In resolutions unanimously adopted in 2017 and 2019, the Tribal Council for the Bad River Band of Lake Superior Chippewa Indians stated, "these places are traditional cultural places, archaeological and historical sites, and include minerals, plants and animals whose health and well-being are necessary for our religious, medicinal, cultural, subsistence health and well-being" (Bad River Band of Lake Superior Chippewa, 2017; 2019b). Additionally, the GLIFWC (2022) outlined how "The creation stories direct Anishinaabeg[5] to seek healing and purpose by cultivating personal relationships with non-human beings through activities like hunting, plant gathering, conducting ceremonies at 'landmarks' and in isolation, and playing traditional games such as baaga'adowewin (lacrosse). The sacred creation stories also serve as an archive of historical information." The GLIFWC (2022) also emphasized why it is "important to understand that the social and cultural resources are not simply physical objects to be mined and cataloged from a particular site, but that the stories and traditions of the indigenous peoples of the area are critical to determining the social and cultural resources that may be present." While many cultural resources may have historical significance, other cultural resources remain central to ongoing cultural and spiritual practices (E. Leoso, pers. comm.).

Section 4.2.1 draws from a wide range of sources to describe Ojibwe perspectives regarding the tangible and intangible cultural, spiritual, and traditional significance of plants, animals, ecosystems, and landscapes. A focus on Ojibwe worldviews in this EIS is appropriate because the existing Line 5 pipeline, Enbridge's proposed pipeline relocation route, and all three alternative pipeline routes are within territories ceded by Ojibwe tribes through the 1837, 1842, and 1854 Treaties (Section 4.1.4). As noted elsewhere, the existing Line 5 pipeline crosses the Bad River Reservation and the river and stream crossings along the proposed pipeline relocation route range from 1.3 river miles to 8.6 river miles upstream of the Bad River Reservation (Figure 1.1-2). The Red Cliff Reservation is also located on Lake Superior downstream of the pipeline crossings. Both Bad River and Red Cliff tribal members are descendants of the original LaPointe Band of Chippewa whose territories extended far beyond the existing reservation boundaries of both the Bad River and Red Cliff tribes. Because the potentially affected tribes generally do

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[5] Anishinaabe (the "first man lowered" or "Original People") include a group of culturally and linguistically related Native American peoples who live in North, Central, and South America. The Anishinaabeg (plural form of Anishinaabe) include the Ojibwe, Odawa, Potawatomi, Algonquin, Saulteaux, Nipissing, and Mississauga peoples. The Ojibwe tribes in northern Wisconsin use Anishinaabe as the name of all indigenous people of Turtle Island, as they are descended from the first one lowered, and refer to themselves as Ojibwe Anishinaabe.

not set or enforce environmental standards in the Ceded Territories (but see Section 4.1.5, Treatment as a State), tribal leaders have expressed concerns during government-to-government interactions that federal and state agencies must adequately consider their worldviews and reliance on natural resources when implementing environmental laws.

Section 4.2.2 addresses cultural resources under state and federal laws and describes the DNR's efforts to comply with these laws, including coordination with the Tribal and State Historic Preservation Offices (THPOs and SHPO, respectively) and federal agencies. The section describes the cultural resources investigations and reports that were made available to the DNR during preparation of the EIS, explains the limitations of the available information, and presents the quantifiable assessment of anticipated impacts to cultural resources as defined in state and federal laws.

Section 4.2.3 presents a qualitative discussion of impacts to cultural resources. The Ojibwe worldview stresses the interconnectivity between the tangible and intangible, the interactions in Creation between humans and the rest of Creation, as well as between non-humans and the rest of Creation (E. Leoso, pers. comm.). These connections result in a distinct "sense of place" for many indigenous people. A recent feature story (Ness, 2023) quoted former Bad River Band Chairman Mike Wiggins, Jr., explaining, "None of the federal and state permitting processes have any place of the spirituality of our people, for our connection to this place. It's very difficult to try to convey in courtrooms and permitting hearings." The inclusion of a qualitative discussion in the EIS attempts to address these sentiments within the regulatory context and responds to basic commitments DNR leadership made during government-to-government consultations (Section 4.1.7).

4.2.1 Ojibwe Worldviews & Lifeways

Like many other Native American tribes, the Ojibwe peoples have relied largely on oral tradition to pass their histories and practices across generations. The Ojibwe also have captured written histories on birch bark scrolls (Peacock and Wisuri, 2002); E. Leoso, pers. comm.). The tribes have thousands of stories that describe Creation and their relationships to nature that are considered sacred. These stories, which continue to be told today, include protocols for how they are told and for who tells them. For example, tribal elders and spiritual leaders may tell specific stories only in the winter due to their belief that snakes and frogs may be evil and not allowed to listen to certain stories. For many tribes, creation stories provide the basis of law, science, and philosophy, and these stories continue to be relevant and useful frameworks for centering tribal values, which in some cases may not be recognized by non-Ojibwe people.

In the Ojibwe stories, the world is described in terms of relationships between various Odinawemaaganag (relatives), all endowed with agency. Non-human beings communicate and express complex emotional states. Storms and weather systems devise strategies to help or hurt others (an example of this is the story about Biboon [winter] kidnapping Niibin [spring]). Human beings are often featured in these stories, but their role is not contemplated as being in charge or in control of the other beings. In many cases, the vulnerability of human beings is illustrated along with the generosity of other parts of Creation. GLIFWC (2016) explains "Anishinaabe tribes in the upper Great Lakes entered into their first treaty with the Spirit of the Universe. This Great Law of Nature holds that the land is a gift from the Creator and the Anishinaabeg are to live in harmony with and take care of that land through ceremonies, teachings, language, and the way they live their lives or their lifeway." One tribal member explained these relationships in this way:

> "*The relationships between humans and non-human beings are not unlike those in the Bible when Adam and Eve are spoken to and tempted by the snake. The Anishinaabe, however, see the snake as the spirit who takes care of everything under the ground, including buried relatives, the roots, and medicines, minerals, and even the oil. Most of which, should not be removed from the ground*

> *and is protected/guarded by the spirit of the snake, as a mixing from below and above the ground may provoke and cause contrary and adverse actions to Creation, including to the human beings. The evident truth to this is how some ground extracts have proven to be harmful to humans and the environment.*" (E. Leoso, pers. comm.).

Lessons from Ojibwe stories underly the Ojibwe worldview, as well as the Bad River Band's approach to conservation, stewardship, and resource management. University of Michigan investigators report Bad River Band members who they interviewed "communicated a contrast of the values found in Anishinaabe teachings with those demonstrated by modern society" (Dooper et al., 2018). For example, the University of Michigan team quoted one participant who stated, "at the very foundations of our spirituality, we're taught to live in harmony and balance with the four orders of Creation, Mother Earth, and also never to take more than what you need…" Similarly, among the beliefs enumerated in the Bad River Band's Integrated Resources Management Plan (Bad River Band of Lake Superior Chippewa, 2001) are the following statements:

- We believe the earth is a living entity and deserves the respect and honor that every living thing is entitled to receive.
- We believe water is the life blood and the environment and the quality of the water determines the quality of life.
- We believe that healthy ecosystems will be maintained by understanding, respecting, rehabilitating, and protecting natural resources and ecological processes.
- We believe that maintaining and promoting biological, social, and cultural diversity is essential for a long-term sustainable environment, and that such diversity creates a resilient base for the ecosystem.
- We believe there is a limit to the amount of resources that can be safely removed from a healthy ecosystem.
- We believe tribal members must return to their traditional roots for the spiritual foundation that is needed to suppress the urge to take more than they need.

These and other listed beliefs underpin the tribe's approach to interactions with the natural world and inform tribal responses to Enbridge's existing Line 5, proposed relocation, and route alternatives.

4.2.1.1 Historical Migration & Bad River Origin Story

The Anishinaabe, and other indigenous peoples, describe the creation of the lands and waters that make up Turtle Island (the Americas) in their origin stories. The creation stories also frame and orient human roles and responsibilities in relation to the other parts of Creation.

The Ojibwe people originally lived along the Atlantic coast in eastern North America. Ojibwe stories tell of being at the Great Salt Water and tribal historians believe this was in the Maine/New Brunswick area (Peacock and Wisuri, 2002); E. Leoso, pers. comm.). There is a historic site in Mi'kmac country in Maine known as Odanah (town) which supports this belief (E. Leoso, pers. comm.). Historians suggest that around 1,500 years ago Ojibwe people began slowly moving westward (Figure 4.2-1) in small groups due to a combination of prophecies and tribal warfare, tracing a path along the rivers and shores of the Great Lakes. Ojibwe stories, however, suggest it may have been up to two thousand years prior to European onset that the people began their migration (E. Leoso, pers. comm.).

As their migration proceeded to the west, groups of Ojibwe settled at various stopping places; today, many still live at the seven stopping places along the migration route. The Ojibwe were well established along the St. Mary's River at Sault Ste. Marie and the surrounding area by the time the French arrived in the Great Lakes area in the early 1600s. Many Ojibwe considered Madeline Island to be a final stopping place and settled in the southern region of Lake Superior. Others continued into northern Minnesota and as far west as Montana (e.g., the Chippewa Cree Tribe of Rocky Boy Montana and Little Shell Tribe of Chippewa Indians of Montana). For the Bad River Band, the Ojibwe prophecy that urged the tribe to move to "the land where food grows on top of the water" seemed a clear reference to the abundant Manoomin (wild rice) in the Kakagon and Bad River Sloughs complex. While many Ojibwe recognized the southern Lake Superior region as the final stopping place, some bands continued westward, such as those in northern Minnesota who recognized the rice lakes there as their final stopping place. The Lake Superior bands do not dispute the stories of these other tribes as they recognize them as all being true (Peacock and Wisuri, 2002); E. Leoso, pers. comm.).

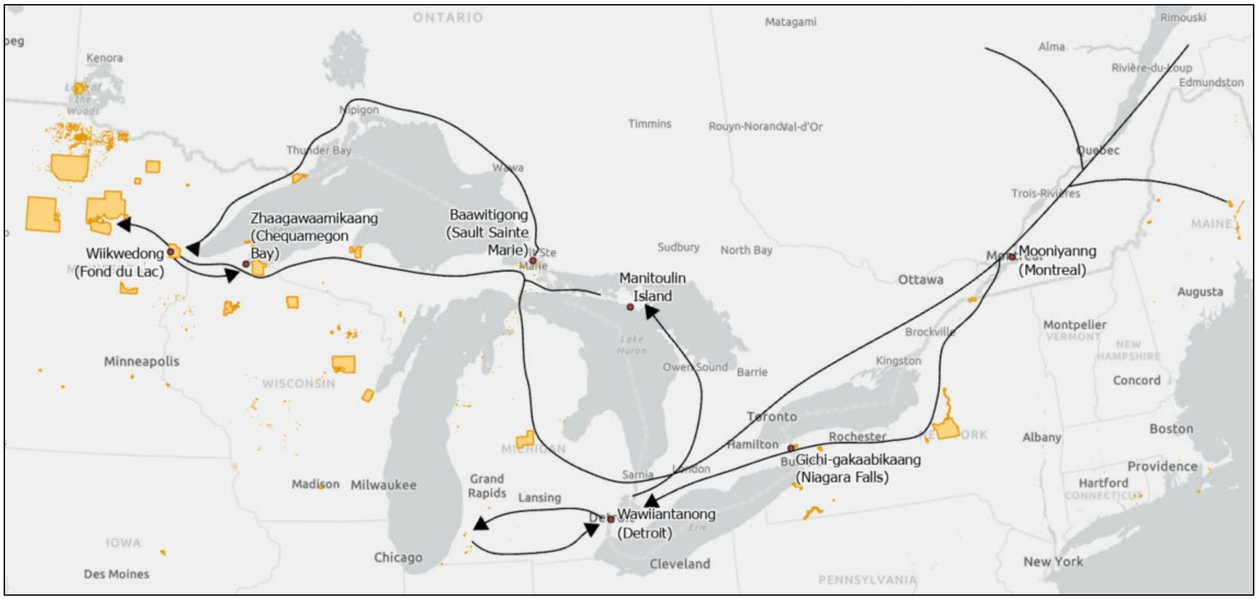

Figure 4.2-1 Ojibwe migration from the East Coast to the western Great Lakes.
Source: DNR, adapted from National Park Trust

During the migration journey, some of the Ojibwe people traveled from Lake Erie along the southern half of lower Michigan and northern Indiana and Ohio into Illinois and settled in the Chicago (Zhigaagong [place of the skunks]) area and traveled north along Lake Michigan toward Lake Winnebago (Winibegong [place of the stagnant smelly water]).

In 1745, the Ojibwe in the Lake Superior region began to move inland into Wisconsin, with their first permanent village at Lac Courte Oreilles at the headwaters of the Chippewa River. Later, the Ojibwe people expanded into other parts of northern Wisconsin, particularly Lac du Flambeau. The "mountain" at Wausau (to see a far way) is a historic fasting site. Today, six bands of Ojibwe people reside in areas across northern Wisconsin (Section 4.1.2).

Although the Ojibwe's migration story describes the movement of the Ojibwe people from the Atlantic coast, beginning sometime prior to the European colonization of that area, older oral traditions describe the Anishinaabeg in relation to the interior of North America. For example, following a great flood, when

Weniboozhoo (original man) and the animals cooperated to reconstitute the land on Turtle's back, Weniboozhoo and Ma'iingan (wolf) were instructed to travel together in all directions. Weniboozhoo was instructed to observe and name all within Creation, including the various land formations and hydrological features. The stories of his travels, which have been recounted in all Ojibwe communities, include descriptions of features known as the Great Lakes, the Gulf of Mexico, the Rocky Mountains, and the Pacific Ocean, and other places far removed from the Atlantic coast. Throughout his travels, Weniboozhoo altered parts of Creation. Oftentimes, these alterations came about from Weniboozhoo's human foibles (e.g., hunger, greed, and boredom) and provide important lessons related to self-control, respect for others, care taking, and the importance of humility. In addition, the Ojibwe had traveled to many places throughout Turtle Island before Europeans' arrival. Petroglyphs once found on the banks of the Bad River were also found on the banks of Misa-ziibii (Mississippi River) in the State of Mississippi (E. Leoso, pers. comm.).

4.2.1.2 Spiritual Connection to the Land

Tribal member identities are often rooted in their relationship and responsibility to the land and all its inhabitants. Ojibwe teachings reference four orders of Creation (physical, plant, animal, and human orders). According to these teachings, the Creator made the physical world first, including Asiniig (rocks), Anangoog (stars), Giizhig (sky), Nibi (water), Noodin (wind), Gimiwan (rain), and Goon (snow). These beings work together and create a variety of habitats where plants, animals, and people can survive. Some Ojibwe people in the western Great Lakes region refer to it as a gitigaan (garden) where many types of trees and plants, the second order of Creation, grow. Working together with the first order (physical world), the plant world creates habitats for other plants, animals, and people. The third order, animals, includes the four-leggeds, swimmers, flyers, and crawlers that rely on the first and second orders for food, shelter, protection, and places to raise young. Ojibwe teachings tell how the Creator instructed the fourth order (people) to take care of plants and animals because they take care of us. Instead of seeing these beings as "natural resources" to be managed, the Ojibwe people consider members of the other orders to be teachers and relatives. Because the other beings have been in existence longer than people, they have much to teach us. They give themselves to provide us with food and shelter. They nourish our spirits with their beauty.

Anishinaabe people speak of the Original Treaties, which refer to the treaties people made with the other-than-human beings. The early Anishinaabe people understood their dependency upon the earlier orders of Creation. While those beings were not dependent upon humans, the people could not survive without the gifts the other beings provided. Fortunately, the non-human beings took pity on the humans and agreed to provide for them, but certain things were expected from the humans in return.

Traditionally, the Ojibwe clan system was created to provide leadership and care for the needs of the four orders of Creation. The seven original clans, each known by its non-human emblem or totem, have a function to serve for their people (Benton-Banai, 1979):

- The Crane and the Loon clans are given the power of Chieftainship. By working together, these two clans provide a balanced government with each serving as a check on the other. Between the two chief clans is the Fish Clan.
- The people of the Fish Clan are the teachers and scholars. They help children develop skills and healthy spirits. They also draw on their knowledge to solve disputes between the leaders of the Crane and Loon clans.
- The Bear Clan members serve as strong and steady police and legal guardians. Bear Clan members spend time patrolling the land surrounding the village, and in so doing, they learn which roots, bark, and plants can be used for medicines.

- The people of the Hoof Clan are gentle like the deer and moose or caribou for whom the clan is named. They care for others by making sure the community has proper housing and recreation. The Hoof Clan people are poets and pacifists avoiding all harsh words.
- The people of the Marten Clan are hunters, food gatherers, and warriors of the Ojibwe. Long ago, warriors fought to defend their villages or hunting territories. They became known as master strategists in planning the defense of their people.
- The Bird Clan serve as spiritual leaders and give the nation its vision of well-being and its highest development of the spirit. The people of the Bird Clan are said to possess the characteristics of the eagle, the head of their clan, in that they pursue the highest elevations of the mind just as the eagle pursues the highest elevations of the sky.

To meet all the needs of the nation, the clans work together and cooperate to achieve their goals. The clan system has built in equal justice, voice, and law and order, and it reinforces the teachings and principles of a sacred way of life.

Many Ojibwe believe that any time something is taken from the land, a spirit is being removed from its natural state and environment. This could range from the smallest rock to the biggest animal. Because the being is being displaced, the Ojibwe people will offer tobacco to that spirit as a gift for the energy that the spirit will now share with them. The spirit will accept the gift and use it to communicate with other beings to relay the purpose and need of the spirit to the Ojibwe people. These intimate familial ties to specific places in the natural world create a spiritual relationship to the land for Ojibwe people. One result is a cultural value placed on stewardship, conservation, and sustainability.

The Bad River Band's Tribal Historic Preservation Office (THPO) conducted oral history interviews with 25 individuals in the Chequamegon Bay region in 2023 (Whyte et al., 2023) and found that:

- 92% of interviewees described significant beliefs connected to their relationship with the environment.
- 68% stated that they have a reciprocal relationship (interdependence) to the conservation of the environment in 'the area.'
- 84% stated that they have a stewardship relationship (or sense of care) to the conservation of the environment in 'the area.'
- 80% stated that they have a responsibility to conserve the environment in 'the area.'
- 76% identified beliefs of reciprocity, responsibility, and stewardship in relation to biodiversity protection, the maintenance of ecological health, and conservation.

Similar beliefs are summarized in a Midwest Alliance of Sovereign Tribes resolution shared with the DNR during the public comment period for the Draft EIS (Vele, 2022): "The Rights of Nature exist prior to human beings, and are exhibited in the vast, interconnected web of life existing in the physical and spiritual world. According to our creation stories, we are the most recently arrived beings within this vast creation. We learn and are guided by those elements of Nature that were here before us. It is our duty and responsibility to respect and protect all of Creation and the Elder beings and Elements with whom we share this world."

4.2.1.3 Nibi (Water)

In correspondence with the Army Corps of Engineers and the DNR, the Bad River Band of Lake Superior Chippewa emphasized that "Nibi (water) is a traditional cultural property and resource of utmost importance to both the Ojibwe as well as the general public and scientific community" (Wiggins Jr., 2022a). Past surveys of Bad River tribal members indicated that "their greatest concerns centered on protection of the environment, especially water quality" (Bad River Band of Lake Superior Chippewa, 2001). Among beliefs enumerated in the Bad River Band's Integrated Resources Management Plan (Bad River Band of Lake Superior Chippewa, 2001) is the statement: "We believe water is the life blood and the environment and the quality of the water determines the quality of life." Dooper et. al (2018) also noted "how many members cited the waterways or 'the water' when asked what part of the reservation they would most like to protect." Because of the importance of water to the tribe, the Mashkiiziibii Natural Resources Department initiated an extensive surface water monitoring program in 1997 and the tribe was granted CWA treatment as a state in 2009 (Sections 1.4.2.1 and 4.1.5).

The Sokaogon Chippewa Community also asserted the importance of water in its correspondence with the USACE (LaRonge, 2024), and shared applicable quotes from tribal elders interviewed for a previous cultural resources study:

> *"Water (nibi or bish) is fundamental to sustaining the cultural and spiritual lives of the Ojibwe (Chippewa) people, as well as their physical and economic well-being."*
>
> *"Water is considered the life-blood of the natural system. Flowing water, such as rivers, creeks and streams–all covered by the term sebe in Ojibwemowin–are thought of as the veins, bloodline of the grandmother, by which life-sustaining water is circulated to all living things."*

Water remains a vital element of Ojibwe peoples' ceremonial life, which often involves the consumption of water. The Bad River Band's Tribal Council in a 2019 resolution stated "the Waabishkaa-ziibi (White River), Gaawanndog-ziibiinis (Potato River), Gaa-aangwasagokaag-ziibiinis (Tyler Forks), Denomie Creek and Denomie Tributaries that join the Mashkii-ziibi (Bad River) and Anishinaabeg-Gichiigaming (Lake Superior) are places that are meant for the continuation of our way of life, and the natural waters found in these places continue to give life to plants and animals and natural groundwater and springs, and from these we are blessed with food and medicine, and clean drinking water" (Bad River Band of Lake Superior Chippewa, 2019b). During the Wisconsin Inter-Tribal Repatriation Committee's March 2023 meeting, the Red Cliff Band's THPO emphatically described the cultural significance of water to the tribes, stating a belief that laws related to water were "spiritual laws appropriated by the Creator." The Bad River Band's water quality standards also address the significance of water to the tribe: "Because of the Tribe's cultural, spiritual, economic, and thus political dependence and interdependence with the waters of the Bad River Reservation, the highest protection of these Tribal waters is essential to the protection of the health and safety of Tribal members, and for the survival and growth of the Tribe." These water quality standards specifically consider "cultural water use," activities involving traditional Ojibwe practices which include ceremonies, harvesting, hunting, and fishing, actual or historical. The significance of water was also brought up several times during technical meetings and site visits with DNR and tribal resource agency staff.

Given the location of the current Line 5 and the waterbody crossings associated with Enbridge's proposed relocation and the three route alternatives, tribal leaders have expressed concerns about the anticipated impacts to the area's water resources from construction activities or if an oil spill were to occur. For example, in a resolution adopted unanimously in 2019, the Tribal Council for the Bad River Band of Lake Superior Chippewa Indians stated "surface water studies demonstrate that a crude oil spill at the Waabishkaa-zibii (White River) or Mashkiigon-ziibi (Bad River) would be catastrophic to the health and economy of the Odanah, WI community; river currents would impact coastal wetlands and wild rice beds, and traditional fishing areas in Anishinaabeg-gichigami (Lake Superior)" (Bad River Band of Lake Superior Chippewa, 2019b). The history, probability, and impacts of potential oil spills are discussed in Chapter 6. Anticipated impacts of oils spills to coastal wetlands, wild rice beds, and traditional fishing areas are discussed in Sections 6.4.4.7,6.4.4.8, and 6.4.4.25.

Tribal perspectives often reflect a holistic view of the interconnections between Nibi and other beings, including humans. For example, a recent feature story (Ness, 2023) quoted former Bad River Band Chairman Mike Wiggins, Jr., saying, "That river is alive, and we see it as animate." Drawing an analogy to a time-lapse video showing the steadily shifting shape of the Bad River over 1,000 years, Chairman Wiggins further explained, "You could watch that river traveling just like a snake. As that little snake swims through, that morphology is part of the dance. The morphology is absolutely part of what makes the river bottom realm so unbelievably rich" (Ness, 2023).

4.2.1.4 Gichiigaming (Lake Superior)

Gichiigaming (Great Sea/Lake Superior) is the largest of the Great Lakes, having more surface area than any freshwater lake in the world. Indigenous people have lived along the shores of Gichiigaming since perhaps 5,000 BCE. Traveling from the east, it is estimated that modern Ojibwe people had established a community at Odanah by the late 1500s. As with other elements of the natural environment, Gichiigaming provides a focal point for various aspects of Native American cultural identity and is central to oral traditions. For example, the Anishinaabe tell of a great underwater lynx-like creature, Mishoo Bizhiw, who lives in the depths of Gichiigaming. He provides a metaphor representing the power, mystery, and innate danger that comes from these sacred waters. With razor like spikes on his back, the face of a lynx or panther, and the body of a sea serpent, this being demands respect. Mishoo Bizhiw is one among many water spirits the Ojibwe acknowledge by offering tobacco and prayer before embarking onto the waters.

Today, Ojibwe subsistence fishers use methods developed by their ancestors, employing spears, nets, and small boats to harvest fish from Gichiigaming. Members of the Red Cliff Band of Lake Superior Chippewa and the Bad River Band of the Lake Superior Chippewa also fish commercially in Gichiigaming. Additionally, the Keweenaw Bay Indian Community and the Bay Mills Indian Community in Michigan rely on Lake Superior commercial fisheries. Section 4.2.1.11 briefly discusses tribal fishing traditions.

Many Ojibwe people view Gichiigaming as being connected to the broader landscape, with the Great Lakes often considered the heart of Turtle Island. When describing the confluence of the Bad River with Gichiigaming, former Bad River Band Chairman Mike Wiggins, Jr. explained, "There's a transfer of spirit where the Bad River becomes Lake Superior, Lake Superior becomes Bad River, up to its origin in Caroline Lake and the Penokee Hills. That's the actual scientific truth. And the rest is how we as human beings fragment, compartmentalize, put things in the science catalogs, and then retrain our minds and hearts to think of things differently. But the absolute natural law is that hydrology is very direct and very connected" (Ness, 2023). Tribal resource agency staff further described the interconnections between the Gichiigaming estuary and the Kakagon and Bad River Sloughs, including the effects of periodic seiches, during site visits with DNR staff in November 2023. They also underscored the significance of the Lake Superior shore for various cultural practices.

Several tribal nations raised concerns during government-to-government consultations and in their written comments on the draft EIS regarding anticipated adverse impacts to Gichiigaming and her fisheries resulting from pipeline construction and a potential oil spill. Tribal leaders pointed out how construction activities could harm water quality and result in alteration of fish habitats due to factors such as sedimentation and turbidity (Wiggins Jr., 2022a; Chiriboga, 2022). They noted how the direct effects of fish mortality would impact a staple diet source for their tribal members. Tribal nations have repeatedly stated that they believe any oil spill, no matter how small, would cause immeasurable and irreplaceable damage to Gichii-gaming, an impact that would profoundly affect their cultural heritage, economy, and ancestral connection to the Great Lakes (Wiggins Jr., 2022a; Craven, 2022; GLIFWC, 2022). Sections 5.7.1and 6.4.4.2 include additional background on Lake Superior and the anticipated impacts to the lake from Enbridge's proposed relocation and route alternatives.

4.2.1.5 Kakagon & Bad River Sloughs

The Kakagon and Bad River Sloughs complex is home to one of the largest naturally occurring Manoomin (wild rice) beds in the Great Lakes basin. The complex supports a variety of rare species, includes spawning habitat for Namé (lake sturgeon), and offers stopover habitat for numerous waterfowl and other migratory birds as part of both the Mississippi and Atlantic flyways. A more detailed description of the Kakagon and Bad River Sloughs is included in Section 5.7.3.4. Information on Manoomin is included in Section 5.7.11. The Bad River people have lived on these lands for generations and have "gained an intimate knowledge from the relationship with wild rice, tending, harvesting, processing and eating the grains of the plant, season after season" (NRCS and WTCAC, 2021). The Kakagon and Bad River Sloughs complex is designated a Conservation Area in the Bad River Band's Integrated Resources Management Plan (Bad River Band of Lake Superior Chippewa, 2001). In a letter to the Army Corps of Engineers, the Bad River Band emphasized that "under the Band's continuing stewardship, the wetlands of our homeland and the densely interlaced network of the rivers and streams in the watershed that feed and replenish them, are recognized as among the most sensitive freshwater estuarine ecosystems on Earth, a thriving refuge for innumerable flora and fauna including many threatened and endangered species" (Wiggins Jr., 2021). While celebrating the Kakagon and Bad River Sloughs recognition as a Wetland of International Importance, the tribe's former chairman described the importance of the Sloughs as follows:

> *"The Kakagon and Bad River Sloughs wetland complex represent everything our Tribal People hold dear and sacred on many different levels. Spiritually, the 'place' and everything it has, the clean water, the winged, the seasons, the rice and fish, connects us with our ancestors and the Creator. The Sloughs sustain the physical well-being of our community with foods such as wild rice, fish, cranberries, waterfowl, venison, and medicines. From an Anishinaabe (Chippewa) world-view perspective, the wetlands ecosystem is a tangible representation of our values of caring for the environment. The international Ramsar recognition is an honor for the Bad River Band and maybe even more importantly, the recognition sends a message about the importance and critical need for biologically productive and water rich areas such as the Kakagon and Bad River Sloughs wetland complex. There is water purification, ecological harmony, and people who are interwoven into this 'place' where the Bad River Reservation dovetails with Lake Superior"* (Bad River Band of Lake Superior Chippewa, 2012).

Tribes have expressed concerns that the Kakagon and Bad River Sloughs complex can be impacted by changes in water levels or if sedimentation occurs in waterways and is carried downstream to the sloughs. Tribes also expressed concerns about the impacts an oil spill could have on Manoomin (Corn Sr., 2022; Wiggins Jr., 2022a). Section 5.7 discusses anticipated impacts to the Kakagon and Bad River Sloughs from Enbridge's proposed Line 5 relocation and route alternatives. Section 5.7.11 discusses anticipated impacts to wild rice from the proposed project and route alternatives.

4.2.1.6 Places, Landscapes, & Viewsheds

The land, watershed, and air are not only part of the landscapes they call home, but integral to who many Native Americans are and to their sense of self and community (Cohen, 1988). For many tribes, self-governance centers on the management of tribally important natural resources, as well as places of historic habitation and religious significance. As noted elsewhere, tribal perspectives and oral traditions often reflect holistic views of the interconnections between landscapes and other beings, including humans. For example, in a resolution unanimously adopted in 2019, the Tribal Council for the Bad River Band stated "changes to the natural waters and lands found in these places will break our relationship with the natural world, threatening the life these places give to plants and animals and natural groundwater and springs, the food and medicine we are blessed with, and the clean drinking water we are blessed with" (Bad River Band of Lake Superior Chippewa, 2019b). In a letter to the Army Corps of Engineers, the Bad River Band indicated "access to land embracing our cultural and historic sites and waterways is critical to Ojibwe cultural survival" (Wiggins Jr., 2021). The Band emphasized, "We value Giimaamaa'akiinaan, our Mother the Earth, and as such, landscapes and viewsheds are also significant cultural resources and the degradation of those also inflict lasting negative psychological impacts to tribal members" (Wiggins Jr., 2021).

Tribes have regulatory authority over certain lands and resources within the boundaries of their respective reservations but have limited authority outside reservation boundaries (but see Section 4.1.4 for activities in the Ceded Territories). GLIFWC (2016) describes concerns that tribes have about metallic mining in northern Wisconsin, noting that the Ojibwe people fear that "Tribal members may lose opportunities to use and harvest resources due to the destruction of fish, wildlife, and plant habitats, the disruption of wildlife migration patterns, the closure of public lands, or the contamination of water, air, or soil. In addition, the economic value of resources harvested by tribal members may be lost." Tribal concerns with respect to Enbridge's proposed pipeline relocation are similar to those raised in the context of mining proposals. For the Ojibwe tribes, a major concern is how a project could alter a region's aesthetic. Tribal people are particularly sensitive to the visual and acoustic impacts of construction and operation as their worldview focuses more on space than time. In a letter to the Army Corps of Engineers, the Bad River Band reiterated "their concern that the placement of the proposed pipeline will adversely impact the purpose of a home, quality of life, and cultural and historic feel and integrity of the area and resources" (Wiggins Jr., 2021).

Geographic locations are not interchangeable, so the loss of a cultural resource in one location cannot simply be replaced with a similar resource in another location . Changes to a local landscape can profoundly affect the tribes who have important cultural stories and spiritual practices relating to their landscapes (GLIFWC, 2016; LaRonge, 2024). The tribe's concerns about these kinds of aesthetic impacts center on both the proposed construction and operation of the pipeline. For example, in their letter to the Army Corps of Engineers, the Bad River Band described how setting "explosions that violently assault Giimaamaa'akiinaan, which is a degrading and violent act against her," contribute to psychological, cultural and economic impacts" (Wiggins Jr., 2021).

4.2.1.7 Bad River Reservation

For tribal communities, lands within reservation boundaries provide an especially important environment needed to exercise their inherent subsistence and spiritual practices of hunting, fishing, gathering, and ceremony (GLIFWC, 2016); E. Leoso, pers. comm.). Section 4.1.2.2 briefly describes the Bad River Reservation. Dopper et. al. (2018) report:

> "*Specific locations on the Bad River Reservation form the foundation of many members' connection to the environment. Among the locations our participants identified as important were the Kakagon Sloughs, Waverly Beach, Madigan Beach, Bad River Falls, the shores of Lake Superior, and burial grounds on the reservation. Just as common, however, were general ties to the reservation that were not linked to specific locations.*"

In correspondence with the Army Corps of Engineers and the DNR, the Bad River Band emphasized that "the THPO considers the entire Reservation a historic district" (Wiggins Jr., 2021; Leoso, 2022). The THPO noted that the Bad River Reservation is "a location associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world" and is "where a community has traditionally carried out economic, artistic, or other cultural practices important in maintaining its historical identity," characteristics identified by Parker and King (1990) for determining "traditional cultural significance" and for listing on the National Register of Historic Places. Among beliefs enumerated in the Bad River Band's Integrated Resources Management Plan (Bad River Band of Lake Superior Chippewa, 2001) is the statement: "We believe the Bad River Indian Reservation and the Bad River Band have been so historically joined that, as a People, no other place can be called home." Similar sentiments were shared during government-to-government interactions with DNR leaders and staff. Quoted in a news article, former Bad River Band Chairman Mike Wiggins, Jr. further explained "We're in our forever home, as a result of treaties that we signed. There is nowhere to retreat to in terms of our way of life, our identity" (Ness, 2023). As noted elsewhere, the existing Line 5 pipeline crosses the Bad River Reservation and the river and stream crossings along Enbridge's proposed pipeline relocation route are 1.3 river miles to 8.6 river miles upstream of the Bad River Reservation. The Bad River Band has also raised concerns about cumulative impacts to the Reservation, as "several other industrial projects are already causing harm to Reservation lands" (Wiggins Jr., 2022a).

4.2.1.8 Ceremonial & Other Culturally Significant Sites

Many cultural activities and places of cultural, historic, and religious significance occur outside of the Bad River Band's reservation boundaries. The Bad River Band's THPO conducted oral history interviews with individuals in the region in 2023 (Whyte et al., 2023) and found that:

- 92 percent of interviewees cited the presence of historic properties and places of historic habitation.
- 92 percent of interviewees identified current cultural practices occurring in 'the area.'
- 92 percent of interviewees described 'the area' as important for educational purposes tied to culture.
- 80 percent of interviewees described the importance of 'the area' as a place where cultural knowledge is transferred across generations.
- 72 percent of interviewees cited sacred places or locations on which sacred cultural practices are conducted.
- 24 percent of interviewees cited locations with historic and cultural properties that serve as burials or places of ancestral remains.

Recognizing traditional cultural properties can be challenging. Federal and state databases and registries may be underinclusive of tribal cultural places. These data sources generally do not include sites of ceremonial significance kept confidential for protectionary reasons by tribal leaders. Further, many sites of cultural importance to the Bad River Band have not yet been registered (Leoso, 2022). As the National Register guidelines acknowledge, "Some kinds of traditional cultural properties are regarded by those who value them as the loci of supernatural or other power, or as having other attributes that make people reluctant to talk about them. Such properties are not likely documented" (Parker and King, 1990). Additionally, "a traditional ceremonial location may look like merely a mountaintop, a lake, or a stretch of river" (Parker and King, 1990). Even cemeteries and historic gravesites may remain undocumented. For example, oral history interviews conducted by Whyte et al. (2023) indicate "There are, that I know of, grave sites in different areas. I don't like to really point those out so much because they're sacred sites and they shouldn't be disturbed… I know of burial sites where people-- didn't have like cemeteries a long time ago… when somebody passed away, they would bury them sometimes behind their dwellings or back there or create their own little family cemeteries."

Numerous traditional ceremonial sites are present on and around the Bad River Reservation. Oral history interviews conducted by Whyte et al. (2023) reveal the area "hosts places that are sacred to the Bad River Band and its members–places that are under current use for ceremonies, family and community practices and activities, and education. Places of historic habitation and religious significance exist in 'the area' that are substantially older than 50 years." Certain locations within the reservation boundaries continue to produce sacred items and plants currently used in ceremonial practices. For example, some beaches yield unique stones important for specific cultural ceremonies practiced by members of the Bad River Band. Other locations have been the sites of Midewiwin (an ancient healing society) and Big Drum ceremonies, both of which are still in practice today (Leoso, 2022). The Sokaogon Chippewa Community identified a traditional cultural landscape along the Potato River at a proposed pipeline crossing, noting the presence of a stand of very old/large ('Grandmother') cedar trees and access to balsam fir and other botanical resources (LaRonge, 2024). One tribal member interviewed by Whyte et al. (2023) shared, "Every family has a special place on Bad River where they do their own ceremonial rituals that we've been practicing since the beginning of time."

The Midewiwin, a group of spiritual advisors and healers, are recognized as spiritual leaders for the Anishinabeg and are an essential part of the worldview of the Ojibwe. Midewiwin study and practice healing methods and strive to maintain a respectful relationship between humans, Earth, and the spiritual realm. Many Midewiwin practices center around public ceremonies that are integral to understanding Ojibwe history, inherent lifeways, and practices. The traditional knowledge associated with Midewiwin encompass healing practices, such as those that include herbal knowledge and the customs and traditional practices associated with locating, preparing, and administering plant medicines. These ceremonies often include the use of prairie sage, sweetgrass, and cedar, community meals (feasts), songs, history, tobacco offerings, and various sacred items (e.g., drums, rattles, eagle whistles and fans, medicines, and Megis [cowry] shells). Tribal members have expressed concerns that alterations to the landscape due to Enbridge's proposed project could affect their ability to gather medicinal plants essential for these spiritual and ceremonial practices.

The drum is a powerful symbol of Ojibwe traditions and beliefs, has been used for centuries to tell stories and connect with the spirit world, and is considered a living entity that possesses its own spirit and energy (Panek, 2023). The drum is also considered to be the heartbeat of Mother Earth and is treated with the utmost respect and reverence. The sound of the drum is believed to carry prayers and wishes of the people to the spirit world. In addition to its role in spiritual practices, the drum is also an important part of Ojibwe cultural identity, representing resilience, resistance, and the endurance and strength of past, present, and future generations (Panek, 2023). One tribal member interviewed by Whyte et al. (2023) shared, "Now we do our big drum ceremonies near the Bad River and the White River." Tribal members have expressed concerns that pipeline construction and operation activities (e.g., blasting, aerial surveillance) have the potential to disrupt these types of ceremonial activities.

One important gathering spot for Ojibwe people is the Pow Wow Grounds located at Old Odanah on the Bad River Reservation (Figure 4.2-2). This area regularly hosts pow wows and other tribal events and the surrounding land provides opportunities for camping. During site visits in November 2023, Mashkiiziibii

Natural Resources Department staff showed the grounds to DNR staff and explained how the Bad River periodically rises over its banks and floods the area. Tribal members have expressed concerns that sediment or oil from the proposed project could potentially wash into this community site, impeding their use and impacting important tribal gatherings.

Figure 4.2-2 The Pow Wow grounds on the Bad River Reservation.
Photo: Dreux J. Watermolen, DNR

4.2.1.9 Hunting, Fishing, & Gathering

Ojibwe spiritual beliefs mandate the use of certain plants, animals, and fish in ceremonial practices (GLIFWC, 2016). Food secured by fishing, hunting, and trapping also constitutes a considerable part of Ojibwe diets. Traditional Ojibwe culture embraces a seasonal round of activities, traditions, and technologies to cope with the climate and environment of the region (Van Der Puy, 1995; Peacock and Wisuri, 2002; Spangler, 2011). Seasons help shape subsistence practices and diets: spring (fish, maple), summer (lots of fishing, a bit of hunting, planting gardens, harvesting berries, nuts, and tree bark), late summer (wild rice, medicinal plants), fall and winter (deer hunting, beaver trapping).

Northern forests and coastal wetlands provide an abundance of wild foods including wild rice, cranberries, blueberries, gooseberries, juneberries, black and red raspberries, grapes, cherries, and chokecherries. Nuts, including acorns from the pin oak and the white oak, hickory nuts, hazelnuts, beechnuts, and butternuts, are also important. Tribal members gather a variety of vegetables including wild potatoes, wild onions, milkweed, and the root of the yellow water lily. A great variety of medicines are derived from plants (Section 4.2.1.13). Historically, hunting practices have included hunting (with bow or gun), trapping, and snaring for sources of food, clothing (tanned hides), and tools (bones and antlers). Today, white-tailed deer, elk, and wild turkey are harvested, as are waterfowl and small game species. Deer meat is considered a sacred, traditional food and is included in ceremonies. For example, the first kill ceremony, conducted when a young hunter kills their first deer or large game, represents a young person becoming an adult hunter and provider for their family and community (Dooper et al., 2018). Smaller animals like otter, beaver, mink, muskrat, raccoon, bobcat, and rabbit are valued for their furs. Every person who Whyte et al. (2023) interviewed stated that the Chequamegon Bay area "is heavily used for contemporary subsistence activities and identified subsistence at least 237 times over the course of their interviews… Some of the most commonly identified species include black ash, cedar, maple, birch, wild rice, basswood, deer, bear, trout, beaver, wolves, and elk. These species have cultural and religious significance to the Band's members and are described as integral to ceremonies, medicines, and traditional and family practices and activities."

4.2.1.10 Manoomin (Wild Rice)

Manoomin (wild rice) plays a central role in the Ojibwe migration story (Section 4.2.1.1). In fact, the distribution of Ojibwe communities corresponds closely to the distribution of Manoomin (GLIFWC, 2016). For the Ojibwe people, Manoomin is referred to as animate and as "him/her." In Ojibwemowin, the name Manoomin is most often translated as "the good fruit" or "the good berry," but some have translated it to mean "Spirit delicacy." Ojibwe people consider Manoomin a gift from the Creator and a spiritual presence required in ceremonies. Manoomin remains an important part of Native Americans' diet, health, and food security (Fletcher et al., 2018). The conservation, harvesting, processing, and consumption of Manoomin "involve cultural, family, and community practices and activities" (Whyte et al., 2023).

Manoomin is harvested not only for its benefits, but also because not harvesting Manoomin would show a lack of appreciation for this gift. The GLIFWC Climate Change Team (2023) noted that nearly every tribal member they interviewed mentioned Manoomin, and they all spoke of their relationship with, and their love and concern for, this plant relative (Croll, 2023). Today wild rice is a topic of everyday conversation and years and events are marked by the Manoomin harvest (Vennum, 1984). Manoomin is so deeply embedded in tribal culture and spirituality that many tribal members fear a loss of identity as their ability to maintain their relationship with Manoomin is threatened by various stressors. For example, when responding to a proposed mine, Frances Van Zile, a member of the Sokagon (Mole Lake) Chippewa, explained the sense of loss that would accompany the destruction of Manoomin, "There is no substitute for wild rice. My whole way of being as an Indian would be destroyed. I can't imagine being without it. And there is no substitute for the lake's rice" (GLIFWC, 2016).

GLIFWC's Climate Change Team (2023) report the following from interviews with tribal elders:

> "*Concern was expressed by many tribal members regarding the decrease and overall health of Manoomin in many areas throughout the Ceded Territories. For example, in Waaswaaganing (Lac du Flambeau), Manoomin was once plentiful, but after the installation of a dam, it is now mostly just present on the rivers. Some feel it is being destroyed in areas such as Clam Lake (Burnett County), but efforts on the lake are underway to remove carp and restore Manoomin.*"

> "*Many stories were shared about poor harvest years or other harvesting issues. Several Mashkiiziibiing (Bad River) members related that they experienced multiple issues with their harvest from 2014 to 2016. Among other concerns, the air was too humid during the period the Manoomin was laid out to dry, which caused Manoomin to mold and resulted in a partial loss of their harvest. A Gaa-miskwaabikaang (Red Cliff) tribal member expressed concern over being forced to travel at least 200 miles from the reservation during the 2016 harvest season after severe storms earlier in the year heavily impacted Manoomin beds closer to the reservation.*"

Manoomin has fairly specific habitat requirements. Plants typically grow in soft, mucky sediments within gently flowing water in rivers, streams, lakes, and ponds, generally at depths between 10 inches and 3 feet (DNR, 2021a). Figure 4.2-3 shows the wild rice waters in Ashland, Bayfield, and Iron counties. The Kakagon Sloughs contain most of the Manoomin beds where the Bad River Band harvests. The Band River people have lived on these lands for generations and have "gained an intimate knowledge from the relationship with wild rice, tending, harvesting, processing and eating the grains of the plant, season after season" (NRCS & WTCAC, 2021). GLIFWC maintains an interactive map of all date-regulated and some non-date-regulated wild rice waters in the Ceded Territories (See: https://data.glifwc.org/manoomin.harvest.info/).

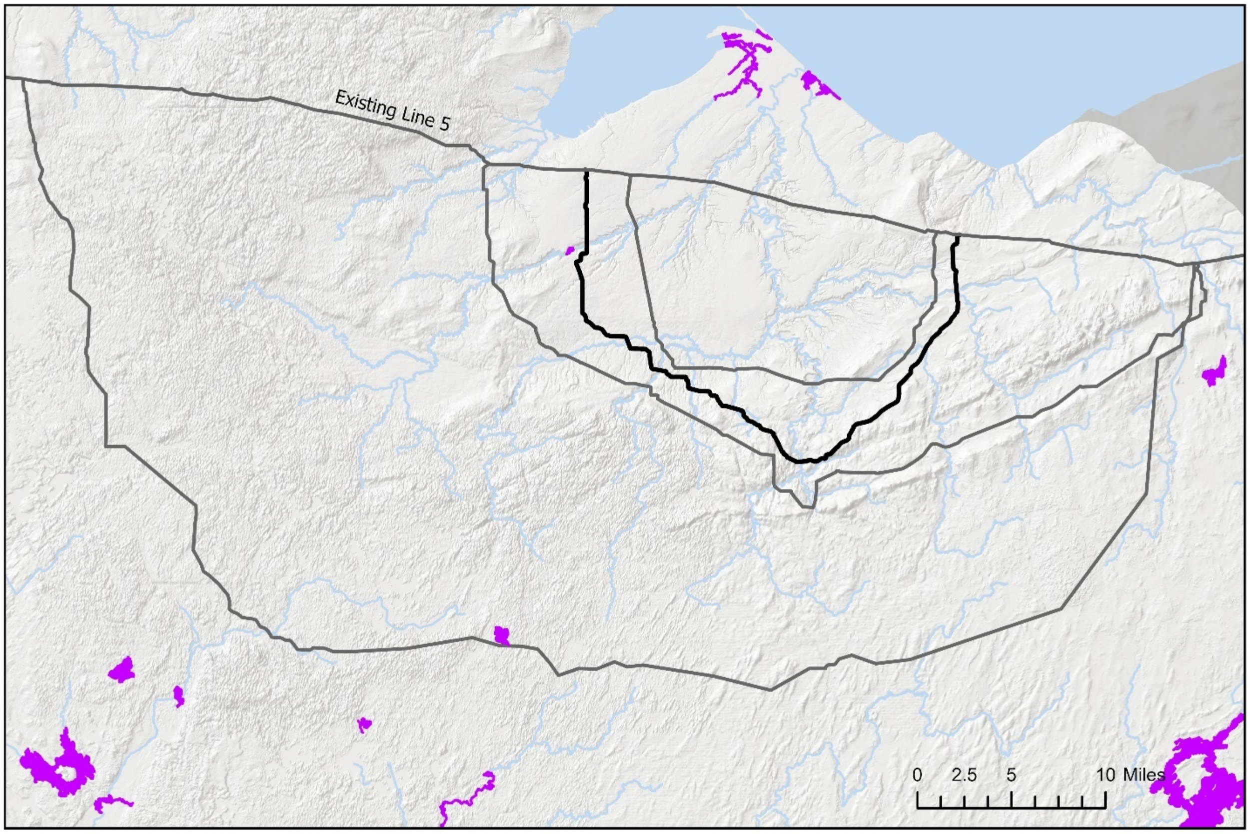

Figure 4.2-3 Wild rice waters around Enbridge's proposed Line 5 relocation route and route alternatives.
Source: DNR and GLIFWC

Tribes have expressed concerns that Manoomin can be impacted by changes in water levels or if sedimentation occurs in waterways and is carried downstream to wild rice areas. Past projects such as damming rivers leading to water level changes, have historically led to a decline in wild rice populations. Most of the elders who GLIFWC spoke with felt that Manoomin is vulnerable to climate change due to changes in water level, stronger and more frequent storm events, pollution, and many other factors (Croll, 2023). Tribes also expressed concerns about the impacts an oil spill could have on Manoomin (Corn Sr., 2022; Wiggins Jr., 2022a). Section 5.7.11 discusses anticipated impacts to wild rice from Enbridge's proposed relocation route and route alternatives.

4.2.1.11 Fishing, Swimmers, Ogaa (Walleye), & Namé (Lake Sturgeon)

The Fish Clan represents one of the main clans in the Ojibwe clan system, with members of the Fish Clan being the presumed descendants of the first beings to rise from the water. Swimmers, a part of the third order of Creation, are those beings in the animal world who swim under the surface of the water.

In addition to the prominent role of swimmers in the Ojibwe worldview, fishing, both Great Lakes and inland, provides nutritionally important sources of low fat, high protein food for many Ojibwe people and is a year-round occupation for many tribal members. The fishery resources of the Bad River Reservation are some of the "most highly valued resources to tribal members for cultural, social, subsistence, and recreational purposes" (Bad River Band of Lake Superior Chippewa, 2001). The significance of the fishery is not limited to the area within the reservation boundaries but extends to all waters of Lake Superior (Bad River Band of Lake Superior Chippewa, 2001). Other tribes who fish Lake Superior include the Red Cliff Band of Lake Superior Chippewa in Wisconsin and the Keweenaw Bay Indian and Bay Mills Indian communities in Michigan.

The main stem of the Bad River, downstream of the confluence with the Marengo River, supports a diverse fish community, with Namé (lake sturgeon) and Ogaa (walleye) being the most well-known beings inhabiting this portion of the river (Bad River Band of Lake Superior Chippewa, 2001). The upper Bad River, upstream of the confluence with the Marengo River, along with the rivers' major tributaries, contain resident brook and brown trout, and provide spawning and nursery areas for numerous other beings (Bad River Band of Lake Superior Chippewa, 2001). Additionally, the Bad River Falls is a traditional site for fishing Ogaa, Namé, and Maashkinoozhe (muskellunge) (Wiggins Jr., 2022a; Leoso, 2022). Mattes and Nelson (2001) found evidence of adult and larval Namé successfully using the upper reaches of the White River, a tributary stream to the Bad River. Interviews with anglers indicated Namé were spawning in the area.

Prior to European contact, Ojibwe tribal fishermen used large birchbark canoes and gill nets constructed from twisted and knotted strands of willow bark to harvest fish from Lake Superior. They also speared through the ice and fished with hand carved decoys (GLIFWC, n.d.). As Europeans entered the Great Lakes region, the Ojibwe used fish to trade with French and English outposts. Fish became one of the mainstays in the diets of the early fur traders (Apostle Island Fish Company, n.d.; Hannibal-Paci, 1998; Holzkamm and Waisberg, 2004).

Fish tend to be consumed in cycles, with peak consumption occurring in spring (GLIFWC, 2016). A wide variety of fishing methods are used on inland lakes and rivers including hook-and-line angling, trolling, netting, and spearing, with subsistence fishers often using methods developed by their ancestors (Holzkamm and Waisberg, 2004). In Lake Superior, fishing is conducted primarily with gill nets from both the large tugs and small boats. Some fishermen also harvest fish with trap nets. During winter months, snowmobiles, instead of boats, transport fishermen out to the stakes which mark their nets, and the catch is pulled through holes chopped in the ice.

Today Lake Superior's commercial fishery is strictly regulated and scientifically managed by tribal, state, federal, and Canadian governments. The combined commercial fish harvest of 11 Ojibwe nations that are members of GLIFWC annually exceeds 2 million pounds (GLIFWC, n.d.). Adikameg (lake whitefish), Namegos (lake trout), siscowet (or fat trout), Kewis (lake herring), and salmon make up over 95% of the tribal commercial harvest. Adikameg is the predominant species sought by tribal fishermen (GLIFWC, n.d.). Tribes have raised concerns about the anticipated impacts an oil spill or alterations of water quality could have on the Lake Superior fishery (Boyd, 2022a; Chiriboga, 2022; Craven, 2022).

A symbol of abundance and good fortune, Ogaa (walleye) remains a popular food source and is reflected in Native American symbolism. White patches around the fish's eyes make it look like it is always watching, a positive trait viewed by some cultures as representing vigilance and protection. The fish's sleek body and sharp teeth may be seen as symbols of power, and its ability to adapt to different environments as a sign of strength. On average, more than 600,000 walleyes are caught-and-released every year on inland lakes across the Ceded Territories in Wisconsin (Van Sickle, 2023). Red Cliff raises walleye in its hatchery to restock inland lakes. Tribes have raised concerns about the anticipated impacts that construction activities, an oil spill, or alterations of water quality could have on Ogaa (Corn Sr., 2022; Wiggins Jr., 2022a).

The harvest and sharing of Namé (lake sturgeon) remain important to the culture of the Anishinaabe people. Archaeologists have found evidence of sturgeon fishing extending 2,500 years into the past (Holzkamm and Waisberg, 2004). Namé is considered a spiritual keeper of the fisheries and has been identified as a culturally sensitive species by the Fond du Lac, Red Cliff, and Bad River Bands of Lake Superior Chippewa, and the Keweenaw Bay and Bay Mills Indian Communities. A few Ojibwe people continue to use the skeleton of Namé to tell traditional stories and share traditional teachings; when these stories are told, each piece of cartilage represents a different part of the story, and the teachings therefore can take many nights to tell (GLIFWC Climate Change Team, 2023). Namé otoliths (ear bones) have been used for ceremonial purposes. Tribes have raised concerns about the anticipated impacts that construction activities, an oil spill, or alterations of water quality could have on Namé (Boyd, 2022a; Corn Sr., 2022; Wiggins Jr., 2022a).

The GLIFWC Climate Change Team's (2023) assessment provides traditional ecological knowledge related to several additional swimmers, including beings present in the project area. Section 5.7.8 discusses potential impacts to fish from Enbridge's proposed relocation and route alternatives.

4.2.1.12 Ziinzibaakwadwaaboo (Maple Sap)

Sugar bushes located throughout the Ceded Territories, particularly along stretches of the Bear Trap Creek, represent a distinctive, regionally and culturally important feature in the Ojibwe landscape. The sugar maple, known as Ininaatig in Anishinaabemowin, is currently tapped to produce maple syrup and sugar on the Bad River Reservation and surrounding areas (Danielsen, 1999; 2001). Red maples can also be tapped. According to the Bad River Band's website, "The rivers are rimmed with maple trees which originally provided much maple sugar for tribal harvesters." A feature story in The Ojibwe News described how a Bad River tribal elder "remembers that in the old days nearly every reservation family claimed their own sugar bush, where they camped-out during the sugar bushing season" (Shortridge, 1997). The article goes on to quote the elder:

> *"When the sap was running, you'd work from dawn to dusk. You'd have to haul the sap, boil it down, cut wood to keep the fires going. One family could tap a hundred or more trees, depending on the size of their work force. The fun part I remember most is when we'd go around visiting all the other camps to gossip and see how much syrup they were getting. We'd make cakes and bread out of the syrup*" (Shortridge, 1997).

Today, according to the Bad River website, “there are only about a half dozen to a dozen families who still harvest the maple sugar, usually in the form of maple syrup for home use, sale, or trade.” DNR staff visited several water crossings on the Bad River Reservation in November 2023. During these site visits Mashkiiziibii Natural Resources Department staff pointed out several sugar bushes along the Bad River and Bear Trap Creek, noting that several families tap a relatively large number of trees (as many as 75-300 being tapped per stand) in the areas. As noted in a letter to the Army Corps of Engineers, sugar bush sites were once a more common element of the northern landscape, but many have been lost, removed, or impacted by development or logging, or were simply not preserved (Wiggins Jr., 2021).

The Ojibwe refer to March as the sugar making moon (ziinibaakwadoke giizis) and April as the maple sap boiling moon (onaabani giizis). The start of the maple syrup season is signaled by sunny days with snow melt and freezing nights, when the maple sap will move up the tree in the morning and back down to the roots in the evening (Danielsen, 1999).

Danielsen (1999) describes the tapping process of one tribal member as follows: [Tribal member] learned from his father and grandfather the process of gathering and boiling maple sap. After conducting a pipe ceremony and tobacco offering to honor the maple trees, [tribal member] inserts tubes known as spiles (negwaakwaan) into the trees. His father used spiles made of sumac (Rhus typhina) before converting to copper, the sacred red metal of the Anishinaabek. Traditionally, tribal members used birch bark buckets (biskitenaaganan) to collect the sap below the spile. [Tribal member] uses commercially produced spiles and metal buckets, but some of the equipment he uses today is over 100 years old. In keeping with the family tradition, his brother and son will sometimes help. He will tap 50 trees by himself or 150 if he has help. After the gallon buckets are filled in one to several days, [he] uses his toboggan to collect the buckets. He pours the sap into a plastic lined holding tank, until 300 gallons are reached, at which time he siphons off the sap into a large pan on a large hearth for boiling during the night. During boiling, a fresh spruce branch (Picea spp.) was traditionally used to stir the sap to dissipate foam (Smith, 1932). A paddle with a screen is used to skim off mineral deposits that float to the top of the boiling sap. After he completes the first boiling, he siphons the reduced and thickened sap into a smaller pan on the smaller hearth for a two hour “finishing” boil. The 300 gallons of sugar maple sap yields seven to eight gallons of syrup after 14 hours of boiling (Danielsen, 1999).

Traditionally, tribal members often continued the boiling process turning the maple syrup into sugar. As the syrup thickened, a small amount of deer tallow was incorporated to keep the sugar soft (Danielsen, 1999). Occasionally the sap was allowed to become sour to produce a maple vinegar (ciwabo) that was used to cook venison into a sweet-sour meat (Smith, 1932).

Tribes have expressed concern about the permanent loss of sugar maple trees in Enbridge’s proposed pipeline corridor ROW (Wiggins Jr., 2022a), as well as the impacts an oil spill could have on activities at sugar bushes along the Bad River and Bear Trap Creek. Although tribal members may have a substitute in store-bought sugar, Dooper et al. (2018) note the importance of the maple sugaring tradition to tribal culture, “the process of making sugar from scratch and sharing the experience with his children is as important as the ultimate product.” Section 5.9.2 discusses anticipated impacts to forest stands from Enbridge’s proposed relocation and route alternatives.

4.2.1.13 Plants Used in Traditional Cultural Practices

The hunting, fishing, and gathering activities associated with subsistence lifestyles have led to a deep understanding concerning the properties and uses of trees and other plants (beings) in the second order of Creation in the Ojibwe worldview. The Ojibwe gather and use hundreds of plant species for a variety of purposes, including food, spices, medicine, and ceremonial purposes, and for materials for making baskets, canoes, and other items (Densmore, 1928; Smith, 1932; Meeker, Elias, and Heim, 1993; Boyd, 2022a); E. Leoso, pers. comm.). Many Ojibwe cultural practices are based on the use of leaves, bark, etc., without harvesting the entire plant (Leoso, 2022). This use of wild plants was and continues to be inextricably tied to the cultural practices and spiritual wellbeing of the people (Wrobel, 2020).

Figure 4.2-4 Ojibwe people gather and use plants like the Braun's holly fern for a variety of purposes.
Photo: Dreux J. Watermolen, DNR

During conversations with tribal representatives from the Bad River Band, Red Cliff Band, and GLIFWC, crops, such as wild rice, cranberries, cattails, cedar, willow, marsh marigold, mushrooms, and other species of flora found within northern forests and coastal wetlands were highlighted as traditional foods or medicinal resources historically and currently used by tribal members. One tribal member interviewed by Whyte et al. (2023) shared, "Well, the ash is used for basket making. Nowadays, they use the birch for crafts also. Cedar trees are used for sacred ceremonies, and that type of thing, and medicine." Birch and ash provide the raw materials for baskets, cradleboards, toboggans, snowshoes, lacrosse sticks, burial urns, bowls, and other craft items (Dooper et al., 2018; Boyd, 2022a). Cedar plays a central role in the wild rice harvest because it is lightweight and especially useful as a ricing stick (Dooper et al., 2018). At one site along Enbridge's proposed pipeline ROW, the Sokaogon Chippewa Community identified "an unusually large number of small ironwood trees and moose wood, both used in traditional construction" (LaRonge, 2024). The Sokaogon Chippewa also identified an area along the Marengo River with large patches of wild ginger (LaRonge, 2024).

In their correspondence with regulatory agencies, tribal leaders and tribal staff identified numerous beings used in traditional Ojibwe cultural practices (Boyd, 2022a; Wiggins Jr., 2021; 2022a; Strand, 2023), and tribal members spoke about traditional uses in oral history interviews (Dooper et al., 2018; Whyte et al., 2023). One tribal member described the Ojibwe relationship with these relatives as follows:

> *"I don't know a plant, tree, bush, or grass that was placed here for no particular purpose in Creation. Whether we use a particular natural resource or not, it is in some way interwoven as being necessary in Creation. It is up to us to figure that out and how we might benefit from the resource, either directly, or indirectly. For example, rice worms become active when the wild rice grows. They like wild rice too, but they like to eat the rice. When the red-winged blackbirds come from South America every year, they like to eat the rice worms. Their diet helps our diet, indirectly. So, wild rice isn't just for us. It helps other parts of Creation, as well"* (E. Leoso, pers. comm.).

The DNR compiled a list of plants used in traditional Ojibwe cultural practices based on various sources including discussions with tribal technical staff and review of tribal comment letters (Table 4.2-1). These sources generally do not delineate clearly which plant uses are currently part of the regular lives of Ojibwe communities. We can assume the beings listed in Table 4.2-1, however, are currently important given their inclusion in the sources cited. Nonetheless, while extensive, the list in Table 4.2-1 is certainly incomplete. In addition, the lack of tribally informed ethnobotanical surveys in the region makes it difficult to identify specific areas where plant beings occur that may be of special concern to tribes (LaRonge, 2024); E. Leoso, pers. comm..

Tribes have expressed concern that the abundance of culturally important beings for the seventh generation, particularly those beings who are dependent upon forested habitat (both wetland and upland), would be impacted anywhere Enbridge's proposed relocation or route alternatives convert forested lands to open lands (Wiggins Jr., 2022a). Tribes have also expressed concerns regarding future access to gathering sites on public lands due to trespass legislation (Meierotto, 2021; Johnson Jr., 2022; Wiggins Jr., 2021). Section 5.9.2 discusses anticipated impacts to forests and other natural communities from Enbridge's proposed Line 5 relocation route and the route alternatives. Section 1.4.3.3 addresses Wisconsin's trespass laws and access to treaty resources.

Table 4.2-1 Plants used in traditional Ojibwe cultural practices in the Upper Great Lakes region and Ceded Territories.

Scientific name	Common name	Source(s)
Abies balsamea	Balsam fir	GLIFWC Climate Change Team, 2023; Herron, 2002; Wiggins, 2022a; Wiggins, 2022b; Wiggins, 2021; Falck et al., 2014; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Acer negundo	Box elder	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Acer pensylvanicum	Moosewood	Lac Courte Oreilles v. Wisconsin court case
Acer rubrum	Red maple	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Acer saccharinum	Silver maple	Meeker et al., 1993
Acer saccharum	Sugar maple	GLIFWC Climate Change Team, 2023; Herron, 2002; Wiggins, 2021; Falck et al., 2014; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Acer spicatum	Mountain maple	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Achillea millefolium	Yarrow	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Achillea tomentosa	Wooly yarrow	Lac Courte Oreilles v. Wisconsin court case
Acorus calamus	Sweet flag	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Actaea alba	White baneberry	Wiggins, 2021; Meeker et al., 1993
Actaea rubra	Red baneberry	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Adlumia fungosa		Strand, 2023
Agrimonia gryposepala	Agrimony	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Allium stellatum	Wild onion	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Allium tricoccum	Wild leek	GLIFWC Climate Change Team, 2023; Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Alnus incana	Speckled alder	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Amelanchier arborea	Smooth juneberry	Falck et al., 2014; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case
Amelanchier laevis	Smooth serviceberry	Falck et al., 2014; Meeker et al., 1993
Amerorchis rotundifolia		Strand, 2023
Amphicarpaea	Hog peanut	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Anaphalis margaritacea	Pearly everlasting	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Andromeda polifolia	Bog rosemary	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Andropogon gerardii	Big bluestem	Meeker et al., 1993
Anemone canadensis	Canada anemone	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Anemone virginiana	Tall anemone	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Antennaria neglecta	Lesser pussytoes	Meeker et al., 1993
Antennaria plantaginifolia	Pussytoes	Meeker et al., 1993

Scientific name	Common name	Source(s)
Anthoxanthum hirtum	Sweet grass	GLIFWC Climate Change Team, 2023; Lac Courte Oreilles v. Wisconsin court case
Apocynum androsaemifolium	Spreading dogbane	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Aquilegia canadensis	Columbine	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Arabis missouriensis		Strand, 2023
Aralia nudicaulis	Wild sarsaparilla	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Aralia racemosa	Spikenard	Wiggins, 2021; Meeker et al., 1993
Arctium minus	Common burdock	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Arctostaphylos uva-ursi	Bearberry	Meeker et al., 1993
Arethusa bulbosa		Strand, 2023
Arisaema triphyllum	Jack-in-the-pulpit	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Armoracia lacustris	Marsh cress	Meeker et al., 1993; Strand, 2023
Artemisia absinthium	European wormwood	Meeker et al., 1993
Artemisia campestris	Field sagewort	Meeker et al., 1993
Artemisia ludoviciana	Wild sage	GLIFWC Climate Change Team, 2023; Herron, 2002; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Asarum canadense	Wild ginger	GLIFWC Climate Change Team, 2023; Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Asclepias incarnata	Swamp milkweed	Meeker et al., 1993
Asclepias ovalifolia		Strand, 2023
Asclepias syriaca	Common milkweed	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Aster macrophyllus	Large-leaved aster	Meeker et al., 1993
Aster novae-angliae	New england aster	Meeker et al., 1993
Aster puniceus	Purple-stemmed aster	Meeker et al., 1993
Astragalus alpinus		Strand, 2023
Athyrium filix-femina	Lady fern	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Bartonia virginica		Strand, 2023
Betula alleghaniensis	Yellow birch	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Betula papyrifera	Paper birch	GLIFWC Climate Change Team, 2023; Herron, 2002; Wiggins, 2022a; Wiggins, 2022b; Wiggins, 2021; Falck et al., 2014; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Betula pumila	Bog birch	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Botrychium lunaria	Moonwort	Wiggins, 2021; Meeker et al., 1993
Botrychium virginianum	Rattlesnake fern	Meeker et al., 1993

Scientific name	Common name	Source(s)
Brassica rapa	Field mustard	Meeker et al., 1993
Calla palustris	Wild calla	Meeker et al., 1993
Callitriche hermaphroditica		Strand, 2023
Callitriche heterophylla	Large water-starwart	Strand, 2023; Fergus et al., 2022
Caltha palustris	Marsh marigold	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Calvatia gigantea	Giant puffball	Lac Courte Oreilles v. Wisconsin court case
Calylophus serrulatus		Strand, 2023
Calypso bulbosa		Strand, 2023
Campanula	Harebell	Lac Courte Oreilles v. Wisconsin court case
Campanula aparinoides	Marsh bellflower	Lac Courte Oreilles v. Wisconsin court case
Capsella bursa-pastoris	Shepard's purse	Meeker et al., 1993
Cardamine maxima	Large toothwort	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993; Strand, 2023
Cardamine, V. concatenata	Cut-leaved toothwort	Wiggins, 2021; Meeker et al., 1993
Carpinus caroliniana	Muscle wood	Herron, 2002; Wiggins, 2022a; Wiggins, 2022b; Wiggins, 2021; Meeker et al., 1993
Carya ovata	Shell bark hickory	Lac Courte Oreilles v. Wisconsin court case
Caulophyllum thalictroides	Blue cohosh	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Celastrus scandens	Bittersweet	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Chamaedaphne calyculata	Leatherleaf	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Chamerion angustifolium	Great willow-herb	Lac Courte Oreilles v. Wisconsin court case
Chimaphila	Prince's pine	Lac Courte Oreilles v. Wisconsin court case
Chimaphila umbellata	Pipsissewa	Meeker et al., 1993
Cicuta	Musquash root	Lac Courte Oreilles v. Wisconsin court case
Cicuta maculata	Common water-hemlock	Meeker et al., 1993
Cirsium arvense	Canada thistle	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Cirsium vulgare	Common thistle	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Cladina arbuscula	Reindeer moss	Lac Courte Oreilles v. Wisconsin court case
Cladonia incrassata	Powder-foot British Soldiers	Fergus et al., 2022
Claytonia virginica	Spring-beauty	Meeker et al., 1993
Clematis occidentalis		Strand, 2023

Scientific name	Common name	Source(s)
Clintonia borealis	Blue bead lily	Wiggins, 2022a; Wiggins, 2022b; Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Comptonia peregrina	Sweet fern	Herron, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Conyza canadensis	Horseweed	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Coptis trifolia	Gold thread	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Cornus alternifolia	Alternate-leaved dogwood	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Cornus canadensis	Bunch berry	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case
Cornus foemina, v. racemosa	Panicled dogwood	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Cornus rugosa	Round-leaved dogwood	Meeker et al., 1993
Cornus sericea, V. alba	Red-osier dogwood	GLIFWC Climate Change Team, 2023; Meeker et al., 1993
Corydalis aurea	Golden corydalis	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Corylus	Hazelnut	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case
Corylus americana	American hazelnut	Meeker et al., 1993
Corylus cornuta	Beaked hazelnut	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Crataegus	Hawthorn	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case
Crataegus coccinea	Red haw apple	Lac Courte Oreilles v. Wisconsin court case
Cynoglossum officinale, V. virginianum	Hound's tongue	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Cypripedium arietinum		Strand, 2023
Cypripedium calceolus	Yellow ladyslipper	Meeker et al., 1993
Cypripedium parviflorum	Yellow ladies' slipper	Lac Courte Oreilles v. Wisconsin court case
Cypripedium parviflorum v. makasin		Strand, 2023
Cypripedium reginae	Showy ladyslipper	Meeker et al., 1993
Descurainia sophia	Tansy mustard	Lac Courte Oreilles v. Wisconsin court case
Diervilla	Brush honeysuckle	Lac Courte Oreilles v. Wisconsin court case
Diervilla lonicera	Bush honeysuckle	Meeker et al., 1993
Dirca palustris	Eastern leatherwood	Wiggins, 2022a; Wiggins, 2022b; Wiggins, 2021; Meeker et al., 1993
Drosera anglica		Strand, 2023
Drosera linearis		Strand, 2023
Drosera rotundifolia	Round-leaved sundew	Meeker et al., 1993

Scientific name	Common name	Source(s)
Dryopteris cristata	Shield fern	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Echinocystis lobata	Balsam-apple	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Eleocharis robbinsii	Robbin's spike rush	Fergus et al., 2022
Eleusine	Goose grass	Lac Courte Oreilles v. Wisconsin court case
Epigaea repens	Trailing arbutus	White and Danielsen, 2002; Meeker et al., 1993
Epilobium angustifolium	Fireweed	Meeker et al., 1993
Epilobium palustre		Strand, 2023
Epilobium strictum		Strand, 2023
Equisetum arvense	Scouring rush, Field horsetail	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Equisetum hyemale	Scouring rush, horsetail	Meeker et al., 1993
Equisetum palustre	Marsh horsetail	Meeker et al., 1993
Equisetum pratense	Meadow horsetail	Meeker et al., 1993
Equisetum sylvaticum	Woodland horsetail	Wiggins, 2022a; Wiggins, 2022b; Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Erigeron philadelphicus	Philadelphia fleabane	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Erigeron strigosus	Daisy fleabane	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Eriophorum angustifolium, V. vaginatum	Cotton grass	Meeker et al., 1993
Erysimum cheiranthoides	Wormseed mustard	Meeker et al., 1993
Erythronium americanum	Trout lily	Wiggins, 2021; Meeker et al., 1993
Eupatorium	Joe-pye weed	Lac Courte Oreilles v. Wisconsin court case
Eupatorium maculatum	Spotted joe-pye weed	Meeker et al., 1993
Eupatorium perfoliatum	Boneset	Meeker et al., 1993
Euphorbia corollata	Flowering spurge	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Eurybia macrophylla	Large-leaved aster	Lac Courte Oreilles v. Wisconsin court case
Euthamia graminifolia	Fragrant goldenrod	Lac Courte Oreilles v. Wisconsin court case, Meeker et al., 1993
Fagus grandifolia	Beech	Lac Courte Oreilles v. Wisconsin court case
Fragaria virginiana, F. vesca	Strawberry	GLIFWC Climate Change Team, 2023; Herron, 2002; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Fraxinus americana	White ash	GLIFWC Climate Change Team, 2023; Herron, 2002; White and Danielsen, 2002; Wiggins, 2021; Meeker et al., 1993

Scientific name	Common name	Source(s)
Fraxinus nigra	Black ash	GLIFWC Climate Change Team, 2023; Herron, 2002; Wiggins, 2022a; Wiggins, 2022b; Falck et al., 2014; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Fraxinus pennsylvanica	Green ash, red ash	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Galium aparine	Small cleaver	Lac Courte Oreilles v. Wisconsin court case
Galium brevipes		Strand, 2023
Galium tinctorium	Small cleavers	Meeker et al., 1993
Galium trifidum	Small bedstraw	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Gaultheria hispidula	Creeping snowberry	Meeker et al., 1993
Gaultheria procumbens	Wintergreen	Herron, 2002; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Gaylussacia baccata	Huckleberry	Meeker et al., 1993
Geranium maculatum	Wild geranium	Lac Courte Oreilles v. Wisconsin court case
Geum aleppicum	Yellow avens	Meeker et al., 1993
Geum canadense	White avens	Meeker et al., 1993
Geum macrophyllum	Big-leaved Avens	Wiggins, 2022a; Wiggins, 2022b; Lac Courte Oreilles v. Wisconsin court case
Geum triflorum	Prairie smoke	Meeker et al., 1993
Glyceria canadensis	Rattlesnake grass	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Glycyrrhiza lepidota		Strand, 2023
Gnaphalium sylvaticum		Strand, 2023
Goodyera oblongifolia		Strand, 2023
Habenaria viridis	Rein orchis	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Hamamelis Virginiana	Witch hazel	Meeker et al., 1993
Helianthus occidentalis	Sunflower	Meeker et al., 1993
Helianthus tuberosus	Jerusalem artichoke	Meeker et al., 1993
Heliopsis helianthoides	Ox-eye daisy	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Hepatica Americana	Round-lobed hepatica	Meeker et al., 1993
Heracleum lanatum	Cow parsnip	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Hericochole odorata	Sweetgrass	Herron, 2002; Meeker et al., 1993
Heuchera richardsonii	Alum-root	Meeker et al., 1993
Hieracium kalmii	Canada hawkweed	Meeker et al., 1993
Hieracium umbellatum	Canada hawk-weed	Lac Courte Oreilles v. Wisconsin court case

Scientific name	Common name	Source(s)
Hordeum jubatum	Squirrel-tail	Meeker et al., 1993
Humulus	Hop	Lac Courte Oreilles v. Wisconsin court case
Humulus lupulus	Hops	Meeker et al., 1993
Hydrophyllum virginianum	Virginia waterleaf	Lac Courte Oreilles v. Wisconsin court case
Impatiens capensis	Jewelweed	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Impatiens pallida	Pale touch-me-not	Meeker et al., 1993
Iris versicolor	Blue flag	Falck et al., 2014; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Juglans cinerea	Butternut	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case
Juncus dudleyi	Dudley's rush	Lac Courte Oreilles v. Wisconsin court case
Juncus effusus	Soft rush	Meeker et al., 1993
Juncus tenuis	Path rush	Meeker et al., 1993
Juniperus communis	Common juniper	Meeker et al., 1993
Lactuca biennis	Tall blue lettuce	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Laportea canadensis	False nettle	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Lappula squarrosa	Stickweed	Meeker et al., 1993
Larix laricina	Tamarack	GLIFWC Climate Change Team, 2023; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Lathyrus ochroleucus	Creamy vetchling	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Lathyrus palustris	Marsh vetchling	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Lathyrus venosus	Wild pea	Meeker et al., 1993
Lemna minor	Duckweed	Meeker et al., 1993
Leucophysalis grandiflora		Strand, 2023
Liatris spicata		Strand, 2023
Lilium canadense	Wild yellow lily	Meeker et al., 1993
Lilium philadelphicum	Wood lily	Meeker et al., 1993
Linaria vulgaris	Butter and eggs	Lac Courte Oreilles v. Wisconsin court case
Linnaea borealis	Twinflower	Meeker et al., 1993
Listera auriculata		Strand, 2023
Listera convallarioides		Strand, 2023
Lithospermum carolineiense	Puccoon	Meeker et al., 1993
Littorella uniflora		Strand, 2023
Lycopodium complanatum	Ground cedar	Meeker et al., 1993
Lycopodium lucidulum	Shining clubmoss	Meeker et al., 1993
Lycopodium obscurum	Ground pine	GLIFWC Climate Change Team, 2023; Herron, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993

Scientific name	Common name	Source(s)
Maianthemum canadense	Canada mayflower	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Maianthemum racemosum	False spikenard	Lac Courte Oreilles v. Wisconsin court case
Maianthemum racemosum, Smilacina racemosa	Feathery false solomons-seal	Meeker et al., 1993
Malaxis monophyllos		Strand, 2023
Malaxis unifolia	Adder's mouth	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Marmota monax	Woodchuck	Lac Courte Oreilles v. Wisconsin court case
Matteuccia struthiopteris	Ostrich fern	Herron, 2002
Melampyrum lineare	Cow wheat	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Melilotus albus	White sweet clover	Lac Courte Oreilles v. Wisconsin court case
Menispermum canadense	Canada moonseed	Lac Courte Oreilles v. Wisconsin court case
Mentha canadensis, Mentha arvensis	Wild mint	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Mirabilis nyctaginea	Heartleaved umbrellawort	Lac Courte Oreilles v. Wisconsin court case
Mitchella repens	Partridgeberry	Wiggins, 2021; Meeker et al., 1993
Monarda fistulosa	Wild bergamot	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Myrica gale	Sweet gale	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Myriophyllum farwellii		Strand, 2023
Nelumbo lutea	Yellow lotus	Lac Courte Oreilles v. Wisconsin court case
Nemopanthus mucronatus	Mountain holly	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Nepeta cataria	Catnip	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Nuphar advena	Yellow water lily	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Nuphar wariegata	Common yellow water lily	Meeker et al., 1993
Nuphur advena		Strand, 2023
Nymphaea odorata	Sweet white water lily	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Oenothera biennis	Evening primrose	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Onoclea, v. sensibilis	Sensitive fern	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Orobanche uniflora	One-flowered cancer-root	Meeker et al., 1993; Strand, 2023
Osmorhiza berteroi		Strand, 2023

Scientific name	Common name	Source(s)
Osmorhiza claytonii	Sweet cicely	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Osmorhiza longistylis	Smooth sweet cicely	Wiggins, 2021; Meeker et al., 1993
Osmunda cinnamomea	Cinnamon fern	Herron, 2002
Ostrya virginiana	Eastern Hop-hornbeam	Herron, 2002; Wiggins, 2021; Meeker et al., 1993
Oxalis acetosella	Common wood sorrel	Meeker et al., 1993
Packera	Entire-leaved groundsel	Lac Courte Oreilles v. Wisconsin court case
Packera aurea	Golden ragwort	Lac Courte Oreilles v. Wisconsin court case
Panax sp.	Ginseng	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case
Panax quinquefolius	American ginseng	GLIFWC Climate Change Team, 2023; Strand, 2023
Panax trifolium	Dwarf ginseng	Wiggins, 2021; Meeker et al., 1993
Parnassia palustris		Strand, 2023
Parthenocissus quinquefolia	Virginia creeper	Lac Courte Oreilles v. Wisconsin court case
Pastinaca sativa	Wild parsnip	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Pedicularis canadensis	Wood betony	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Pellaea	Brake	Lac Courte Oreilles v. Wisconsin court case
Penstemon hirsusts		Strand, 2023
Penstemon pallidus		Strand, 2023
Perdix perdix	Partidge	Lac Courte Oreilles v. Wisconsin court case
Persicaria amphibia	Swamp persicaria	Lac Courte Oreilles v. Wisconsin court case
Persicaria careyi	Carey's persicaria	Lac Courte Oreilles v. Wisconsin court case
Petasites sagittatus	Sweet coltsfoot	Fergus et al., 2022; Strand, 2023
Phaseolus lunatus	Lima bean	Lac Courte Oreilles v. Wisconsin court case
Phragmites australis	Giant reed	Meeker et al., 1993
Phryma leptostachya	Lopseed	Wiggins, 2021; Meeker et al., 1993
Physocarpus opulifolius	Ninebark	Meeker et al., 1993
Picea glauca	White spruce	Wiggins, 2021; Falck et al., 2014; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Picea mariana	Black spruce	Herron, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Pinguicula vulgaris		Strand, 2023
Pinus banksiana	Jack pine	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993

Scientific name	Common name	Source(s)
Pinus resinosa	Red pine, norway pine	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Pinus strobus	White pine	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Plantago major	Common plantain	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Platanthera flava		Strand, 2023
Platanthera hookeri		Strand, 2023
Platanthera orbiculata		Strand, 2023
Polygala paucifolia	Fringed polyhala	Meeker et al., 1993
Polygonatum pubescens	Small solomon's seal	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Polygonum amphibium	Water smartweed	Meeker et al., 1993
Polygonum pensylvanicum	Smartweed	Meeker et al., 1993
Polygonum persicaria	Lady's thumb	Meeker et al., 1993
Polygonum punctatum	Interrupted smartweed	Meeker et al., 1993
Polystichum braunii	Braun’s holly fern	Fergus et al., 2022
Pontederia cordata	Pickerelweed	Meeker et al., 1993
Populus balsamifera	Balsam poplar	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Populus deltoides	Cottonwood	Meeker et al., 1993
Populus tremuloides	Quaking aspen	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Potamogeton diversifolius	Water-thread Pondweed	Fergus et al., 2022
Potamogeton oakesianus	Oakes’ pondweed	Fergus et al., 2022
Potentilla arguta	Tall cinquefoil	Meeker et al., 1993
Potentilla norvegica	Rough cinquefoil	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Potentilla palustris	Marsh five-finger	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Prenanthes Alba	Lion's foot	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Primula mistassinica		Strand, 2023
Prunella vulgaris	Healall	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Prunus americana	Wild plum	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case
Prunus nigra	Canada plum	Meeker et al., 1993
Prunus pensylvanica	Pin cherry	Wiggins, 2021; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Prunus pumila	Sand cherry	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993

Scientific name	Common name	Source(s)
Prunus serotina	Black cherry	Meeker et al., 1993
Prunus virginiana	Choke cherry	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Pyrola chlorantha	Shin leaf	Lac Courte Oreilles v. Wisconsin court case
Pyrola elliptica	Elliptic shin-leaf	Meeker et al., 1993
Pyrola minor		Strand, 2023
Pyrola rotundifolia	Shinleaf	Meeker et al., 1993
Quercus alba	White oak	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Quercus macrocarpa	Bur oak	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Quercus rubra	Red oak	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Quercus velutina	Black oak	Lac Courte Oreilles v. Wisconsin court case
Ranunculus cymbalaria		Strand, 2023
Ranunculus gmelinii		Strand, 2023
Ranunculus lapponicus		Strand, 2023
Ranunculus pensylvanicus	Bristly buttercup	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Ranunculus sceleratus	Cursed crowfoot	Lac Courte Oreilles v. Wisconsin court case
Rhododendron groenlandicum, Ledum groenlandicum	Labrador tea	GLIFWC Climate Change Team, 2023; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Rhus glabra	Smooth sumac	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Rhus typhina	Staghorn sumac	White and Danielsen, 2002; Meeker et al., 1993
Ribes americanum	Wild black currant	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Ribes cynosbati	Prickly gooseberry	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Ribes glandulosum	Skunk currant	Meeker et al., 1993
Ribes hirtellum	Smooth gooseberry	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Ribes hudsonianum	Canadian black currant	Meeker et al., 1993
Ribes oxyacanthoides	Gooseberry	White and Danielsen, 2002; Meeker et al., 1993
Ribes triste	Swamp red current	Wiggins, 2022a; Wiggins, 2022b; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Rorippa palustris	Marsh cress	Lac Courte Oreilles v. Wisconsin court case
Rosa blanda	Smooth rose	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Rubus allegheniensis	Wild blackberry	White and Danielsen, 2002; Meeker et al., 1993
Rubus canadensis	Highbush blackberry	Lac Courte Oreilles v. Wisconsin court case

Scientific name	Common name	Source(s)
Rubus flagellaris	Northern dewberry	Meeker et al., 1993
Rubus idaeus	Raspberry	GLIFWC Climate Change Team, 2023; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Rubus pensilvanicus	Blackberry	White and Danielsen, 2002; Meeker et al., 1993
Rubus pubescens	Dwarf red raspberry	Meeker et al., 1993
Rudbeckia hirta	Black-eyed susan	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Rudbeckia laciniata	Cut-leaved coneflower	Meeker et al., 1993
Rumex altissimus	Water dock	Meeker et al., 1993
Rumex crispus	Curled dock	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Sagittaria cuneata	Arum-leaved Arrow-Head	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Sagittaria latifolia	Broadleaf arrowhead	GLIFWC Climate Change Team, 2023; White and Danielsen, 2002; Meeker et al., 1993
Salix discolor	Pussy willow	Meeker et al., 1993
Salix exigua, v. interior	Sandbar willow	Meeker et al., 1993
Salix fragilis	Crack willow	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Salix lucida	Shining willow	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Salix pedicellaris	Bog willow	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Salix planifolia	Tea leaved Willow	Fergus et al., 2022
Salix pyrifolia	Balsam willow	Meeker et al., 1993
Salix spp.	Willows	Herron, 2002
Sambucus canadensis	Common elderberry	Meeker et al., 1993
Sambucus racemosa	Red elderberry	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Sanguinaria canadensis	Bloodroot	GLIFWC Climate Change Team, 2023; Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Sanicula marilandica	Black snakeroot	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Sarracenia purpurea	Pitcher plants	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Sceptridium rugulosum	Virginia grape fern	Lac Courte Oreilles v. Wisconsin court case;
Schoenoplectus tabernaemontani	Great bulrush	Lac Courte Oreilles v. Wisconsin court case
Scirpus cyperinus	Wool grass	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Scirpus validus	Softstem bulrush	Meeker et al., 1993
Scophthalmus maximus	Turbot	Lac Courte Oreilles v. Wisconsin court case
Scutellaria galericulata	Marsh skullcap	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Scutellaria parvula var. parvula		Strand, 2023

Scientific name	Common name	Source(s)
Senecio aureus	Golden ragwort	Meeker et al., 1993
Silene latifolia, Silene nivea, Lychnis alba	White campion	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Silphium perfoliatum	Indian cup plant	Lac Courte Oreilles v. Wisconsin court case
Sisyrinchium montanum	Blue-eyed Grass	Meeker et al., 1993
Sium suave	Water parsnip	Meeker et al., 1993
Smilacina stellata	Star-flowered Solomon's Seal	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Smilax hispida	Cat brier	Meeker et al., 1993
Smilax lasioneura, V. herbacea	Carrion flower	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Solanum nigrum	Black nightshade	Meeker et al., 1993
Solidago canadensis	Canada goldenrod	Meeker et al., 1993
Solidago flexicaulis	Zig zag goldenrod	Meeker et al., 1993
Solidago juncea	Early goldenrod	Meeker et al., 1993
Solidago rigida	Stiff goldenrod	Meeker et al., 1993
Sorbus americana	American mountain ash	Wiggins, 2021; Meeker et al., 1993
Sparganium glomeratum		Strand, 2023
Species Group	Gourds	Lac Courte Oreilles v. Wisconsin court case
Species Group	Lichens	Lac Courte Oreilles v. Wisconsin court case
Species Group	Squash	Lac Courte Oreilles v. Wisconsin court case
Sphagnum	Sphagnum moss	Herron, 2002; Lac Courte Oreilles v. Wisconsin court case
Spiraea alba	Meadowsweet	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Spiraea tomentosa	Steeple bush	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Spiranthes lacera	Slender ladies' tresses	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Spiranthes romanzoffiana	Hooded ladies' tresses	Meeker et al., 1993
Stachys palustris	Hedge-nettle	Meeker et al., 1993
Stellaria media	Chickweed	Meeker et al., 1993
Streptopus amplexifolius		Strand, 2023
Streptopus, v. roseus	Twisted stalk	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Symphoricarpos albus	Snowberry	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993

Scientific name	Common name	Source(s)
Symphyotrichum cordifolium	Bluewood aster	Lac Courte Oreilles v. Wisconsin court case
Symplocarpus foetidus	Skunk cabbage	Meeker et al., 1993
Tanacetum, V. vulgare	Tansy	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Taraxacum, V. officinale	Dandelion	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Taxus canadensis	Canadian yew	Wiggins, 2021; Meeker et al., 1993
Tephroseris palustris		Strand, 2023
Thalictrum dasycarpum	Meadow rue	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Thuja occidentalis	White cedar	GLIFWC Climate Change Team, 2023; Herron, 2002; Wiggins, 2022a; Wiggins, 2022b; Falck et al., 2014; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Tilia americana	Basswood	GLIFWC Climate Change Team, 2023; Herron, 2002; White and Danielsen, 2002; Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Toxicodendron radicans	Poison ivy	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Trientalis borealis	Northern starflower	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Triglochin maritima		Strand, 2023
Triglochin palustris		Strand, 2023
Trillium grandiflorum	White trillium	Wiggins, 2021; Meeker et al., 1993
Triosteum perfoliatum	Horse gentian	Meeker et al., 1993
Tsuga canadensis	Hemlock	Herron, 2002; Wiggins, 2021; Falck et al., 2014; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Turritis glabra (syn. Arabis glabra)	Tower mustard	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Typha	Cattail	Herron, 2002; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case
Typha latifolia	Common cattail	Meeker et al., 1993
Ulmus americana	American elm	Herron, 2002; Meeker et al., 1993
Ulmus rubra	Slippery elm	Lac Courte Oreilles v. Wisconsin court case
Unkown	Cranberry pole bean	Lac Courte Oreilles v. Wisconsin court case
Unkown	Hare's tail	Lac Courte Oreilles v. Wisconsin court case
Unkown	Large pie pumpkin	Lac Courte Oreilles v. Wisconsin court case
Unkown	Lesser cat's foot	Lac Courte Oreilles v. Wisconsin court case
Unkown	Lyall's needle	Lac Courte Oreilles v. Wisconsin court case
Unkown	Navy bean	Lac Courte Oreilles v. Wisconsin court case
Unkown	Ojibwe potato	Lac Courte Oreilles v. Wisconsin court case
Unkown	Ojibwe squash	Lac Courte Oreilles v. Wisconsin court case

Scientific name	Common name	Source(s)
Unkown	Wild cherry	Lac Courte Oreilles v. Wisconsin court case
Unknown	Winterberry	Lac Courte Oreilles v. Wisconsin court case
Urtica dioica	Stinging nettle	Meeker et al., 1993
Utricularia geminiscapa		Strand, 2023
Utricularia purpurea		Strand, 2023
Utricularia resupinata		Strand, 2023
Uvularia grandiflora	Large flowered bellwort	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Uvularia sessilifolia	Wild oats, sessile leaved bellwort	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Vaccinium oxycoccos	Small cranberry	Herron, 2002; Meeker et al., 1993
Vaccinium vitis-idaea		Strand, 2023
Vaccinium, V. angustifolium, & *V. myrtilloides*	Blueberry	GLIFWC Climate Change Team, 2023; Falck et al., 2014; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Vaccinium, V. macroparpon	Cranberry	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Verbascum	Mullein	Lac Courte Oreilles v. Wisconsin court case
Verbena hastata	Blue vervain	Meeker et al., 1993
Viburnum acerifolium	Arrowwood	Meeker et al., 1993
Viburnum lentago	Nannyberry	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Viburnum rafinesquianum	Downy arrowwood	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Viola canadensis	Canada violet	Lac Courte Oreilles v. Wisconsin court case
Viola conspera	American dog violet	Wiggins, 2021; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Viola pubescens	Downy yellow violet	Meeker et al., 1993
Virburnum opulus	Highbush cranberry	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Vitis riparia	Riverbank grape	White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Xanthium	Cocklebur	Lac Courte Oreilles v. Wisconsin court case
Zanthoxylum americanum	Prickly ash	Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993
Zea mays	Corn (hominy)	Herron, 2002; Lac Courte Oreilles v. Wisconsin court case
Zizania palustris	Wild rice	GLIFWC Climate Change Team, 2023; Herron, 2002; White and Danielsen, 2002; Lac Courte Oreilles v. Wisconsin court case; Meeker et al., 1993

4.2.1.14 Giizhik (Northern White Cedar)

Giizhik (northern white cedar) remains central to Anishinaabe teachings, ceremony, and lifeways, often representing health and the continuity of life. It is one of the four main medicines used by the Ojibwe tribes (GLIFWC Climate Change Team, 2023). Gatherers maintain relationships with Giizhik forests across a gradient of Giizhik dominance (R. M. Clark et al., 2022). Interviews of tribal elders from GLIFWC member tribes revealed a great diversity of uses for Giizhik (Danielsen, 2002). Some of these included steeping the leaves in boiling water as an air freshener and to make tea, cleaning solutions, and hair rinses. The leaves may be burned for ceremonial smudging, incense, and as an insect repellent. Fresh leaves and boughs may be used as bedding and floor coverings, placed in living spaces as talismans, and hung over maple sap cooking kettles to prevent boil-overs. Giizhik trunks may be used for building dugout canoes, flat bottom ricing boats, and frames for birch bark canoes. Some people use the strong, rot-resistant wood as fence posts or to make baskets, basket frames, fish decoys, ice fishing tip-ups, snowshoes, paddles, and rice knocking sticks. Additionally, the wood can be burned as kindling to smoke animal hides. All parts of the tree may be used to make medicines (Meeker, Elias, and Heim, 1993; Dickmann and Leefers, 2016).

The Ojibwe people view Giizhik as self-determining beings who maintain spiritual, physical, and intellectual roles and responsibilities in Creation (e.g., Kimmerer, 2013; Watts, 2013). Giizhik are providers of medicine, materials, and teachings throughout their lives, which can extend more than 1,000 years (Kelly, Cook, and Larson, 1994). Giant, ancient Giizhik grow along the shores of Gichimikinaakong-minis (Mackinac Island) where they are considered ongoing spiritual guardians of the sacred island to this day.

Figure 4.2-5 Mature northern white cedar trees along Enbridge's proposed Line 5 ROW.
Photo: Dreux J. Watermolen, DNR

Over the last century, Giizhik has declined in abundance across its range and future declines are projected due to land-use change, timber harvesting practices, herbivory, and climate change (Heitzman, Pregitzer, and Miller, 1997; Cornett et al., 2000; Rooney, Solheim, and Waller, 2002; GLIFWC Climate Change Team, 2023). Populations of white-tail deer (Waawaashkeshi) are above historical norms. Cedar is a favorite winter food source of deer, and ecologists agree that over-browsing by deer is likely a leading cause of cedar decline (Kozich et al., 2022).

Anishinaabe gatherers maintain intimate and intergenerational knowledge and communications with Giizhik, especially at the local scale. These relationalities may guide and inform forest management (Kimmerer, 2013), particularly in understanding Giizhik at local to landscape scales, across land tenure types and through time. Mashkiiziibii Natural Resources Department staff pointed out several mature stands of Giizhik in the proposed pipeline ROW and near proposed waterbody crossings during site visits with DNR staff in July and November 2023 (Figure 4.2-5). Tribes have expressed concern about the permanent loss of old growth cedar trees in Enbridge's proposed pipeline corridor ROW, noting that they "may not regrow in our lifetimes—if at all—due to factors such as increased deer browse and the northern shift of climatic zones" (Wiggins Jr., 2022a). Section 5.9.2 discusses anticipated impacts to northern white cedar forests and other forest stands from Enbridge's proposed relocation and route alternatives.

4.2.1.15 Culturally Modified Trees

Intentional physical manipulations of growing trees can result in unusual shapes and distinctive growth forms that support traditional tree uses as part of cultural practices. Historically, culturally modified trees are believed to have been part of an extensive land and water navigation system in place long before the arrival of European settlers. It is well known that Native Americans had a widespread trail system throughout the Upper Great Lakes region, often following waterways and trails created by animal movements and migrations (C. E. Brown, 1930; Mello, 2016; Schaetzl, n.d.). Oral history interviews conducted by Whyte et al. (2023) confirm the presence of such trails in and around the Bad River Reservation: "we've explored parts of what we were trying to rediscover the Bad River trail, the ancient trail system that went from, I guess, probably Lake Superior through the reservation before the reservation was even in existence."

Culturally modified trees served as 'exit signs' off the principal land and water routes, leading people to areas of specific human interest and necessity, and then directing them back to the main route (Downes, 2011; 2023). Destinations could have been springs (a preferred source of drinking water), areas with exposed stone and copper deposits (used for adornments, hunting implements, and tools), gathering sites for medicinal plants, plants used to make dyes and paints, ceremonial sites, and ancestral burial sites. Before drainage ditches and canals alleviated persistent flooding, much of northern Wisconsin's landscape was flooded for long periods. Throughout spring and summer, paths near rivers and creeks would not be visible when water overflowed the banks. Culturally modified trees high on the banks could still be spotted, however, indicating where to exit a waterway to reach sites of interest. Such trees could also indicate areas of portage and safe crossing (Downes, 2023). In Wisconsin, culturally modified trees appear to be concentrated in ecotone environments like at the bottom of hills, at the edge of water, or atop ridges, and are often found in clusters of two or more (Tovar, 2016).

While some debate remains among archeologists and historians as to whether people manipulated trees to cause them to point toward landmarks (Allison, 2005; Tovar, 2016), Native American oral traditions support the cultural significance of trees as important landmarks. In fact, one tribal member noted that Bad River community members continue to modify trees in the present day. These could indicate the locations of tobacco offerings, hunting successes, or other aspects of daily life (E. Leoso, pers. comm.).

Tribal members have expressed concern that the clearing of forest stands for pipeline ROW and construction on both Enbridge's proposed relocation and the alternative routes could remove culturally modified tees. It is not possible to state accurately the extent of such an impact, however, as there is no publicly available or accessible inventory of culturally modified trees present across northern Wisconsin.

4.2.1.16 Ma'iingan (Gray Wolf)

Various Native American cultures consider Ma'iingan (wolf) to be a medicine being associated with courage, strength, loyalty, and success at hunting. Ma'iingan also plays a critical role in the Anishinaabe creation story and many Anishinaabe people consider Ma'iinganag to be a relative.

Among the Anishinaabe, oral tradition says that following the great flood, when Weniboozhoo and the animals cooperated to reconstitute the land on Turtle's back, Weniboozhoo and Ma'iingan were instructed to travel together in all directions. As David (2022) explains:

> "*Ma'iingan assumed many responsibilities, including teaching the Ojibwe how to survive on an often-harsh landscape; how to hunt; how to build stamina and work cooperatively; and importantly, how to raise young in extended family groups. They would also work to keep the deer herd healthy and help protect populations of plant beings important to the Ojibwe from over-browsing by deer. The Ojibwe responsibilities were to view Ma'iingan as their relative, to treat them with respect, to think of their best interests, and to be appreciative and humble in accepting the benefits that wolves provide. And, as in the other treaties made with the more-than-human beings, the Ojibwe recognized that the proper relationship with all these beings demanded reciprocity and responsibility. Since treaties are recognized as "supreme law," these tenets have never changed.*"

A primary teaching from this story is that Ma'iingan and the Ojibwe developed a deep and powerful relationship, often described as being brothers. Another primary teaching is that Ma'iingan and Ojibwe would forever share intertwined fates. This is reflected in the teaching that says: "Aaniin ezhiwebizid Ma'iingan, mii ge-izhiwebizid Anishinaabe. Aaniin ezhiwebizid Anishinaabe, mii ge-izhiwebizid Ma'iingan" (What happens to the wolf will happen to Anishinaabe. What happens to the Anishinaabe will happen to the wolf.) (Dunn, 1997; Price, 2023).

The Anishinaabe have monitored and recorded the plight of Ma'iinganag since colonial times. Throughout the colonial period, the persecution of Ma'iinganag paralleled the subjugation of Native American peoples. As Ma'iinganag was pushed out of his territories, Native American people were forced into treaties and land concessions relinquishing their homelands (Price, 2023). It became clear that both Anishinaabe people and Ma'iingan shared intertwined fates during this period.

The Twentieth Century provided a turning point for both Ma'iingan and Anishinaabe people. American citizens and conservation organizations became conscious of the near extermination of Ma'iinganag. In 1973, Congress passed the Endangered Species Act providing federal protection to imperiled species including Ma'iingan. At the same time, federally recognized tribes began empowering themselves through legal and legislative means. In the 1970s, several congressional acts that supported tribal sovereignty were passed. In the Ceded Territories of Wisconsin and Minnesota, court decisions reaffirmed the Ojibwe's treaty rights (Section 4.1.4). As tribal nations began to flourish, Ma'iinganag populations rebounded once again.

In addition to the cultural relationship with Ma'iingan, the Ojibwe people have spent centuries sharing the North American landscape with wolves resulting in substantial traditional ecological knowledge that can inform current Ma'iingan stewardship. Among the Ojibwe people, there is an understanding that

Ma'iingan presents little threat to human health and safety and an appreciation for the ecological role Ma'iingan plays in maintaining the long-term health of prey populations and the health and diversity of plant communities. This in turn yields strong Ojibwe support for maintaining a fully healthy and ecologically functional wolf population on the land.

Tribes have expressed concerns that changes to the legal status of Ma'iingan, overharvest during the legislatively mandated hunting season, and uncertainty regarding the population could adversely affect the tribes' interests in this being both on- and off-reservation (Wiggins Jr., 2022a). Section 5.10.3.5 discusses anticipated impacts to Ma'iingan from Enbridge's proposed Line 5 relocation route and route alternatives.

4.2.1.17 Migizi (Bald Eagle)

Migizi (bald eagle) is revered and respected by Ojibwe people. Migizi is known as "a bird closest to the Creator and who carries up messages and prayers" (GLIFWC Climate Change Team, 2023). Migizi plays a significant role in healing ceremonies and ceremonies honoring and respecting other people. In healing ceremonies, Migizi carries the sickness out of the body and up to the Creator for healing. The sick person must believe in the power of the prayer carrier for the flight to be successful. Like many other sacred articles, it is a great honor when gifted with or being a caretaker of feathers from Migizi. Other parts of Migizi, such as bones and talons, are used in ceremonies, celebrations, healings, and everyday cultural practice (GLIFWC Climate Change Team, 2023).

Migizi lives near rivers, large lakes, and other large areas of large open water. Nests are built in mature or old growth conifers or hardwoods in areas with good visibility, near water, and with ample prey (GLIFWC Climate Change Team, 2023). Migizi generally uses areas with minimal to moderate human development and disturbance. Some Migiziwag remain in the Ceded Territories for the winter if there is enough food; others migrate short distances (GLIFWC Climate Change Team, 2023). Consultants for Enbridge documented three bald eagle nests in the vicinity of Enbridge's proposed ROW in 2020 and 2023 surveys (See Appendix AA) and (Midwest Natural Resources, Inc., 2023).

Migiziwag are protected by the Bald and Golden Eagle Protection Act and tribes have expressed concerns that Enbridge's proposed project could negatively affect them and their nests (Fergus, Lozinski, and Zander, 2022; Wiggins Jr., 2022a). Section 5.10.4.8 discusses anticipated impacts to Migizi from Enbridge's proposed Line 5 relocation route and route alternatives.

4.2.1.18 Amik (Beaver)

Amik (beaver) is part of the Ojibwe clan system and is a sub-clan of the Waabizheshi (Marten) Clan. Members of the Amik Clan are believed to be providers (including hunters and gatherers), strategists, and builders. Amik has a close association with Nibi (water), being viewed as one of Nibi's caretakers. Several Ojibwe place names speak to the significance of Amik in the Ceded Territories. Some examples are Amikowiish-zaaga'igan (Beaver Lodge Lake) in west central Wisconsin and Amiko-ziibiins (Beaver Creek) in north central Wisconsin. In addition, an Ojibwe constellation (referred to as Gemini on western star charts), observed in winter and spring, portrays Amik.

Amik represents wisdom because it uses its gifts to promote wellness for itself and its family. According to Ojibwe oral tradition, the Creator gave Amik large teeth and the knowledge of how to build, enabling the beaver to positively impact its environment and create a more sustainable world. As one Anishinaabe storyteller relates:

> *"Amikwag build dams, dams that create deep pools and channels that don't freeze, creating winter worlds for their fish relatives, deep pools and channels that drought proof the landscape, dams that make wetlands full of moose, deer and elk, food cooling stations, places to hide, and muck to keep the flies away. Dams that open spaces in the canopy so sunlight increases, making warm and shallow aquatic habitat around the edges of ponds for amphibians and insects. Dams that create plunge pools on the downstream side for juvenile fish, gravel for spawning, and homes and food for birds."*
>
> "*And who is the first back after a fire to start the regeneration make work? Amik is a world builder. Amik is the one that brings the water. Amik is the one that brings forth more life. Amik is the one that works continuously with water and land and plant and animal nations and consent and diplomacy to create worlds. To create shared worlds*" (CBC Radio, 2020).

Oral history interviewees explained that because Amik reminds us how to be better human beings, special care must be taken when killing and eating Amikwag (GLIFWC Climate Change Team, 2023). When harvesting an Amik, nearly all its body should be used out of respect and its bones should be placed in a body of water along with Asemaa (tobacco) which will assure that its life will return and Amikwag will always be plentiful.

Amikwag are common on the Bad River Reservation and DNR staff observed beaver activity on Bear Trap Creek near the County Highway A crossing during site visits in November 2023. MNRD staff pointed out how Amik activity helped mitigate flooding. During oral history interviews, a Lac du Flambeau member described how "when Amikwag are not being harvested in a sustainable way, they are likely to either overpopulate or experience a high rate of mortality due to disease. Regular sustainable harvesting will help maintain a balance in their population" (GLIFWC Climate Change Team, 2023).

Tribes have expressed concerns that an oil spill could adversely impact Amik (Fergus, Lozinski, and Zander, 2022). Section 5.10.3.6 discusses anticipated impacts to Amik from Enbridge's proposed relocation and route alternatives.

4.2.1.19 Waabizheshi (American Marten)

Waabizheshi (marten) represents one of the Ojibwe clans (dodems) and plays a significant role in the Anishinaabeg lifeway. Martens were extirpated (locally extinct) by the 1930's due to overharvest and intense logging practices. From the 1970s to 2010, large-scale marten reintroductions and augmentations occurred in Wisconsin and Upper Michigan. Wisconsin reintroductions were concentrated in the Chequamegon and the Nicolet National Forest. Including the most recent discovery of martens on Madeline Island, they have now been detected on 12 of the 22 Apostle Islands (Carl, 2024). While marten populations are currently ample enough in Minnesota and Upper Michigan to sustain harvest seasons, they are listed as endangered in Wisconsin by Ojibwe tribes and state authorities (Carl, 2024).

4.2.2 Cultural Resources under State & Federal Historic Preservation Laws

This section describes documented cultural resources, as defined by state and federal regulations, found along Enbridge's proposed Line 5 relocation and route alternatives. It provides quantitative and qualitative assessments of anticipated effects of the project on these resources using the framework of historic preservation regulations. As discussed in the introduction to Section 4.2, under state and federal laws, "cultural resources" are defined as physical remains of human activity. They include places of religious and cultural significance, as well as archeological and historic resources such as objects, structures, buildings, sites, districts, and landscapes (NRCS, 2021; USFWS, 2020a). Historic properties are a subset of cultural resources, and, as defined by the National Historic Preservation Act (NHPA), include cultural resources that are listed on or eligible for listing on the National Register of Historic Places (NRHP) (36 CFR § 800.16 (l) (1)). The NRHP is described by the National Park Service (NPS) as constituting the "official list of the Nation's historic places worthy of preservation" (National Park Service (NPS), 2021). It was established by the NHPA and is maintained by the NPS.

4.2.2.1 Methods for Identifying & Assessing Effects to Cultural Resources

DNR archaeologists identified documented cultural resources along Enbridge's proposed route and route alternatives using archival sources and known site databases. In addition, a series of cultural resources reports completed for Enbridge's proposed Line 5 relocation project identified new sites or refined understanding of previously identified sites. Enbridge commissioned archaeological, architectural history, and tribal cultural resources investigations for the proposed relocation route. In compliance with the NHPA, principal investigators for each study met the Secretary of the Interior's standards for conducting archaeological investigations. Enbridge did not subject the route alternatives to cultural resources surveys; very little of those primarily rural areas have been surveyed in the past. The Bad River Band produced an oral history report pertaining to historic, cultural, religious, and subsistence sites in the area (Whyte et al., 2023).

Enbridge provided the spatial data from the various investigations. These locational data for archaeological and cultural sites are confidential and exempt from Wisconsin's open records law (§ 44.48 (1) (c) and § 157.70 (2) (a), Wis. Stat., NHPA § 304, Archaeological Resources Protection Act § 9(a)), and may only be accessed by authorized personnel. As non-public data, these maps are not included with this EIS.

Assessment of Enbridge's proposed Line 5 relocation with respect to cultural resources for this EIS incorporated both regulatory determinations and qualitative analysis. Preliminary regulatory assessments pursuant to § 106 of the NHPA were completed by USACE. This process included assessing the potential significance of cultural resources per NRHP eligibility criteria (36 CFR § 60.4) and/or assessing the project's potential effects on cultural resources, as defined by the Act [36 CFR § 800.4 (c & d)]. USACE considered a variety of information sources to facilitate determinations, including the Bad River Band's oral history report (Whyte et al., 2023), archaeological reports (Eichmann, Thomas, et al., 2020; Eichmann et al., 2022), architectural history reports (Derrick and Tucker-Laird, 2022), a tribal cultural resources survey (Jones and Moose, 2022), and information gathered during consultation and field visits, among other sources (USACE, 2024b; 2024a). As of publication of this EIS, effects determinations from USACE are provisional pending resolution of § 106 consultation. Qualitative assessments use information gathered from public comments, tribal comments, consultation with tribes, USACE's draft Environmental Assessment (USACE, 2024a), through documentation and reports completed to address historic preservation regulations (as above), consultation documentation (USACE, 2021; 2022; 2024b), and cultural resources protection plans submitted by Enbridge (Eichmann and Drake, 2024; Eichmann and Jones, 2024).

4.2.2.2 Cultural Resources Investigations, Reports, & Protection Plans

Enbridge commissioned a tribal cultural resources survey, an archaeological survey, and an historical architectural reconnaissance survey within a study corridor buffering the proposed Line 5 relocation corridor (Derrick and Tucker-Laird, 2022; Jones and Moose, 2022; Eichmann et al., 2022). Bad River Band submitted an oral history report on history, culture, and subsistence within a broader project area to USACE (Whyte et al., 2023). Enbridge also commissioned a Cultural Resources Protection Plan (Eichmann and Jones, 2024) and an Unanticipated Discoveries Plan (Eichmann and Drake, 2024) based on the above information sources to assist USACE with consultation under Section 106 of the NHPA, and to address potential effects to historic sites. At the time of publication of this Final EIS, consultation regarding the project and reports was ongoing between USACE, SHPO, and consulting tribes. Further information regarding historic preservation under USACE jurisdiction may be available through the Wisconsin SHPO office or the USACE. Findings from these investigations are summarized below.

The archaeological studies used a 100-meter buffer from the USACE permit area to define an area of potential effect (APE). They also incorporated the limits of disturbance (LOD) in their analysis, defined as the area where ground disturbance will occur.

4.2.2.3 Tribal Cultural Resources Survey

A Traditional Cultural Resources (TCR) survey, sponsored by Enbridge, was conducted to identify tribal historic properties and cultural resources within, or adjacent to, the project area and to provide recommendations to avoid or minimize effects to identified sites. The TCR report authors are private consultants working for Dirt Divers, LLC, contracting with Enbridge, and are not affiliated with consulting tribes. The TCR survey authors used the term "tribal cultural resources places" (TCRP) for tribal historic properties and cultural resources (Jones and Moose, 2022). Methodology consisted of documentary research, interviews with tribal members selected by the consultant, surface reconnaissance of the entire project area, and targeted archaeological survey within the proposed relocation route (Jones and Moose, 2022:3-4). Methodology for oral interviews was not provided.

The TCR survey corridor generally centered on the proposed alignment and measured approximately 300 feet wide and 42.2 miles long. Eleven potential tribal cultural places were identified during survey and an additional location was identified during subsequent site inspections (Table 4.2-2). Types of sites identified include sustenance gathering locations, sugar bushes, eagle roosting sites, post-contact artifact scatters, rock arches, and rock overlooks. Site protection plans were presented in Enbridge's Cultural Resources Protection Plan (Eichmann and Jones, 2024) and are summarized in Table 4.2-2. USACE pledged to incorporate the protection measures as special conditions when issuing CWA Section 404 and Rivers and Harbors Act Section 10 permits for the proposed project (USACE, 2024a).

All 11 TCRPs were recommended by the authors as having tribal cultural significance (Jones and Moose, 2022). One resource was determined as potentially eligible for the NRHP by USACE (Eichmann and Jones, 2024; USACE, 2024b). Each site was recommended for preservation and/or limiting impact by tribal monitoring during construction, minimization of disturbance by limited site clearing, and HDD as a pipeline installation method. Of note is that resource #10 has been subjected to geotechnical coring within the site boundary. Coring effects are likely limited/temporary, though documentation provided by Enbridge indicated that work within these sites would be avoided pending Section 106 review (Enbridge, 2020f). In general, all areas identified as within the APE but outside of the LOD could be affected by noise, alteration of the physical landscape, and interruption of wildlife travel patterns. Each site identified as within the LOD would likely be affected by the above as well as direct pipeline installation methods, vegetation clearing (particularly sugar bushes and hunting sites) and construction traffic.

Table 4.2-2 Tribal cultural resources properties and consultant recommendations.

ID*	Description	Within LOD**	Within APE***/LOD	USACE NRHP Determination	CRPP Treatment Measure
3	Eagle roosting/ hunting trees	No	Yes	Not eligible	HDD, minimized clearing, monitoring
4	Active maple sugar harvest	Yes	Yes	Not eligible	Minimized clearing and monitoring
5	Active maple sugar harvest	Yes	Yes	Not eligible	Minimized clearing and monitoring
6	Historic metal and field stone	Yes	Yes	Not eligible	Monitoring
7	Historic metal and field stone	Yes	Yes	Not eligible	Monitoring
8	Rock overlook	Yes	Yes	Not eligible	Monitoring
9	Rock overlook	No	No	Not assessed by USACE – recommended not eligible by Moose and Jones (2024)	Exclusion fencing, monitoring
Tribal field obs. 1	Rock arch	Yes	Yes	Not eligible	Minimize clearing, exclusion fencing, monitoring
10	Rock overlook	Yes	Yes	Not eligible	Outside of project area. Recommend monitoring
11	Historic metal debris	No	Yes	Not eligible	No special requirements recommended
12	Traditional cultural resource place for hunting, fishing, and gathering	Yes	Yes	Potentially eligible	HDD, minimized clearing, monitoring
13	Active maple sugar harvest	Yes	Yes	Not eligible	Minimized clearing and monitoring

* Numbering starts at exhibit 3, from Jones and Moose, 2024. ** LOD = limits of disturbance. ***APE = area of potential effect.

Exhibit 3 – Eagle Roasting/hunting trees: Documented as an eagle roosting/hunting tree location on Wisconsin DNR land. The space was noted as having spiritual significance for the exchange of gifts with eagles, as well as for the presence of large white pines and bald eagles. It is 45 feet away from the proposed corridor. To minimize disturbance to the site, Enbridge plans to use HDD installation instead of blasting, to minimize vegetation clearing to 30 feet, and to provide a tribal monitor during construction (Eichmann and Jones, 2024:23).

Exhibit 4 – Active maple sugar harvesting area: This is a privately owned maple sugaring stand. Indigenous affiliation was not established, though maple sugar production was described as an important cultural activity within the area (Whyte et al., 2023) (Section 4.2.1.12). It is not located within the pipeline corridor, but a proposed access route bisects the stand. Effects would likely include vegetation clearing for the access route. Mitigation measures would include environmental and indigenous monitoring during clearing and construction, along with minimization of vegetation clearing. It was noted that at least a 200-foot by 30-foot corridor of the stand would likely be cleared. The proposed pipeline route is located approximately 50 feet away from the stand. The HDD method is proposed in this area due to a nearby water crossing (Eichmann and Jones, 2024:23; Jones and Moose, 2022).

Exhibit 5 – Active maple sugar harvesting area: This is a privately owned maple sugaring stand. Indigenous affiliation was not established, though maple sugar production was described as an important cultural activity within the area (Whyte et al., 2023) (Section 4.2.1.12). Almost 25 percent of the site area is proposed for clearing to make space for an HDD pullback location. Mitigation measures would include environmental and indigenous monitoring during clearing and construction, along with minimization of vegetation clearing.

Exhibit 6 – Historic metal and field stone: Historic metal and field stone secondary deposit. Site is located within the LOD. While no significance has been attributed to the site, Enbridge would have tribal and environmental monitors on site during non-blasting construction. A site-specific blasting plan would be required (Section 1.4.3.18).

Exhibit 7 – Historic metal and field stone: Historic metal and field stone secondary deposit. Site is located within the LOD. While no significance has been attributed to the site, Enbridge would have tribal and environmental monitors on site during non-blasting construction. A site-specific blasting plan would be required (Section 1.4.3.18).

Exhibit 8 – Rock outcrop overlook: This is a rock overlook with a sweeping eastward view over the Bad River watershed and nearby hills. It is located on private land. No indigenous affiliation has been identified for the site, though similar geographic features have been associated with cultural practices and Ojibwe places of power (Whyte et al., 2023:8). The outcrop is located within the LOD, and blasting is proposed as the construction method in this location. Indigenous monitors would be allowed to inspect the site after blasting operations cease (Eichmann and Jones, 2024:33). A site-specific blasting plan would be required (Section 1.4.3.18).

Exhibit 9 – Rock outcrop overlook: This is a rock overlook with a sweeping eastward view over the Bad River watershed and nearby hills. It is near Exhibit 8 but is 265 feet from the proposed pipeline. No indigenous affiliation has been identified for the site, though similar geographic features have been associated with cultural practices and Ojibwe places of power (Whyte et al., 2023:8). No treatment plans were provided for this site, as it is outside the APE and LOD.

Tribal Field Observation 1 – Rock arch: This is a rock arch identified by tribal staff visits consisting of four large boulders that have spalled off a rock outcrop to form a 2-meter-wide by 1.5-meter-high opening. It is near Exhibits 8 and 9. The entire edifice rests on an unstable scree slope. It is partially supported by a large poplar tree. The authors remark that the structure is likely to fall down the slope at some point due to natural erosion. The blasting construction method is proposed in the area, which could expedite structural failure. Treatment practices to attempt to limit disturbance would include a minimum 25-foot buffer, installation of exclusion fencing, and monitoring during non-blasting periods (Eichmann and Jones, 2024:35-36). A site-specific blasting plan would be required (Section 1.4.3.18).

Exhibit 10 - Rock outcrop overlook: This is a rock overlook with a sweeping eastward view over the Bad

River watershed. No indigenous affiliation has been identified for the site, though similar geographic features have been associated with cultural practices and Ojibwe places of power (Whyte et al., 2023:8). It is outside the LOD, but within the APE. Blasting is the planned construction technique along the route nearest the feature. Enbridge plans to provide exclusion fencing perpendicular with the route along with monitoring during non-blasting periods (Eichmann and Jones, 2024:35-36). A site-specific blasting plan would be required (Section 1.4.3.18).

Exhibit 11 – Historic metal debris/midden: Historic metal debris and tubs were located by the TRCS, with additional material located during archaeological survey; the archaeological site is codified as AS-0415. The site area is bisected by the route. The archaeological report concludes the site is a midden (historic dump for domestic waste) from the 1950s and 1960s with multiple deposits from nearby residents. The location for the midden was likely selected as it is at the end of a dead-end road (Eichmann et al., 2022:65-66). The construction technique used in this area would likely be blasting, which would destroy parts of the site in that area. Treatment techniques include tribal monitors during non-blasting periods (Eichmann and Jones, 2024:38). A site-specific blasting plan would be required (Section 1.4.3.18).

Exhibit 12 – Traditional hunting, gathering, and fishing location on public lands owned by Iron County: The site was determined eligible for listing on the NRHP by USACE (USACE, 2024a). The location is guaranteed to be open to tribal members to exercise usufructuary rights (Jones and Moose, 2022:53). USACE invited consulting tribes along with GLIFWC specialists on field visits to the site, during which specific treatment/preservation methods were recommended. The area was noted as having groups of mature cedar trees, which have special significance for Ojibwe peoples (Whyte et al., 2023);(Section 4.2.1.14). Two areas were selected for specific tree protections to avoid impacts to culturally important trees. Tree treatment area 1 would include general prescriptions for minimization of clearing to a 30-foot corridor along with installation of temporary fencing, marking, or signage to protect the cedar trees, installation of exclusionary fencing, limiting of travel to existing access roads, and tribal monitoring. During site visits, GLIFWC documented approximately 38 mature cedar trees, of which 13 have canopy within the LOD and nine have trunks therein. Consulting tribes and GLIFWC requested that these trees be protected before, during, and after construction. Enbridge concluded that several trees would be affected to facilitate construction activities. One cedar would be removed, and another could need to be removed depending on in-field construction requirements. Several other cedar trees would be pruned to a height of up to 14 feet to facilitate equipment movement. In additional, signage and fencing would be installed to protect trees. Further minimization efforts include HDD pipe installation and employment of equipment matting on the forest floor (Eichmann and Jones, 2024:40; USACE, 2024a:7; Jones and Moose, 2022:53). Despite these restrictions, installation of the pipeline within the site would have both temporary and permanent effects to the integrity of the traditional cultural site. Removal of 1 to 2 cedar trees and pruning of others would affect the look and feel of the site, while affecting a tree species of special significance for Ojibwe peoples. Periodic maintenance or travel along the corridor could necessitate periodic vegetation management that would affect use of the site and vegetation species of interest. Traditional subsistence practices would be negatively affected during the period of construction activities and during periods of maintenance due to the presence of machines and people. The presence of a cleared corridor could alter wildlife travel patterns, which in turn could affect tribal hunting strategies.

Exhibit 13 – Privately owned maple sugaring stand: Indigenous affiliation was not established here, though maple sugar production was described as an important cultural activity within the area (Whyte et al., 2023) (Section 4.2.1.12). The proposed activity within the site consists of using an existing access route to get to the pipeline corridor. Mitigation measures would include environmental and indigenous monitoring during clearing, along with minimization of vegetation clearing. Limited effects would be anticipated as the route adheres to an existing roadway.

4.2.2.4 Archaeological Investigations

A Phase I archaeological survey was conducted by ERM on behalf of Enbridge in Ashland and Iron counties in 2019 and 2020. ERM established a survey area of 5296.9 acres. This includes a corridor varying in width between 220 to 1520 feet surrounding the preferred route, along with access roads and facility construction areas. A total of 3,275.5 acres were surveyed in 2019 (62 percent of the routes under consideration) (Eichmann, Thomas, et al., 2020). An additional 1,211.30 acres were surveyed in 2020, constituting 99 percent of ERM's proposed survey corridor (Eichmann, Howell, et al., 2020; Eichmann et al., 2022). Survey results were compiled in a final report of investigations (Eichmann et al., 2022). Treatment plans were provided in its Cultural Resource Protection Plan (Eichmann and Jones, 2024).

Preliminary research identified no previously reported archaeological sites within the project survey corridor. Archaeological field surveys identified 27 previously undocumented archaeological sites and six isolated finds within 300 feet of the LOD. A total of 19 sites are within the USACE APE and are being addressed pursuant to Section 106 of the NHPA. Of these, five sites are determined potentially eligible for the NRHP. All sites listed in Table 4.2-3 are located within 300 feet of the limits of disturbance for the project. Not all sites identified during ERM's survey are included in the table, as some were identified during investigation of areas no longer within the proposed project area.

Table 4.2-3 Archaeological and burial sites within 300 feet of limits of disturbance.

Smithsonian Code	Burial Site #	Site Type	Within LOD	Within USACE APE	NRHP Eligibility	Treatment Plan
AS-0415/Exhibit 11		HCM concentration	Yes	Yes	Not Eligible*	Monitoring
AS-0416		Farmstead	Yes	No	Not Eligible+	Exclusion fence, monitoring
AS-0417		Farmstead	No	Yes	Unevaluated	Exclusion fence, monitoring
AS-0418		Farmstead	No	No	Not Eligible+	None
AS-0420		Logging or Mining camp	Yes	Yes	Not Eligible*	Exclusion fence
AS-0421		Cabin/homestead	No	Yes	Not Eligible*	Exclusion fence
AS-0425		Farmstead	No	Yes	Potentially Eligible*	Exclusion fence, monitoring
AS-0429		Isolated finds	Yes	No	Not Eligible+	None
AS-0430		Transportation site	Yes	Yes	Not Eligible*	None
AS-0431		Farmstead	Yes	Yes	Not Eligible*	None
AS-0433		HCM concentration	Yes	Yes	Not Eligible*	None
AS-0434		Isolated finds	No	Yes	Not Eligible*	None
AS-0436		Isolated finds	Yes	No	Not Eligible+	None
AS-0439		Isolated finds	No	Yes	Not Eligible*	None
AS-0440		HCM concentration	Yes	Yes	Not Eligible*	None
AS-0441		HCM concentration	No	Yes	Not Eligible*	None
AS-0442		Lithic scatter	No	Yes	Potentially Eligible*	Exclusion fence

Smithsonian Code	Burial Site #	Site Type	Within LOD	Within USACE APE	NRHP Eligibility	Treatment Plan
AS-0443		Cabin/homestead	No	Yes	Potentially Eligible*	Exclusion fence, monitoring
AS-0444		HCM concentration	Yes	Yes	Not Eligible*	None
AS-0445		HCM concentration	Yes	Yes	Not Eligible*	None
BA-0590		Farmstead	Yes	No	Not Eligible+	None
DG-0176		Foundation/depression, commercial	No	No	Unevaluated	None
IR-0051		HCM concentration	No	No	Not Eligible+	None
IR-0052		Mining site	No	Yes	Potentially Eligible*	Exclusion fence, monitoring
IR-0054		HCM concentration	Yes	No	Not Eligible+	None
IR-0055		Isolated finds	Yes	Yes	Not Eligible*	None
IR-0057		Well	No	Yes	Unevaluated*	None

* USACE determination, + ERM recommendation

The following paragraphs briefly describe each of the archaeological sites identified within 300 feet of the proposed project area.

AS-0415/Exhibit 11 is a mid-20th Century midden with primarily household debris scattered around the surface. It was identified as Exhibit 11 during the TCRS (see above). No structural remains were identified. The site is at the end of a dead-end road, a common location for refuse dumping. The portion of the site coincident with the proposed blasting corridor will be destroyed by the project. Further, surface and near surface midden deposits within the LOD will likely be compressed by vehicular traffic. The USACE determined the site as not eligible for the NRHP, as it is a common site type with little subsurface integrity that cannot be associated with historically important events/persons and has no affiliation with architectural remains. Treatment plans consist of monitoring before and after blasting. Disturbance to this common site type would be unlikely to result in the loss of important historic information.

AS-0416/AHI 19 is a double pen, threshing log barn likely dating to the late 1890s to mid-1940s. The site is located in a small island of scrub brush surrounded by agricultural fields. It is a solitary, collapsing structure. It was recommended by ERM as not eligible for the NRHP as it is isolated in context, maintains no structural integrity, and cannot be associated with historically important persons/events (Derrick and Tucker-Laird, 2022; Eichmann and Jones, 2024:72). Relative to construction related activities, the site is in the LOD of an HDD pullback area and is 100 feet from the proposed pipeline, where bedrock blasting would likely be employed. Preservation commitments from Enbridge would include installation of exclusion fencing to prevent vehicle damage during HDD drilling, and monitoring before and after blasting operations (Eichmann and Jones, 2024). A site-specific blasting plan would be required (Section 1.4.3.18). It is unlikely that there would be direct effects to the site during construction, as blasting is sufficiently removed from the site, and fencing would prevent vehicular access during HDD operations. It would not likely be affected after construction due to distance from the ROW.

Site AS-0417 is the ruins of a 20th Century farmstead comprised of two fieldstone walls, a barn foundation, and a surface scatter of associated artifacts. No subsurface artifacts were encountered during shovel testing. ERM recommended that the site holds little potential for providing significant historic information due to lack of subsurface deposits, lack of architectural features (i.e., only one foundation), and no association with historic events/persons. Enbridge shifted the proposed ROW alignment south to avoid the site. Bedrock blasting is proposed 200-250 feet away. Proposed treatment measures include installation of exclusion fencing to prevent vehicular access and pre- and post-blasting monitoring. A site-specific blasting plan would be required (Section 1.4.3.18). There would be no direct effects to the site during construction as no ground disturbance is planned within the area, blasting operations are located 200-250 feet away, and vehicles would be excluded from the site. Given the distance from the ROW, subsequent maintenance operations would likely avoid impact to the site. The USACE did not evaluate the structure for the NRHP as the agency considers the project to have no effect on this resource (Eichmann and Jones, 2024:72; USACE, 2024b).

AS-0418 is a scatter of historic artifacts in an agricultural field near the ruins of an early-mid 20th Century side-gabled house. The structure was collapsing at the time of survey and is located 80 feet north of the site, outside of the LOD. ERM recommended that the portion of the site within the survey area is not eligible for the NRHP as there is a paucity of material within a disturbed context. No association with significant individuals was identified. Enbridge moved the LOD south to avoid the sites. No other treatment measures were recommended. The proposed centerline is approximately 100 feet south of the site. The site would not be affected by vehicular access, as the agricultural field scatter is outside the LOD and ROW. A site-specific blasting plan would be required (Section 1.4.3.18). Blasting operations would have no effect on the previously disturbed field scatter and the house ruins are approximately 200 feet away. Due to the distance from the proposed mainline, future maintenance operations would likely have no effect.

AS-0420 is documented as a probable logging/mining camp or homestead located on the north slope of a small hill and 164 feet from an unnamed tributary of Gehrman Creek. Site features include a collapsing log cabin, surface artifacts, a cellar pit, and several unidentified pits. The site is approximately 100 feet east of the similar AS-0421, though no artifacts or features were identified between the sites during shovel testing, leading to independent site codification. ERM reports that the site has been disturbed by previous logging, and no association with historically significant individuals/events was identified. The USACE determined the site is not eligible for the NRHP. The eastern edge of the site is within an access road of the LOD, using an existing two-track logging road. The logging road would be modified to accommodate pipeline installation equipment. Treatment measures for the site would include installation of exclusion fencing along both sides of the access route. The installed fencing would protect structural features and would limit potential effects to the site during construction. Overall, vehicular access through the eastern site margin would cause some additional soil compaction and could affect subsurface artifacts in the area, if present (Eichmann et al., 2022; Eichmann and Jones, 2024; USACE, 2024b). This impact would be unlikely to result in the loss of historically important information, as disturbance would be isolated to the site edge and focused on a previously disturbed part of the site.

AS-0421 is documented as a probable logging camp or farmstead located on an unnamed tributary of Gehrman Creek. Site features include a 20-square-foot, collapsed, log structure with a ruined stone chimney along with a scatter of metal artifacts. The site is approximately 100 feet west of the similar AS-0420, though no artifacts or features were identified between the sites during shovel testing. The site has been logged and subject to agriculture in the past. It is not within the LOD, and no ground disturbance or vehicle access is planned. As such, the site would not be disturbed by the proposed project. The USACE determined the site is not eligible for the NRHP due to previous disturbance, the unlikelihood of producing significant historic information, and no association with historic events/persons (Eichmann et al., 2022; Eichmann and Jones, 2024; USACE, 2024b).

Site AS-0425 is an early to mid-20th Century farmstead, likely built between 1905 and 1917, with structural features including three foundations, a rock boundary wall, and a stone-lined ditch. The site was recommended as potentially eligible for the NRHP by the USACE. It represents a well-preserved example of a post railroad rural settlement in Ashland County with minimal previous disturbance. The LOD was shifted to avoid the site by 20 feet. The proposed pipeline installation is located 60 feet from the western edge of the site and could include bedrock blasting. A site-specific blasting plan would be required (Section 1.4.3.18). The USACE would require installation of exclusion fencing and monitoring before and after to avoid or reduce effects (Eichmann and Jones, 2024; USACE, 2024b). Direct effects to the site would be avoided, as it is outside the LOD and would be protected by a fence during construction. As it is outside of the ROW, it is unlikely to be affected by subsequent maintenance operations.

AS-0429 is an isolated find of a non-diagnostic lithic flake identified within a farm field. The site is not eligible for the NRHP as it is unlikely to yield historically significant information. It is located within the construction ROW for the proposed project and no preservation measures were recommended (Eichmann et al., 2022). The site could be affected by vehicular access and material stagging. However, as an isolated find located within a plowed field, site impacts would be negligible and unlikely to result in the loss of historically significant information.

AS-0430 is a segment of a rail spur and associated former bridge crossing the Bad River and its floodplain. The rail grade rises 3-6 feet above the floodplain. The bridge segment is evidenced by numerous wooden pilings within the river and riprap placed along the bank. The segment connected granite quarrying operations to the Wisconsin Central Railroad in Mellen (Eichmann et al., 2022).The USACE determined the site is not eligible for the NRHP as the bridge has been destroyed by flooding and the spur was dismantled, while the entire area has been disturbed by historic logging operations (Eichmann et al., 2022; USACE, 2024b). The southern extent of the site is within the permanent and construction ROWs and LOD. The proposed construction method in the area is HDD drilling. Drilling operations would be unlikely to adversely affect the coincident portion of the site, as it has already been severely disturbed by residential landscaping. Even in the event of open trenching or excavating for maintenance, effects on the overall site would be minimal as they would be confined to a small, disturbed portion of a 1,080-foot linear site.

AS-0431 is a late 19th to mid-20th Century residential material scatter identified on the surface of an agricultural field. A house was located on the site but was destroyed in the mid-1900s. The site has been plowed for decades since demolition. Research did not identify historically significant persons/events associated with the property (Eichmann et al., 2022). The USACE recommended the site as not eligible for the NRHP as it is unlikely to contribute significant historic information (USACE, 2024b). No treatment measures were required. The western edge of the site is within an access route for the proposed project. Effects of vehicular access over the site would be minor, as the site is already mixed and artifacts are highly fragmented from demolition and plowing.

AS-0433 is a mid-late 20th Century farm implement dump located on a low ridge above an intermittent stream. No subsurface materials were identified during shovel testing. Materials include a GMC truck frame, manure spreader, hay bailer, harvester, tiller, and piles of pushed wood and dirt. Archival research did not located structures associated with the implements (Eichmann et al., 2022). The USACE determined the site is not eligible for the NRHP, as it is unlikely to contribute important historic information, and there is no association with significant events or persons (USACE, 2024b). The site is within the LOD and is bisected by Enbridge's proposed route, with permanent and construction ROWs traversing it. The site would likely be partially destroyed either by moving the abandoned farm implements somewhere else or by pipeline installation, which could consist of blasting in this location. Little to no historic information would be lost due to site destruction as the materials present are all common farm implements. A site-specific blasting plan would be required (Section 1.4.3.18).

AS-0434 is an isolated find of a two-person hand-saw fragment. No other materials were identified during shovel testing in the area (Eichmann et al., 2022). The USACE determined the site is not eligible for the NRHP as it does not contribute historically significant information (USACE, 2024b). It is within the USACE APE but would not be affected by the project as it is 90 feet from the proposed pipeline installation.

AS-0436 is an isolated find of a 19th-20th Century whetstone found in an agricultural field. As an isolated find of a common implement the site does not contribute historic information and it is not eligible for the NRHP. It is located within the LOD at the edge of an access route (Eichmann et al., 2022). No preservation measures were recommended and vehicular access through the plowed field would have no effect on the site.

AS-0439 is an abandoned mid-20th Century metal flatbed wagon located within a wetland. No other materials were identified during pedestrian survey in the area (Eichmann et al., 2022). The USACE determined the site is not eligible for the NRHP as it does not contribute historically significant information (USACE, 2024b). It is within the USACE APE but would not be affected by the proposed project, as it is 80 feet from proposed HDD drilling installation.

AS-0440 is a small surface scatter of mid-20th Century domestic material located on the edge of a farm field and a transmission line corridor. No architectural features were identified in the field, though aerial imagery identified a structure present in 1963 but removed by least 1983. As a common domestic refuse site with little archaeological integrity and no association with historically significant events/persons, the USACE determined the site is not NRHP eligible (Eichmann et al., 2022; USACE, 2024b). The site is located within a temporary workspace for the LOD, but outside the construction ROW by about 5 feet. While installation methods would likely avoid the site, vehicular access, vegetation clearing activities, and staging would likely compact soils and fragment artifacts. As a common mid-20th Century residential midden site with little site integrity, further site disturbance would not result in a loss of important historic information.

AS-0441 is a surface scatter of 20th Century residential materials located in a shallow ravine. No associated structural features were identified in the field or during archival research, and shovel testing did not reveal subsurface deposits. As a common domestic refuse site with little archaeological integrity that could not be associated with historically significant events/persons, the USACE determined the site is not NRHP eligible (Eichmann et al., 2022; USACE, 2024b). The site is located 30 feet from the proposed pipeline but is outside the LOD. Proposed construction methods at this location include HDD drilling. Direct effects would be avoided by the proposed project, as there would be no ground disturbance within the site. Potential site maintenance activities could affect the site, however, little to no historically significant information would be lost by site disturbance, as it is a common residential surface midden.

Site AS-0442 is a Late Archaic period lithic scatter located on the upland edge of a delineated wetland. Archaeologists recovered an expanding stemmed hafted biface and two tertiary flakes from a single shovel test pit. Close-interval shovel testing expanding out from the find location, along with testing around the entire edge of the wetland coincident with the APE, failed to identify additional material. Due to the paucity of Later Archaic sites in the area it was recommended for further testing or avoidance in the event of project related effects (Eichmann et al., 2022). The LOD is located approximately 175 feet south of the find within an intermittent wetland. HDD drilling is proposed within the LOD. HDD at this distance from the site would have no direct effect on the site, as there would be no ground disturbance either for construction or vehicular access. The site would be provided with exclusion fencing to prevent traffic access in the event of inadvertent release of HDD drilling fluids (Eichmann and Jones, 2024:83). Potential future maintenance activities would need to avoid the site to prevent site disturbance.

Site AS-0443 consists of a late 19th to early 20th Century homestead ruin. Structural features were identified including a foundation wall with an internal cellar pit and a possible privy. Numerous surface finds were documented including several diagnostic artifacts dating to the late 1800s to early 1900s. The earthen foundation with an unlined cellar is a rare architectural feature with the potential to inform regarding early farmstead settlement. Archival research indicates site occupation ended prior to 1917. As an intact site with the potential to yield important historic information regarding early homesteading in the region, the USACE determined the site is potentially eligible for the NRHP (Eichmann et al., 2022; USACE, 2024b). The farmstead is located outside an access route by approximately 30 feet and is 200-250 feet away from the proposed pipeline corridor. The planned installation method in the LOD is bedrock blasting. A site-specific blasting plan would be required (Section 1.4.3.18). Protective treatment measures for the site would include installation of exclusion fencing along the side of the site nearest the corridor and monitoring before and after blasting episodes (Eichmann and Jones, 2024:83). The site would not be directly affected by the project as there would be no ground disturbance or vehicular access during construction. It would be unlikely to be affected during subsequent maintenance activities as it is located outside the ROW.

AS-0444 is a scatter of brick and mortar located within a former plowed/graded field. It is not associated with any nearby structure and was likely deposited as a fill substrate or as an architectural debris dump. The site location is not associated with historically significant events/persons, and the site type is unlikely to yield information important to local history (Eichmann et al., 2022). The USACE determined the site is not eligible for the NRHP (USACE, 2024b). The very edge of the site is adjacent to the construction ROW and 180 feet from the proposed pipeline. HDD installation is proposed at this location. Potential effects on the site are minimal, as only about 40 square feet overlap the ROW. In addition, damage to brick-and-mortar debris within a plowed field would not result in the loss of historically important information.

AS-0445 is a diffuse historic material scatter including two wagon/trailer wheels, a metal barrel, and two structural features: a collapsed shed and a 12-foot by 8-foot shallow depression, containing the barrel. The site is situated on a hayfield edge and has been subject to plowing and timber harvesting. ERM suggests the shed ruins were redeposited or repositioned here as a convenient dumping location. Aerial reconnaissance identified two outbuildings located in the area in the 1980s and 1990s. The site location is not associated with historically significant events/persons, and the site type is unlikely to yield information important to local history (Eichmann et al., 2022). As such, the USACE determined the site is not eligible for the NRHP (USACE, 2024b). The site is located within an HDD pullback area of the LOD. Vehicular access and staging activities would likely trample the site and could damage surface features. Damage to integrity would be unlikely to result in the loss of historically important information as the site contains modern outbuildings and a sparce surface scatter of wagon/trailer wheels.

BA-0590 consists of the remains of a bulldozed 1930s-1950s era farmstead located within a plowed agricultural field. Several residential artifacts were identified during survey, but no architectural features were found. ERM recommended the site as not eligible for the NRHP as it lacks archaeological integrity, no historically significant persons/events were associated with the site, and it is unlikely to yield historically significant information. The artifact scatter is within the LOD for a temporary work site surrounding a mainline valve site. No treatment measures are recommended (Eichmann et al., 2022; Eichmann and Jones, 2024). Vehicular access and staging during construction would likely cause additional site disturbance. However, these effects would likely be minor as the site has been disturbed previously by demolition and years of plowing.

DG-0176 consists of the remnants of the Parkland Health Facility. The area is in the Town of Parkland, across the highway from an Enbridge pipeyard. The site is outside the LOD and no pipeline installations will occur in the vicinity. DG-0176 would not be affected by the project.

IR-0051 is a scatter of 20th Century food, beverage, and kitchen material. It is located 200 feet from an access route and 650 feet from the proposed pipeline location. The site would not be affected by the proposed project, as there would be no ground disturbance or vehicular traffic coincident with the site. It has been recommended as not eligible for the NRHP by ERM as it is not likely to contribute significant information regarding the history of the area and has no association with historic events/people (Eichmann et al., 2022).

Site IR-0052 is a large late 19th to early 20th Century mine and mining camp. The site harbors multiple structural foundations, a midden, and numerous tailings piles. Portions of the site are within feet of the LOD. The site represents a well-preserved aspect of Iron County's early industrial history, and it is recommended as potentially eligible for the NRHP (USACE, 2024b). Enbridge shifted the LOD approximately 300 feet to avoid the site. The present proposed ROW alignment avoids the eastern site edge by 20 feet (Eichmann and Jones, 2024:85). Exclusion fencing would be installed along the margins of the LOD to prevent impacts and monitoring would be scheduled before and after bedrock blasting (USACE, 2024b). The site is unlikely to be affected by construction as no ground disturbance or vehicular access would occur within the boundaries. It would be unlikely to be affected by subsequent maintenance operations as it is outside Enbridge's proposed project ROWs.

IR-0054 is an early to mid-20th Century farmstead with surface features, but no subsurface artifacts were identified. The site was likely abandoned by the mid-1940s. There is a later period abandoned camper with an associated garbage deposit at the location. ERM recommends that the site is not eligible for the NRHP as the structural features have been severely disturbed from decades of logging activity, the lack of subsurface deposits make it unlikely to yield significant historic information, and the site could not be associated with historic events/people (Eichmann et al., 2022). The site is within the LOD and is bisected by the proposed construction and permanent ROWs. The planned installation technique through the site is HDD drilling. Drilling would likely proceed under the site and would avoid direct effects. However, the site would likely be subject to vehicular traffic during construction and subsequent maintenance operations, which could damage the site. The site would be subject to monitoring during construction due to a nearby waterway crossing (Eichmann and Jones, 2024). Potential effects on the site would likely have a minimal effect as the site retains little archaeological integrity and it is unlikely to yield significant historic information.

IR-0055 is an isolated find of a non-diagnostic lithic flake found in a shovel test. Shovel testing expanding out from the find location failed to identify additional material (Eichmann et al., 2022). The USACE determined the site is not eligible for the NRHP as no additional material was identified during testing. It is located just outside the HDD drill path and the permanent ROW of the LOD. No preservation measures were recommended (Eichmann et al., 2022; USACE, 2024b). The site would be unlikely to be affected by the proposed project, as there would be no ground disturbing activities or vehicular access within the site. Subsequent maintenance activities would likely avoid the site as it is outside the ROW.

IR-0057 consists of a cased well in a metal well-house. No other features or artifacts were reported associated with the site. It is within the USACE APE and approximately 260 feet from the LOD. The pipeline installation method nearest the site is proposed as HDD drilling (Eichmann et al., 2022). The USACE concluded that the site would not be affected by the proposed project due to its distance from the LOD. Vehicular traffic would avoid the site, and there would be no ground disturbance within the vicinity. No preservation measures were recommended, and it was not evaluated for the NRHP (USACE, 2024b).

All sites identified as within the LOD are subject to direct effects from construction of Enbridge's proposed pipeline relocation, including ground disturbance from excavation or blasting, compression or rutting from traffic, and disturbance from HDD operations. Directional drilling should not be considered a low-impact installation method within the drill pathway, as potential cultural deposits above the pipeline could be affected by subsequent maintenance activities, or by errors or damage to boring equipment during installation, including discharge of drilling fluids. Subsurface archaeological sites located outside of the LOD would likely have little effect from pipeline installation methods as ground disturbance and vehicular access would be limited to within the LOD. An exception could include sites with above ground structural remains in which blasting or similar high energy disturbances occur nearby. The USACE would require monitoring of these types of sites (USACE, 2024b). Potential long-term effects to archaeological sites within the LOD include continued vehicle access and ground disturbance associated with maintenance activities. Cumulative effects on archaeological sites within the LOD could result from disturbance from maintenance work and soil compaction, soil rutting, and crushing of subsurface materials from traffic.

4.2.2.5 Historic Architectural Reconnaissance Survey

ERM completed the historic architecture survey in Ashland, Bayfield, and Douglas counties in 2019 and 2020. The survey area included the LOD and a viewshed up to 0.5-miles around the proposed facilities and vegetation clearing areas (Derrick and Tucker-Laird, 2022). The researchers followed the Wisconsin Historical Society's Survey Manual for reconnaissance surveys and evaluated sites per NRHP criteria.

Twenty-one resources were identified in the survey area, one of which was previously recorded (Table 4.2-4). Those identified included a ca. 1880 log barn, a ca. 1900 farmstead, ca. 1920s dwellings and outbuildings, a 1930s windmill, 1940s dwellings and farmsteads, and a 1955 linear ranch and garage. ERM recommended that none of these resources are eligible for NRHP listing and recommended no further consideration of them (Derrick and Tucker-Laird, 2022). The USACE determined that none of the resources within the APE are NRHP eligible (USACE, 2022; 2024b). Further information on these architectural resources is publicly available through the Wisconsin Historical Society's Architecture and History Inventory (https://wisconsinhistory.org/Records/Article/CS2834).

Table 4.2-4 Architectural resources identified within viewshed of proposed project area.

AHI #	Address	NRHP eligibility	In LOD	In USACE APE
19	74418 E Butler Road	Not Eligible*	Yes	Yes
242143	61327 Dahlstrom Road	Not Eligible+	No	No
242144	61465 Hegstrom Rd	Not Eligible*	No	Yes
242145	46240 Highway 112	Not Eligible+	No	No
242146	44620 Highway 112	Not Eligible*	No	Yes
242147	61108 Wieberg Road	Not Eligible*	No	Yes
242148	43337 G Anderson Rd	Not Eligible+	No	No
242149	61639 Highway 112	Not Eligible+	No	No
242150	South side of Marengo River Rd	Not Eligible+	No	No
242151	40955 Van de Brugge	Not Eligible+	No	No
242152	39715 North York Rd	Not Eligible*	No	Yes
242153	40133 Highway 13	Not Eligible*	No	Yes
242154	39443 North York Rd, Ashland Twp	Not Eligible*	No	Yes
242155	39221 Section 5 Rd	Not Eligible*	Yes	Yes
242156	39831 Highway 13	Not Eligible*	Yes	Yes

AHI #	Address	NRHP eligibility	In LOD	In USACE APE
242157	71098 County Road C	Not Eligible+	No	No
242158	71649 County Highway C	Not Eligible*	No	Yes
242159	36487 Golf Course Rd	Unevaluated+	No	No
242160	35561 Cooper Falls Drive	Not Eligible*	No	Yes
242161	35585 Cooper Falls Drive	Not Eligible*	No	Yes
242162	68805 Mesik Road	Not Eligible*	Yes	Yes

* USACE determination, + ERM recommendation

Little to no direct or cumulative effects to architectural resources would be anticipated to result from Enbridge's proposed pipeline relocation as much of the undertaking consists of installation of underground facilities. Indirect effects to resources could occur from vegetation removal, though these would be temporary and would not affect character defining attributes of the structures. None of the documented architectural resources within the project's viewshed are recommended eligible for the NRHP (USACE, 2022).

4.2.2.6 Summary

Table 4.2-5 shows the number of archaeological and burial sites intersected by Enbridge's proposed Line 5 relocation route and route alternatives. Table 4.2-6 presents known and mapped archaeological sites, architectural resources, and historic districts within the limits of disturbance for the proposed route and within a 120-foot buffer of the centerline for the route alternatives. Prior to Enbridge's survey of their proposed Line 5 relocation route, no archaeological sites and only one architectural resource were documented within the ROW. No cultural resources field surveys for the Line 5 project were conducted along the route alternatives. Prior to completing cultural resources survey for the project, Enbridge's proposed ROW had the fewest documented historic sites within 120 feet of the corridors. A post-survey comparison of all alignments cannot be made, as only Enbridge's proposed route was subject to survey. Completing cultural resources field investigations for alternate alignments is not required for compliance with cultural resources regulations.

Table 4.2-5 Number of archaeological and burial sites intersected by Enbridge's proposed relocation and route alternatives.

Scenario	Proposed	RA-01	RA-02	RA-03
Length of Pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Archaeological Sites (count)				
Within Permanent ROW	5	0	3	4
Within Temporary Workspace	10	0	3	4
Burial Sides (count)				
Within Permanent ROW	0	1	0	0
Within Temporary Workspace	0	1	0	0

Table 4.2-6 Cultural resources data for Enbridge's proposed Line 5 relocation route and route alternatives.

Smithsonian or burial site code	Site name	Site type
Proposed Route – Sites within limits of disturbance		
AS-0415		Historic Material Concentration
AS-0416		Farmstead
AS-0418		Farmstead
AS-0420		Cabin/homestead, logging camp
AS-0425		Farmstead
AS-0429		Isolated finds
AS-0430		Transportation site
AS-0431		Farmstead
AS-0433		Historic material concentration
AS-0436		Isolated finds
AS-0440		Historic material concentration
AS-0444		Historic material concentration
AS-0445		Historic material concentration
BA-0590		Farmstead
IR-0054		Cabin/homestead
IR-0055		Isolated finds
AHI 19	Daniel Butler Log Barn	Astylistic utilitarian building
AHI 242155	39221 Section Five Rd	Other vernacular house
AHI 242156	1001 6th St	Front gabled house
RA-01 – Sites within a 120-foot buffer		
BAS-0006	Unnamed cemetery	Cemetery
	Copper Falls State Park	NRHP historic district #5001425
RA-02 – Sites within a 120-foot buffer		
IR-0023	Steel	Cabin/homestead
IR-0028	Koski Kame	Cabin/homestead
RA-03 – Sites within a 120-foot buffer		
BA-0130	Bearsdale Creek Trader's Site	Cabin/homestead
BA-0134	Hazelett's Camp	Logging camp
BA-0139	Ox Pete's camp	Logging camp
BA-0255	West Fort Chippewa River Site	Lithic scatter
AHI 242830	42805 Telemark Rd	House
	Montreal Company Location Historic District	NRHP[1] #80000141

[1] NRHP National Register of Historic Places

4.2.2.7 Bad River Band Oral History Report

As noted in Section 3.4, the geographic scope of the Draft EIS covers not only the directly affected environment (the proposed and alternative route ROW) but the indirectly affected environment as well. This includes areas not covered by permit review. The tribal view of what constitutes the APE, what constitutes a ’traditional cultural property,’ and what makes a cultural property significant – is broader than definitions encapsulated by federal and state regulatory processes. For this EIS, the Tribal view represents the geographic scope and types of Tribal cultural places that could be affected by the proposed project. Tribal views are diverse and may be shared among sovereign tribes or held independently (Section 4.2.1). The Bad River Band’s views are especially relevant for Enbridge’s proposed Line 5 pipeline relocation, as the current route bisects the Bad River Reservation, while the proposed route traverses west, south, and east of the reservation, all within the upstream watershed, within ancestral lands of the Band. In numerous meetings, both between technical experts and with the public, tribal members and subject matter experts have expressed strong opposition to Enbridge’s proposed pipeline relocation based on effects on cultural resources.

In 2021 the USACE invited consulting tribes to conduct oral-history interviews to inform the agency about important historic properties. The Bad River Band agreed and submitted a completed report in 2023 (USACE, 2024b). The report identified 10 geographic locations as being culturally important sites (Whyte et al., 2023), an additional site was added during THPO field visits (USACE, 2024b). The USACE assessed these sites and determined that seven of them could be considered under Section 106 of the NHPA as they are within USACE’s APE. Table 4.2-7 summarizes USACE’s Section 106 determinations. Qualitative analysis on cultural resources incorporating information from the Bad River Band’s report continues in Section 4.2.3.

Table 4.2-7 Cultural resource locations identified in the Bad River Band’s oral history report.

Location number	Cultural resource	USACE eligibility determination	Treatment measure
1	Bad River	Not eligible	HDD, minimized vegetation clearing, monitoring, no blasting
2	Kakagon	Not evaluated	None, outside USACE scope of undertaking
3	Potato River	Eligible for NRHP	HDD, minimized vegetation clearing, monitoring, no blasting, limit removal and pruning of cedars within 30’ of corridor
4	Bear Trap Creek	Not eligible	Dry crossing, no blasting, monitoring
5	Copper Falls	Not evaluated	None, outside USACE scope of undertaking
6	Penokee area	Not evaluated	None, outside USACE scope of undertaking
7	Tyler Forks	Not eligible	HDD, minimized vegetation clearing, monitoring, no blasting
8	Marengo River	Not eligible	HDD, minimized vegetation clearing, monitoring, no blasting
9	White River	Not eligible	HDD, minimized vegetation clearing, monitoring, no blasting
10	Wood Creek area	Not evaluated	None, outside USACE scope of undertaking
11	Silver Creek	Not eligible	HDD, minimized clearing, monitoring

Source: (USACE, 2024b)

4.2.3 Pipeline Effects on Cultural Resources

As described in Section 4.2.1, “Anishinaabe identity is directly connected to the environmental surroundings which hold the knowledge and stories critical to the peoples’ continued survival” (Chiriboga, 2022). From this worldview, environmental destruction has deeply significant consequences. When hunting, fishing, and gathering in their traditional territories, the Anishinaabeg see their role as part of the natural and spiritual order. Three key aspects of the Anishinaabe worldview underlie Ojibwe perspectives on land altering activities:

- The differences between human and non-human beings, in terms of intelligence and awareness, capacity for emotion and intrinsic value and other characteristics, are less prominent. The Anishinaabeg consider water, animals, plants, rocks, and other manifestations of Creation as “spiritual beings.” As such, an interaction with the environment that is interpreted by a mainstream American lens (western culture) as management or harvest of inanimate and unintelligent ”resources,” might be interpreted by an Anishinaabe person as fulfilling obligations to spirits to recognize and honor them. All spiritual beings, whether human or non-human, exercise agency, have rights and warrant respect. It is customary to ask permission before harvesting a plant or animal (or even entering a sacred space) and offering Asemaa (tobacco) to the manidoog as a sign of respect.

- Humans are not the masters of the world but rather weak and pitiable creatures, dependent upon all other non-human beings for survival. The proper attitude toward the natural world is one of caretaking, humility, and gratitude.

- The relationship between humans and the rest of nature is one of reciprocity. Animals, for example, will offer themselves to a hunter as an act of pity for her or his weakness. If gifts are not accepted with respect and gratitude, the natural world will withdraw cooperation.

This worldview stresses the interconnectivity between the tangible and intangible. As one tribal member described:

> “*For example, how the loss of one small tree displaces thousands of birds that fly by and land on it because each year they remembered it’s being. If anyone bothered to acknowledge only one tree, and the number of birds, insects, and animals that rely on its existence, they might see how those beings consistently rely on that one tree, year after year. I think a migratory bird survey in Brazil did occur recently which tracked the bird back to the exact same trees in its migration pathway where it landed and nested in consecutive years. How does it know the exact same tree? The smell? The sight? The sound? Or, the sense? How will displaced birds, insects, animals, affect Creation?*” (E. Leoso, pers. comm.).

For many Ojibwe people, cultural resources cannot be separated from natural resources. The importance that the Bad River Band places on natural resources means that loss of (or diminished access to) these resources pose a distinct threat to tribal members’ lifestyle and cultural identity. Such loss would affect several aspects of the community’s culture, including its sense of place, the availability of resources for traditional practices, oral tradition and teachings, and aspects of the Ojibwe language (Dooper et al., 2018).

Tribal values for natural and cultural resources (e.g., medicinal plants, culturally or spiritually important areas or resources) are not readily quantifiable. Actions that result in the loss of a resource, or access to a resource, are considered detrimental by the tribes and cannot be mitigated. Such effects contribute to the continued erosion of tribal resources, which in turn, contributes to overall societal and health effects. For example, Dooper et al. (2018) quote a tribal member, “for the community here, if there’s an abrupt end to resources, like wild rice, it would be economically devastating to them, spiritually devastating, and emotionally devastating.” This type of loss and impact is especially significant for disproportionately affected communities such as tribal communities, as is discussed in Section 4.3.

The oral history interviews conducted by the Bad River Band’s THPO (Whyte et al., 2023) identified historical, cultural, religious, and subsistence lifeways belonging to the Bad River Band and drew the following conclusions based on the information provided by the 25 interviewees:

> *“(1) There are historic properties, including places of historic habitation and religious significance, throughout ‘the area’. Given their age and significance, the properties would likely qualify for the National Register of Historic Places.”*
>
> *“(2) There are cultural and religious properties and resources in ‘the area,’ including the habitats of plants used for traditional purposes, locations where people currently enact ceremonies, and places with monumental value because events of the Band’s origin story and other ancient stories happened in those locations.”*
>
> *“(3) There is daily dependence by the interviewees on the conservation of the environmental conditions and natural resources of the entire area, given such conditions and resources are integral to the maintenance of historical heritage and cultural, religious, and subsistence activities and practices, which include the family and cultural practices and activities that are enacted through subsistence.”*
>
> *“‘The area’ taken in its entirety has numerous properties and resources and is the location of numerous activities and practices with tangible, intangible, and monumental value in terms of their historical, cultural, religious, and subsistence significance.”*

The degree to which these resources are affected by Enbridge’s proposed pipeline relocation would vary. If quantitative values are assigned, the effects are direct and localized (Section 4.2.2). If a more holistic Ojibwe tribal perspective is used to determine effects, any proposed pipeline relocation route, route segment, or route alternative would have direct, indirect, and permanent effects on tribal members and tribal resources, including treaty resources as all of the routes are within the Ceded Territories. These effects cannot generally be categorized by extent (e.g., region of interest, construction work area, permanent right-of way). As Chiriboga (2022) states, “For the Anishinaabeg, the pipeline has already changed the barrens by changing its aesthetics. While some changes may not be perceived as generally negative, many are undoubtedly so.” Tribal members and tribal governments have expressed their desire and expectation for a healthy and functional environment that ensures a continuation of traditional lifeways and the meaningful exercise of treaty rights)(Boyd, 2022a; 2022b; Corn Sr., 2022; Wiggins Jr., 2021). The sections that follow provide qualitative assessments of effects from this perspective. As Chiriboga (2022) states, “For the Anishinaabeg, the pipeline has already changed the barrens by changing its aesthetics. While some changes may not be perceived as generally negative, many are undoubtedly so.” Tribal members and tribal governments have expressed their desire and expectation for a healthy and functional environment that ensures a continuation of traditional lifeways and the meaningful exercise of treaty rights (Boyd, 2022a; 2022b; Corn Sr., 2022; Wiggins Jr., 2021). The sections that follow provide qualitative assessments of effects from this perspective.

4.2.3.1 Effects of Pipeline Construction

Enbridge's proposed pipeline relocation route and all three route alternatives would have varying levels of effects on cultural resources dependent on their geographic proximity and the associated construction activities. Effects on cultural resources, as discussed in this section, would be similar regardless of the route alternative.

As described in Section 4.2.2, most construction-related effects would be temporary to short-term and restricted to the construction work area, temporary workspaces, access roads, pump stations, and materials staging areas. In this manner, construction-related activities pose threats to waters, natural resources, and important cultural resources through the unavoidable disturbances during construction, as well as from the resulting environmental alterations. Potential effects could be long-term or permanent, minor or major effects. Indirect effects on some types of resources also could occur downstream or within a larger geographic area.

Construction across waterbodies could result in increased turbidity and sedimentation (Section 5.6.3.3). Any waterbodies or streams crossed by the routes could experience increases in storm water runoff and erosion from cleared vegetation, increases in turbidity and sedimentation, changes to stream flow due to horizontal directional drilling testing water, or degradation of aquatic habitat from instream construction. Such changes could potentially affect wild rice habitat and production, as well as fisheries. Enbridge has developed applicant-proposed measures intended to minimize these types of effects (Enbridge's EPP, Appendix D).

The extent of the Bad River Band's dependence upon and interdependence with its natural resources, and especially its water resources, is unique. The water resources of the Tribe are integral to its members' health, welfare, and economic security, as well as the economic and political integrity of the Tribe itself. The Tribe has depended on the ability of the natural resources, particularly the water resources, to provide cultural preservation and resources for consumption, subsistence, and sustainable economic development.

The Bad River Band's water quality standards include an antidegradation policy applicable to all surface waters of the Reservation. The narrative criteria for aesthetic water quality, require:

> *All waters (including wetlands) within the Reservation shall be free from substances, attributable to wastewater discharges or pollutant sources resulting from other than natural background conditions, that:*
>
> a. *Settle to form objectionable deposits;*
> b. *Float as debris, scum, oil, or other matter forming nuisances;*
> c. *Produce objectionable color, odor, taste, or turbidity;*
> d. *Cause injury to, are toxic to, or produce adverse physiological responses in humans, animals, or plants;*
> e. *Produce undesirable or nuisance aquatic life;*
> f. *Produce nutrients or other substances that stimulate algal growth producing objectionable algal densities, nuisance aquatic vegetation, dominance of any nuisance species instream, or cause nuisance conditions in any other fashion; or*
> g. *Adversely affect the natural biological community of the waterbody.*

Failure to meet the criteria constitutes an enforceable violation of the water quality standards, and no discharge that has the potential to create or support a violation of these Narrative Criteria shall be approved.

Although several acres of open water would be affected by Enbridge's proposed route and each of the route alternatives, the effects on waterbodies during construction would likely be minor and temporary. Effects also would vary dependent on the quality of the existing waterbody. Tribes remain very concerned about sedimentation, inadvertent releases of HDD drilling fluids, and oil spills. Releases during construction could directly affect tribal resources, including, but not limited to, water quality, wild rice, aquatic animal species, and plants used for medicines (Section 4.2.1). For instance, impacts to high-quality waterbodies, like trout streams and wild rice waters, could decrease the suitability of surface water as a habitat for sensitive species or degrade the existing beneficial use of the waterbody. The effects would vary based upon the proximity of the resource and the type of resource, as well as the size and type of release. Even if contained quickly, tribes state the resulting effects would compromise their protected landscapes. An example of this would be a spill during equipment refueling that could enter a wild rice water if not contained. As some spills could affect reservation land, these effects could have a major impact on tribes. Tribes do not have the ability to replace lost resources in a different location or to move away from their reservations.

Enbridge's proposed Line 5 relocation route and route alternatives would cross Ceded Territories. Ancestral cultural sites within ceded lands would be subject to irreparable damage, if directly crossed by construction activities that cause ground disturbance or potential indirect visual effects or access restrictions; these effects, in turn, would damage each tribe's heritage. The Band's Oral History Report indicates that the proposed routes could affect burial sites, animal and plant subsistence sites, gathering sites, fasting sites, historic habitation sites (including former tribal allotments), physical features such as mountains and waterways, spiritual sites, and sites of monumental cultural value, including locations central to the Ojibwe origin story (Whyte et al., 2023).

Construction work areas, including temporary work spaces and access roads, would result in fragmentation of forests and changes in forest composition, resulting in impacts to other beings (plant and wildlife populations; Sections 5.9 and 5.10). Effects could be permanent and major depending on the habitat and beings present. As discussed in Sections 5.9 and 5.10, these effects could include decreases in total habitat area, amount of interior habitat, biodiversity (species richness), and connectivity. Fragmentation also could cause an increase in the amount of edge habitat, increase the risk of non-local beings (invasive species) spread, and isolate some habitat types. These types of effects could affect tribal resources consisting of both plant and animal beings.

Tribal access to resources on public lands, such as hunting and fishing areas, could be restricted due to closed work areas. During construction, prohibitions on hunting and fishing would be placed within the construction work area, which would typically be a moving area 120 feet wide and several miles long corridor. Hunting success could be depressed in the larger area surrounding active construction and would likely be avoided by tribal hunters. A temporary loss of these activities during construction would result in negative effects on tribal members, particularly if the prohibition coincided with a peak hunt, harvest period, or ceremonial event, which could in turn cause economic, subsistence, and health effects. In the company's comments on the Draft EIS, Enbridge (2022a) emphasized "Enbridge will not impede the lawful exercising of the right to hunt, fish, or gather on property open to the public. In areas where the rerouted Line 5 crosses public land, members of the Signatory Tribes and public can lawfully hunt, fish or gather; however, to ensure public safety, access to the right-of-way will be temporarily restricted during active pipeline construction or maintenance activity. During active construction or maintenance activity, Enbridge will make its best efforts to accommodate requests for access to the ROW for all such lawful activity and will identify a point of contact to coordinate access locations and timing to ensure public safety."

The loss of medicinal and traditional plants could be a short-term to permanent effect with a magnitude ranging from minor to major. If the same beings were replanted during revegetation, the effect would be reduced. As shown in Section 5.9.2, the potential effects on forested land would be long-term to permanent and major for all route alternatives due to the long period of time required for forest regeneration. Loss of trees would be a direct effect on tribal resources, particularly for important species like black ash, white ash, birch, sugar maple, northern white cedar, balsam fir, and hemlock. “The ability to maintain and pass on traditional knowledge and teachings associated with these relatives is directly connected to their existence and wellbeing as well as our ability to harvest in these areas” (Boyd, 2022b).

An effect that could occur due to construction is the spread of non-local beings (invasive species), which are often introduced by construction equipment and seed mixes used for restoration. Over time, non-local beings can outcompete native vegetation and change plant composition, altering the types and quantity of medicinal and traditional use plants. Some non-local beings, such as wild parsnip, contain chemicals that are phototoxic and cause severe damage to the skin of anyone who comes into contact with it. When beings, such as wild parsnip, become established, a further diminishment of medicinal plant resources and a diminishment of the right to gather them due to the phototoxicity of the surrounding vegetation occurs. Noxious weeds and invasive species are discussed in Section 5.11.

Indirect construction-related effects would include, but are not limited to, dust, vibration, noise, and air quality changes (Sections 5.1 and 5.3). Enbridge has identified various measures to limit these effects, such as dust suppression, limiting idling by construction vehicles, and covering spoil piles (Enbridge’s EPP, Appendix D).

Increased noise levels could result from normal construction activities, such as clearing, grading, and trenching. The greatest noise effects during construction would result from blasting (Section 5.1.6.3) and HDD operations (Section 5.1.6.4). Wildlife could be affected directly by construction activities or indirectly from disturbances caused by human activity and noise associated with construction activities (Section 5.10). Increased noise could cause hunted species, such as white-tailed deer, to leave the area, resulting in an impact on tribal hunting practices. Since construction-related noise is temporary, the deer may return later, resulting in this effect being temporary to short-term.

Impacts on air quality during construction would be short-term, minor, and localized (Section 5.3). This is primarily due to the nature of the construction activities, in which people and equipment move along the route, thus limiting the exposure of residents and resources in any one area. Air quality also would be indirectly impacted through the removal and burning of trees, some species of which are important resources for Native American peoples.

4.2.3.2 Effects of Pipeline Operations

As described throughout Chapter 5, effects from pipeline operations would largely be associated with impacts on vegetation associated with maintenance of a permanent pipeline ROW and aboveground facilities, as well as air emissions from pump stations. Chiriboga (2022) argues “Pipeline maintenance activities are obvious and noticeable. When they occur without proper warning to the community or notification of Tribes, they lead to concern and stress. Ultimately these activities could affect the important cultural stories related to the landscape.”

The largest potential effect on cultural resources from pipeline operations would be an incident that resulted in the accidental release of oil (Chapter 6). In the event of an accidental release of oil, the severity of effects would depend on the location and type of cultural resources within the area of and downstream from the spill. Any release affecting a wild rice water or a walleye, lake trout, or lake sturgeon water would cause irreparable effects on cultural resources. Tribal members have also expressed concerns that oil could potentially wash into the Bad River Band's Pow Wow grounds or other sacred sites, impeding their use and affecting important tribal gatherings.

Tribal members and leaders have also expressed concerns about repeated noise from aerial surveillance and from ROW maintenance (i.e., clearing encroachment of woody vegetation). Although these effects would generally be temporary to short-term and restricted to the area of the construction ROW, they would recur on a periodic basis.

4.2.3.3 Cumulative Effects

When past, present, and reasonably foreseeable future actions are analyzed in concert with the proposed route, the potential for cumulative effects on tribal resources would be present. Incremental effects (or cumulative effects) on Native American communities are part of a larger pattern of structural racism, or "the normalization of an array of dynamics—historical, cultural, institutional and interpersonal—that routinely advantage white people while producing cumulative and chronic adverse outcomes for people of color and American Indians" (Minnesota Department of Health (MDH), 2014). These cumulative effects are important considerations in the context of environmental justice, as described in Section 4.3. These patterns are perpetuated when "decisions are made without accounting for how they might benefit one population more than another, or when cultural knowledge, history and locally generated approaches are excluded. When this happens, programs and policies can reinforce or compound existing race-based inequities" (MDH, 2014). Chiriboga (2022) describes how, "Pipelines like Line 5 are particularly difficult in this regard because they are traditionally permitted in piecemeal and fragmentary fashion by different regulatory agencies according to land ownership. This creates a situation where the same pipeline or pipeline company is operating under different permits, maintenance requirements, and regulatory oversight. This creates not only confusion, but risks diminishing the holistic view that Anishinaabe embody: protection and respect for all beings."

The tribes look at not just the immediate effects, but what is going to potentially affect future generations (Peacock and Wisuri, 2002). For example, the goal of the Bad River Band's Integrated Resources Management Plan is "to maintain and improve the health of ecosystems within the Bad River Reservation for at least seven generations, while providing resources at a sustainable level of harvest" (Bad River Band of Lake Superior Chippewa, 2001). Similarly, three principles guided the tribe's development of the plan: "1) protection of the environment and natural resources; 2) respect for the earth and all living things; and 3) the belief that we have a moral responsibility to the Seventh Generation" (Bad River Band of Lake Superior Chippewa, 2001). In addition, the plan includes statements that "We believe we have a moral responsibility to the Seventh Generation," and "the Seventh Generation is entitled to at least the same environmental quality that we presently enjoy." In this manner, Ojibwe people link the time of the ancestors to that of the descendants. Similar sentiments were expressed in tribal correspondence to the DNR (Meierotto, 2021; Boyd, 2022a; 2022b; Wiggins Jr., 2022a).

Many of the existing resources and the environment that was in place prior to clear cutting and activities related to other infrastructure projects (e.g., roads, transmission lines, development) have been cumulatively diminished. In a letter to the USACE, the former chairman of the Bad River Band raised concerns about these types of cumulative effects stating, "The Reservation and watershed are already facing numerous environmental stressors from other impending projects and past industrial contamination…" including "the disruptive effects of the Xcel transmission line, hazardous liquid leaks from oil tankers and steel plants, and runoff and mercury deposition from new and historic mining in the region" (Wiggins Jr., 2022b). Similarly, in the Bad River Band's comments on the Draft EIS (Wiggins Jr., 2022a), the tribe noted "the Wisconsin Public Service Commission is currently considering a permit that would enable the construction of the Xcel Transmission Line which will also degrade habitat around the perimeter of the

Reservation… Such degradation will impact cultural and historic properties important and necessary to the Ojibwe culture."

In their comments to the USACE (Boyd, 2022b), the Red Cliff Band offered an additional illustration of cumulative effects:

> *"Ash trees are culturally significant relatives that help us to make cradleboards, snowshoes, traditional lacrosse sticks, and baskets. The prevalence of white ash and black ash trees in this area is expected to diminish due to Emerald Ash Borer and the changing climate. These barriers to access ash trees would be compounded by the proposed L5 Project construction, the existence of the Right of Way, and the unfathomable potential of an oil spill. The ability to maintain and pass on traditional knowledge and teachings associated with these relatives is directly connected to their existence and wellbeing as well as our ability to harvest in these areas."*

Neither Enbridge's proposed Line 5 relocation route nor the route alternatives would cross reservation lands; however, they would cross Ceded Territory lands on which tribes exercise their treaty rights to access tribal resources. Hunting, fishing, traditional use of resources, and gathering is ceremonial—these activities are not just for subsistence , but to bring a whole community together to connect with the outside world. As such, the tribes indicate any major changes to the environment affects not only the ceremony, but people's mental, physical, and spiritual health.

The Native American tribes are emphatic that Enbridge's preferred route and the route alternatives would have long-term detrimental effects on tribal lands, natural resources, cultural resources, spiritual places, medicines, food, and tribal members. These effects cannot be categorized by duration (short term or permanent) or by extent (region of interest, construction work zone, or pipeline ROW). It is also not possible to determine which alternative is better when each alternative affects tribal resources, tribal identity, and tribal health.

While non-quantifiable effects are difficult, if not impossible, to mitigate, tribes feel they should be entrusted with the inspection, monitoring, and maintenance activities in and through their lands and territories as they are most familiar with their resources.

4.2.3.4 Climate Change Impacts on Cultural Resources

In a letter to the Army Corps of Engineers, the former chairman of the Bad River Band stated, "This indirect impact is relevant to the project's effects on the Band's cultural property because climate change will irreversibly change the Reservations' habitat and environment. Some cultural sites are associated with the unique feeling of being present there or special animals or plants that are found in only certain areas of the Reservation and Ceded Territory. Climate change, which this pipeline will contribute to, will disrupt the ecosystem on the Band's Reservation, making it impossible for the Band's citizens to access and maintain special sites key to the Band's cultural heritage" (Wiggins Jr., 2022b). All tribes that participated in consultation and collaboration explained their belief that any new oil transportation infrastructure would lead to increasing GHG emissions and reducing chances of meeting pollution reduction targets.

Many studies confirm that climate change impacts threaten tribal lands and resources, ways of life, culture, and economies (WICCI, 2020; 2021; GLIFWC Climate Change Team, 2023). As noted throughout this EIS, Enbridge's proposed Line 5 relocation route and all three route alternatives are located within territories ceded to the United States under treaties. These lands and associated resources are important to preserving the traditional ways of life, including fishing, hunting, wild rice farming, maple sugar gathering, the collection of plants for medicines, spiritual, and ceremonial purposes, shelter, and other needs.

Studies indicate rising temperatures, hotter, drier summers, and more frequent and intense storms will adversely affect water quality and quantity in the Great Lakes region, endangering homes, human health and safety, economies, and culturally important species. Climate change could also shift or reduce the habitat ranges of culturally significant plant and animal species, such as medicinal plants and traditional foods like wild rice, thereby affecting the ability of tribal communities to harvest these species (Norton-Smith et al., 2016). In addition, tribes are tied to specific geographic locations due to the presence of their reservations and cultural, spiritual, and natural resources that sustain them. For many tribes, the reservation is a primary location for practicing traditional lifeways and for providing for its members. If effects are permanent, tribes do not have the ability to replace lost resources in a different location or to move away from the reservation.

The effects of climate change could potentially exacerbate pipeline construction and operation related effects (e.g., declines in water quality from increased surface water runoff or streambed disturbances, permanent alteration or loss of habitats, loss of culturally important species, etc.).

4.2.3.5 Health Effects

Effects on tribal resources would affect the mental and physical health of tribal communities. A belief in the interrelationships of the physical, emotional, and spiritual selves is a fundamental aspect of the Ojibwe way of being (Peacock and Wisuri, 2002). Tribal leaders, during consultation with DNR leadership and staff, reinforced the belief that the health of the tribes and their members directly relates to the health of the ecosystem. Tribes manage their lands within their reservation boundaries, but they also watch the land and water that surrounds the reservation boundaries because their history and way of life is not limited to the boundary lines on current-day maps. What tribal communities choose to protect helps define them as a people. Nearly all tribal members who submitted comments on the Draft EIS suggested that the proposed Line 5 relocation route and route alternatives, including keeping the current Line 5 in place and/or abandonment, would add to the negative mental, spiritual, and physical health effects already disproportionately suffered by Native American populations. These increased rates of mental health problems, suicide, and substance use, especially among youth, have been documented by research over time (Gone and Trimble, 2012; Norton-Smith et al., 2016; Kwon, Kabir, and Saadabadi, 2024).

Ojibwe cultures have a deep and longstanding connection with the natural environment (Section 4.2.1.2). This connection is integral to cultural identity and the loss of cultural resources could result in profound impacts on mental health including increased incidence of alcoholism, depression, and suicide. In a letter to the Army Corps of Engineers, the former chairman of the Bad River Band stated, “The proposed project threatens public health and safety, will likely be highly controversial, and will involve unique risks to the communities downstream of the project area” (Wiggins Jr., 2022b).

As summarized by Dooper et al. (2018),

> *“Tribal members suggested that loss of land, species, and traditional lifestyles also have mental health implications. One tribal elder shared that “elders are experiencing grief related to the loss of rice. They try to bring elders out [to the rice beds] but they don’t go because they don’t want to see what has changed” (Participant 11). Another elder described that the “loss of a resource is just the same as the loss of one of your relatives…it’s deeper than thinking of them as resources in that way. It means a part of your teachings, a part of your culture, is not going to be there.” (Participant 14). This description of grief and loss indicates a deep social-emotional connection to natural resources and reflects the potential mental health impacts of environmental change.”*

> *"Tribal members shared that healthy living and overcoming social issues related to historical trauma, poverty, incarceration, and drug and alcohol use can be achieved by maintaining a proper relationship with the environment."*

The potential effects are amplified by the fact that Enbridge's proposed relocation route and all three route alternatives run through the Ceded Territories and around the Bad River Reservation. Several tribal members expressed concern that any road closures in the region, due to construction or a major pipeline failure, could isolate the Bad River community from basic services and could isolate family members living in different regions from each other. The consequences of construction and the constant threat of a spill that could affect traditional cultural practices would have long-term consequences to this community. The emotional toll of a spill in the area would be devastating.

4.2.4 Additional Considerations

While Sections 4.2.1-4.2.3 focus on Ojibwe lifeways, it is important to recognize that members of other tribal nations with interests in northern Wisconsin may hold similar views to those of the Ojibwe. For example, a letter to the DNR from the Brothertown Tribe commented, "We understand in our lifeways that Water and Earth are necessary elements - having sustained life for more than seven generations prior to this; and each are necessary to sustain future generations… We depend on these living beings for medicine, food, water, shelter, air purification, climate control and so much more. Therefore, we have tremendous respect for these essential elements and a responsibility to protect them for future generations" (Ryan, 2020).The Brothertown Indian Nation letter further noted, "Honoring and recognizing the strong belief system and traditional views of American Indians as to the living spirit embodied within all things; recognizing that all things are interwoven and inter-connected in a way that encourages each of us to look out for one another, to respect one another, to be responsible for one another as equals - those values are worth acknowledging and respecting… (Ryan, 2020)."

Similarly, many of the cultural resources discussed in Sections 4.2.1-4.2.3 have significance to other Native American peoples in the state and surrounding states. For example, wild rice features in the lives of numerous tribes. Oral tradition of the Menominee Tribe, whose English name derives from the Ojibwe word for "wild rice man" (GLIFWC, 2016), explain Manoomin was the gift of one of the Underneath beings and that tobacco offerings are necessary to insure a good harvest (Milwaukee Public Museum, 2023). The annual, three-day St. Croix Wild Rice Pow-wow, in existence for more than 20 years, takes place at the Tribal Center in Hertel in late August and hosts drums and singers from tribes all over North America. The Oneida Nation recently restored about 3,000 acres of wetlands, grasslands, prairies, and forests on its reservation and is now working to restore wild rice in the area (Vaisvilas, 2023).

Lake sturgeon hold cultural significance for several additional tribes (Holzkamm and Waisberg, 2004; J. Mitchell, 2013). For example, the Menominee people consider lake sturgeon to be an ancestral relative of their tribe. In the tribe's creation story, the Menominee people originated from the bear. The lake sturgeon is the younger brother of the bear and is a leader of one of the Menominee bands. The Menominee Reservation encompasses Keshena Falls, known in the Menominee language as Nama¨ o Uskı´wa¨mıˆt, meaning sturgeon spawning place (Beck, 1995). Wolf River and Lake Winnebago sturgeon congregated at Keshena Falls each spring to spawn, and they were an important and reliable source of fresh meat. The lake sturgeon is also known as the keeper of the wild rice (Beck, 1995; Runstrom et al., 2002). The Menominee would honor the sturgeons return with a ceremonial feast and fish dance and give thanks to the higher power with a sacrificial offering of sturgeon (Beck, 1995; Grignon, 1994).

As noted in Section 4.1.2, several tribes in Wisconsin and Michigan provided extensive comments on the Draft EIS, which were made publicly available on the DNR website. The DNR considered the full range of views and cultural resources of all tribes during preparation of the Final EIS.

4.3 Environmental Justice

This section discusses environmental justice considerations, which were a common theme raised during public scoping and drafting of the EIS. The advancement of environmental justice is meant to address the effects of decision making over time that could have led to disproportionate adverse effects on health and well-being, and also the disproportionate exclusion of some groups from accessing environmental benefits such as access to nature in green and blue spaces (parks, trees, waterbodies, etc.). The EPA has adopted the definition established in President Biden's Executive Order 14096, which takes a whole-of-government approach, directing all federal agencies to incorporate the advancement of environmental justice in their policies and practices:

> *"Environmental justice' means the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other Federal activities that affect human health and the environment so that people:*
>
> - *are fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards, including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural or systemic barriers; and*
> - *have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices."*

And so environmental justice is pursued through meaningful involvement, with the goals of addressing disproportionate and adverse effects and enabling equitable access.

In the context of the proposed Line 5 relocation, environmental justice relates to how the benefits and costs of the proposed project–environmental, socioeconomic, cultural, public health, and safety–are distributed among different communities, and in particular, among Native American and economically disadvantaged communities in the region. An important aspect of environmental justice is the free, prior, and informed consent of the peoples affected by environmental laws, regulations, and policies.

For many Native Americans throughout Wisconsin and the United States, disproportionate effects are part of their generational experience of genocide, forced relocation, cultural suppression, and political exclusion (Wisconsin Department of Health Services, 2024). The result of these unjust laws and practices have led to significant disparities amongst Native American communities when it comes to their health and well-being, such as higher rates of incarceration, higher rates of removal from their homes through the child welfare system, lower educational outcomes, and health effects (O'Connor et al., 2015; National Indian Child Welfare Association, 2015; Prison Policy Initiative, 2024). For example, COVID-19 hospitalization rates are 1.6 times higher for Native American Wisconsinites compared to white Wisconsinites, and Native Americans in Wisconsin also experience a higher rate of infant mortality (Timberlake, 2022). As recommended in the CEQ guidance, "Agencies should recognize the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed agency action."

Part of that recognition as it relates to Native American communities is the deep cultural, spiritual, and historic connection between people and natural resources. As discussed in Sections 4.2.1-4.2.3, many of the anticipated and potential effects of the proposed project on natural resources (described in Chapter 5) would have further cultural, spiritual, and social effects particular to the Ojibwe people. As described by Deborah McGregor (2018), Canada Research Chair in Indigenous Environmental Justice at York University, and an Anishinaabe, "Indigenous environmental justice" or Mino-Mnaamodzawin (living well with

Earth) views all plants, animals, land, water, and air as sentient beings–relatives to one another and to humans–deserving of protection, with inherent rights and responsibilities to help maintain the balance of life on the planet.

The anticipated environmental justice effects of Line 5 have recently received international attention as human rights issues. The United Nations (UN) Permanent Forum on Indigenous Issues serves as a high-level advisory body to the UN's Economic and Social Council. Representatives of the Bad River and Red Cliff Bands and other indigenous leaders have urged the UN Permanent Forum to consider environmental and human rights concerns associated with Line 5 (Stebbins, 2023). The UN Permanent Forum issued a report in April 2023 that "calls upon Canada to re-examine its support for the Enbridge Line 5 oil pipeline, which jeopardizes the Great Lakes in the United States. The pipeline presents a real and credible threat to the treaty-protected fishing rights of Indigenous Peoples in the United States and Canada. The UN Permanent Forum recommends that Canada and the United States decommission Line 5" (Economic and Social Council, 2023).

In July 2023, an international human rights expert appointed by the UN Human Rights Council released a report in which he recommended Canada "cease construction or operation of" several pipelines, including Line 5, until the "free, prior, and informed consent of the Indigenous Peoples affected is secured" (Tzay, 2023). The Special Rapporteur's report states,

> *"For example, Canada continues to support the operation of the Line 5 pipeline, despite the opposition of directly affected Indigenous Peoples in Canada and the United States of America. The transportation of crude oil and liquid natural gas by Canadian-owned Enbridge is creating the risk of a catastrophic oil spill that could contaminate the lands and waters of Indigenous Peoples on both sides of the border. Canada is advocating for the pipeline to continue operations, following the decision of a Parliamentary Committee that did not hear testimony from the affected Indigenous Peoples. The Government invoked the 1977 transit pipeline treaty with the United States to prolong Line 5 operations, which is inconsistent with its international commitment to prevent and mitigate the effects of climate change by phasing out fossil fuels"* (Tzay, 2023).

4.3.1 General Approach Used in This EIS

In considering environmental justice in relation to effects of Enbridge's proposed Line 5 relocation, the DNR followed the guidance developed by the CEQ (CEQ, 1997) for NEPA compliance. The CEQ guidance states that:

> *There is not a standard formula for how environmental justice issues should be identified or addressed... Agencies should determine whether minority populations, low-income populations, or Indian tribes are present in the area affected... [and] whether there may be disproportionately high and adverse human health or environmental effects on [those] populations, or Indian tribes.*

The CEQ guidance further states that:

> *Agencies should recognize that the question of whether [an] agency action raises environmental justice issues is highly sensitive to the history or circumstances of a particular community or population, the particular type of environmental or human health impact, and the nature of the proposed action itself...*

Following the CEQ guidance on environmental justice and selected "promising practices" reported by the Federal Interagency Working Group on Environmental Justice and NEPA Committee (2016), the DNR took a hybrid approach that included an analysis of Census data to confirm the presence of economically-disadvantaged and Native American communities in proximity to Enbridge's existing, proposed, alternative pipeline routes, and a series of discussions with tribal members and staff from the Bad River, Red Cliff, and Lac du Flambeau Bands of Lake Superior Chippewa, the Forest County Potawatomi Community, and GLIFWC. Finally, DNR staff conducted background research on the Missing and Murdered Indigenous Women (MMIW) crisis to better understand the safety concerns disproportionately experienced by Native American communities, and, therefore, directly tied to environmental justice.

4.3.2 Identifying Disproportionately Affected Communities in the Region

The DNR used Census data to evaluate the presence and concentration of low-income, minority, and Native American populations in proximity to Enbridge's existing Line 5 ROW, proposed Line 5 relocation route, and route alternatives. The U.S. Census aggregates data at various geographic levels, the smallest of which are Census blocks. These data, however, are limited to the basic demographics tracked by the ten-year census. The next level up, Census block groups, are the smallest unit for which results of the continuous American Community Survey are reported. Block groups within five miles of the proposed and alternative routes were considered in the analysis (Figure 4.3-1). A five-mile buffer represents a rational area to account for socioeconomic characteristics as the populations residing within this buffer would be most affected most by the proposed project. Therefore, several of the Census block groups within Ashland, Bayfield, Douglas, Iron, and Sawyer counties were included in the evaluation for Enbridge's proposed relocation and all route alternatives. Table 4.3-1 summarizes the number of Census blocks groups and the total areas within five miles of the proposed route and route alternatives.

Table 4.3-1 Number of Census blocks, block groups, and total areas within five miles of Enbridge's proposed Line 5 relocation route and route alternatives.

Route	Number of Census blocks within 5 miles of route[1]	Number of Census block groups within 5 miles of route[1]	Counties within 5 miles of route	Total block area considered (square miles)
Proposed reroute	1,097	18	Ashland, Bayfield, Iron	582.6
RA-01	968	18	Ashland, Bayfield, Iron	524.5
RA-02	1,044	19	Ashland, Bayfield, Iron	720.9
RA-03	1,564	26	Ashland, Bayfield, Douglas, Iron, Sawyer	1,306.1

[1] Block and Block Group data source: 2020 United States Census.

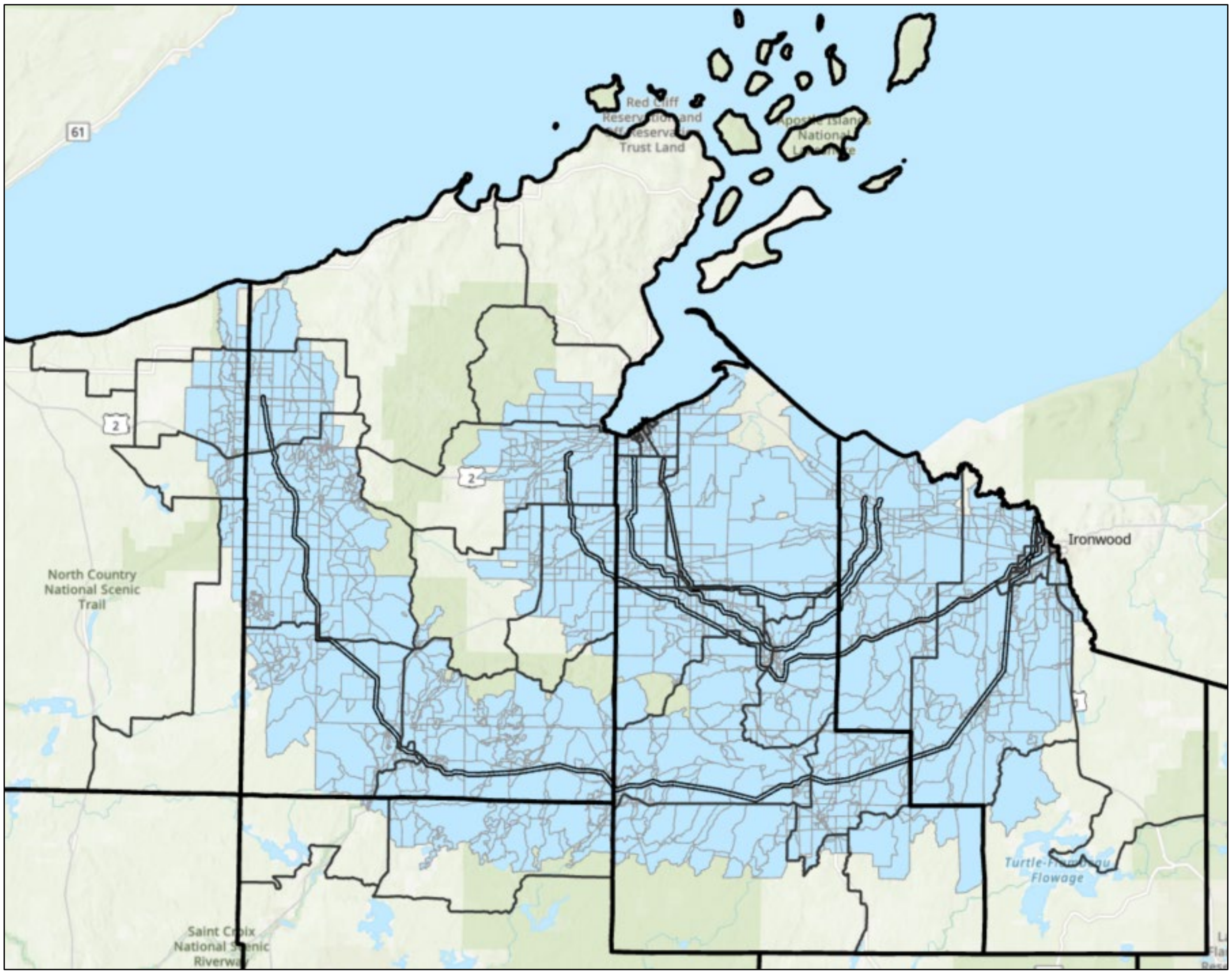

Figure 4.3-1 Census blocks within a 5-mile buffer of Enbridge's proposed Line 5 relocation route and route alternatives.
Source: DNR

The U.S. Census Bureau collects data on United States residents through the decennial census and American Community Survey. The DNR used data from decennial censuses and American Community Survey to compute the socioeconomic characteristics of the three-county area. The Census Bureau administers the American Community Survey annually and extrapolates data based on a small sample size. To address any numerical biases arising from this survey approach (i.e., too few residents sampled from a rural area), the Census Bureau aggregates data into five-year reports to increase the number of observations (residents) and strengthen the estimates. Where possible, the DNR used the 2022 American Community Survey 5-year report (2022) as it represents the most recent 5-year report available from the Census Bureau. Although the entire population of a block group does not fall within the established five-mile buffer and therefore the American Community Survey estimates are likely to be upward biased, it is the only suitable approach given the availability of the socioeconomic indicators of interest at the block group level. To provide context for the numbers, the DNR looked at the socioeconomic characteristics along each route and compared those with the average figures from the three counties (Ashland, Bayfield, and Iron) as well as from the entire state.

Table 4.3-2 presents regional and statewide demographic characteristics. The population increased in all counties between 2010 and 2020 except for Ashland County, where the population declined by 0.8%. The highest population increase (8.0%) occurred in Bayfield County. The population in Wisconsin increased by 3.6% in the same period. Population densities range from 8 persons per square mile in Iron County to 15 persons per square mile in Ashland County, significantly lower population densities than found in Wisconsin as a whole. Among ethnic groups, “white” is the most frequently identified race in all local counties including Wisconsin. In each of the counties, the second most frequently identified race is “Native American/Alaska Native.”

The residents of Iron County have the highest median age (56 years) while the residents from the Red Cliff Reservation have the lowest median age (29 years). Bayfield County (31.9%) has the highest percent of adult population holding a bachelor’s degree or higher followed by Iron (22.6%) and Ashland counties (18.6%). The Red Cliff Reservation (10.6%) and Bad River Reservation (9.7%) have the highest percentage of adult population with less than a high school education and lower percentages (8.7% and 11.1%, respectively) of adult population with a bachelor’s degree or higher (Table 4.3-2).

Table 4.3-2 Regional demographics, 2020.

	Ashland County	Bayfield County	Iron County	Bad River Reservation	Red Cliff Reservation	Wisconsin
Population						
2010 Population[1]	16,157	15,014	5,916	1,479	1,123	5,686,986
2020 Population	16,027	16,220	6,137	1,545	1,403	5,893,718
Change in population (number), 2010 to 2020	-130	+1,206	+221	+66	+280	+206,732
Change in population (%), 2010 to 2020	-0.8%	+8.0%	+3.7%	+4.5%	+24.9%	+3.6%
2020 Population Density (persons per sq. mile)	15.3	11.0	8.1	7.9	61.8	108.8
Median Age[2] (years)	42.2	53.6	56.1	44.1	29.4	39.9
Educational attainment[3]						
Less than high school graduate	5.9%	5.0%	4.8%	9.7%	10.6%	7.4%
High school graduate (includes equivalency)	35.5%	27.9%	33.0%	33.5%	30.8%	30.4%
Some college or associate's degree	40.0%	35.2%	39.6%	45.7%	49.9%	32.5%
Bachelor's degree or higher	18.6%	31.9%	22.6%	11.1%	8.7%	29.7%
Race & ethnicity						
White	79.1%	82.9%	94.7%	19.0%	11.4%	78.6%
Black or African American	0.7%	0.3%	0.2%	0.3%	0.1%	6.2%
Native American/Alaska Native	12.5%	9.9%	1.0%	72.6%	78.3%	0.8%
Asian	0.5%	0.2%	0.2%	0.0%	0.1%	3.0%
Native Hawaiian/Other Pacific Islander	<0.1%	<0.1%	<0.1%	0.1%	0.0%	<0.1%
Some Other Race	0.1%	0.3%	0.4%	<0.1%	0.3%	0.3%
Two or more races	4.6%	4.5%	2.3%	3.7%	4.4%	3.5%
Hispanic or Latino (any race)	2.4%	1.7%	1.2%	4.3%	5.4%	7.6%

Unless otherwise noted, data are from the US Census Bureau’s 2020 Census, Table P9.

[1] US Census 2010 decennial census.

[2] U.S. Census Bureau. "Age and Sex." American Community Survey, ACS 5-Year Estimates Subject Tables, Table S0101, 2022.

[3] U.S. Census Bureau. "Educational Attainment." American Community Survey, ACS 5-Year Estimates Subject Tables, Table S1501, 2022. Expressed in terms of percentage of adult population (equal or greater than 18 years of age).

The American Community Survey collects unemployment and labor data. The DNR reviewed five-year average data from 2018 to 2022 for the three-county region (Table 4.3-3). Unemployment in the region ranged from an average of 3.6 percent (Bayfield County) to 13.1 percent (Bad River Reservation). The unemployment rate is higher on the Bad River and Red Cliff reservations in comparison to the unemployment rates in the surrounding counties, which have higher unemployment rates in comparison to Wisconsin as a whole (3.4%).

Table 4.3-3 includes both the mean and median household income for the study areas. While median household income ranged from $50,214 on the Red Cliff Reservation to $67,266 in Bayfield County, the mean household income ranged from $59,304 on the Red Cliff Reservation to $85,328 in Bayfield County. Median income is lower than that of the mean household income indicating the existence of outliers (extremely high-income levels of some households). The study areas have lower mean and median household incomes than Wisconsin as a whole.

About 5.4 percent of the population were without health insurance in Wisconsin. The Red Cliff Reservation has the highest share (14.7%) of uninsured population in the three-county region, while Bayfield County has the lowest share (5.8%) of uninsured population.

Table 4.3-3 Employment, income, and health insurance by region.

	Ashland County	Bayfield County	Iron County	Bad River Reservation	Red Cliff Reservation	Wisconsin
Labor Force[1] (number)	8,072	7,718	2,804	764	572	3,130,460
Unemployment rate[1]	4.4%	3.6%	3.9%	13.1%	12.9%	3.4%
Median household income[2] ($2022)	$57,000	$67,266	$55,777	$65,750	$50,214	$72,458
Mean household income[3] ($2022)	$71,624	$85,328	$69,652	$72,859	$59,304	$94,995
Population without health insurance[4]	6.5%	5.8%	6.2%	9.2%	14.7%	5.4%

[1] U.S. Census Bureau. "Employment Status." American Community Survey, ACS 5-Year Estimates Subject Tables, Table S2301, 2022. Labor force includes population of 16 years and over.

[2] U.S. Census Bureau. "Median Income in the Past 12 Months (in 2022 Inflation-Adjusted Dollars)." American Community Survey, ACS 5-Year Estimates Subject Tables, Table S1903, 2022.

[3] U.S. Census Bureau. "Mean Income in the Past 12 Months (in 2022 Inflation-Adjusted Dollars)." American Community Survey, ACS 5-Year Estimates Subject Tables, Table S1902, 2022.

[4] U.S. Census Bureau. "Selected Characteristics of Health Insurance Coverage in the United States." American Community Survey, ACS 5-Year Estimates Subject Tables, Table S2701, 2022.

Table 4.3-4 presents the socioeconomic characteristics along Enbridge's proposed Line 5 relocation route and route alternatives. As the proposed relocation and RA-01 are located close to each other (Figure 4.3-1), they have common block groups within the five-mile buffers. Therefore, the results for both routes appear in the same column. The Census Bureau uses a diversity index to measure the likelihood that two randomly selected people within a defined geography (block, county, state, etc.) will be from different races and/or ethnicity groups. The diversity index of an area ranges between 0 and 1. A value of 0 indicates the population of the area constitute a single ethnic group while the value of 1 indicates equal shares of all ethnic groups—suggesting greater diversity with a mix of different ethnic groups. In comparison to other routes, the poverty rate and share of Native American population is higher in the RA-01/Proposed relocation.

Table 4.3-4 Environmental justice indicator attributes along Enrbidge's proposed Line 5 relocation route and route alternatives.

Environmental justice indicators	Proposed route/ RA-01	RA-02	RA-03	Iron, Ashland, and Bayfield counties	Wisconsin
Total population, 2022[1]	1,008	948	862	38,384	5,893,718
Educational attainment[2]					
Less than high school graduate	5.6%	6.1%	5.5%	5.1%	6.6%
High school graduate	33.8%	33.1%	33.2%	32.2%	30.6%
Some college or associate degree	38.8%	38.5%	36.7%	38.4%	33.0%
Bachelor's degree or higher	21.8%	22.3%	24.6%	24.3%	29.8%
Age[3]					
Population below five years of age	4.9%	4.1%	3.8%	4.3%	5.5%
Population above sixty four years of age	22.6%	26.3%	30.0%	27.0%	17.7%
Dependency ratio*	0.6	0.7	0.8	0.7	0.5
Poverty rate[4]	14.7%	10.9%	10.0%	12.9%	10.6%
Race & ethnicity[1]					
Native American Population[5]	8.7%	5.1%	1.2%	8.2%	1.0%
Non-white Population[6]	16.0%	9.8%	6.1%	14.0%	19.6%
Diversity index[7]	0.3	0.2	0.1	0.3	0.4

[1] U.S. Census Bureau. "HISPANIC OR LATINO, AND NOT HISPANIC OR LATINO BY RACE." Decennial Census, DEC Demographic and Housing Characteristics, Table P9, 2020.

[2] U.S. Census Bureau. "Citizen, Voting-Age Population by Educational Attainment." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B29002, 2022. Percentage expressed in terms of citizens 18 years and over.

[3] U.S. Census Bureau. "Sex by Age." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B01001, 2022. Percentage expressed in terms of total population.

[4] U.S. Census Bureau. "Poverty Status in the Past 12 Months by Household Type by Age of Householder." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B17017, 2022. Percentage expressed in terms of all households.

[5] Calculated by the following equation: Native American or Alaskan Native Population/Total Population

[6] Calculated by the following equation: (Total Population- White Alone Population)/Total Population

[7] Source: (Blau, 1979; P. Meyer and McIntosh, 1992)

* Dependency ratio is estimated as the ratio of sum of population below fifteen years of age and population above sixty four years of age to the population of working age population (age of 15 to 64).

The DNR also evaluated employment, income, and health insurance coverage for the Census block groups crossed by or directly adjacent to Enbridge's existing route, the proposed route, and the route alternatives (Table 4.3-5). RA-03 has the highest labor force while the lowest unemployment rate.

Table 4.3-5 Employment, income, and health insurance coverage along Enbridge's proposed relocation route and route alternatives.

Indicator	Proposed route/ RA-01	RA-02	RA-03	Iron, Ashland, and Bayfield counties	Wisconsin
Labor Force[1] (Number) ACS 2022	9,473	8,730	10,126	18,599	31,29,606
Unemployment rate[1] (%) ACS 2022	3.7%	3.8%	3.3%	4.0%	3.4%
Income[2]					
Below $35,000	27.9%	28%	26.7%	28.6%	22.0%
From $35,000 to $59,000	20.8%	20.8%	22.1%	21.0%	19.5%
From $60,000 to $99,999	26.3%	27.4%	25.9%	26%	24.3%
From $100,000 to $149,999	15.7%	15%	16.2%	15.3%	18.4%
Above $150,000	9.3%	8.9%	9.2%	9.1%	15.9%
Population without health insurance[3] ACS 2022	5.6%	5.6%	5.2%	6.1%	5.4%

[1] U.S. Census Bureau. "Employment Status for the Population 16 Years and Over." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B23025, 2022. Labor force includes population of 16 years and over. Population considered is 16 years and over in labor force.

[2] U.S. Census Bureau. "Household Income in the Past 12 Months (in 2022 Inflation-Adjusted Dollars)." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B19001, 2022. Population considered is total number of households.

[3] U.S. Census Bureau. "Types of Health Insurance Coverage by Age." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B27010, 2022. Population considered is civilian noninstutionalized population. The civilian noninstitutionalized population refers to people who are not residing in institutions such as nursing homes, prisons, jails, mental hospitals, and juvenile correctional facilities.

In summary, the data demonstrate the presence of the Native American population in the area, and that this population experiences a higher rate of unemployment, lack of health insurance, and lower median income. Because of the proximity of Enbridge's proposed Line 5 relocation to Native American communities as well as economically disadvantaged communities, per CEQ guidance, environmental justice is an important consideration.

A primary goal of advancing environmental justice is to address the cumulative effects of environmental and other decision making over time, which could lead to disproportionate impacts on health and well-being for certain groups. In the context of environmental justice, EPA (2022a) has defined cumulative effects as:

> "… *the totality of exposures to combinations of chemical and non-chemical stressors and their effects on health, well-being, and quality of life outcomes.*"

CEQ guidance recommends:

> *"… agencies should consider relevant public health data and industry data concerning the potential for multiple or cumulative exposure to human health or environmental hazards…and historical patterns of exposure to environmental hazards….Agencies should consider these multiple, or cumulative effects, even if certain effects are not within the control or subject to the discretion of the agency proposing action."*

Cumulative effects and health considerations are discussed above in Section 4.2.3.3.

4.3.3 Discussions with Tribal Members & Staff

As part of the formal consultations between the DNR, the Bad River Band, and the Red Cliff Band (Section 4.1.7.1), the DNR Secretary committed to making department staff available for technical meetings with staff from the natural resources, environmental, and historic preservation departments of the interested tribes and the GLIFWC. Between August 2020 and June 2021, DNR staff met (virtually) with staff from the Bad River Band, Red Cliff Band, Lac du Flambeau Band, Forest County Potawatomi Community, and GLIFWC for a series of six technical discussions. The purpose of these discussions was to further inform the development of the Draft EIS. In addition to the general technical meetings, two smaller meetings were held to discuss specific topics between select DNR staff, consultants, and tribal and GLIFWC staff. The first of these focused on a GLIFWC analysis of the potential effects the proposed Line 5 ROW crossing of Iron County Forest land would have on tribal treaty rights (Section 5.12.2). The second was on sharing information and tribal perspectives on cultural resources.

While environmental justice concerns were not explicitly the focus of these technical meetings, they became a through-line connecting many of the topics discussed. From this–and given the limitations of a solely quantitative and literature-based approach–it was decided that the DNR would host two additional meetings (ostensibly listening sessions) on environmental justice and MMIW with selected tribal and GLIFWC staff. The purpose of these meetings was for DNR staff involved in drafting the EIS to learn about environmental justice effects of the proposed project based on the experience, knowledge, and insights of tribal members, elders, and staff. The two meetings were held in late August 2021.

Tribal and GLIFWC participants were recommended by natural resource agency managers from the Bad River, Red Cliff, and Lac du Flambeau Bands, and GLIFWC, as well as the THPO of the Forest County Potawatomi Community. In all, 14 tribal members and staff participated in one or both meetings, representing each of the four tribal communities and the GLIFWC. Participants included four natural resource, environmental, and treaty-rights specialists, three THPOs, two emergency management coordinators, the manager of a tribal program for victims of domestic and sexual abuse, an environmental justice specialist, a tribal judge, a tribal chief of police, and a natural resource and economic development extension educator. Two of the participants are tribal elders. DNR attendees included the department's Tribal Liaison and EIS coordinator, a policy and engagement coordinator, and a natural resources technician. These meetings began with individual introductions and greetings, with participants describing their professional roles and experiences in relation to environmental justice, and what they most wanted to communicate during the meeting. Participating tribal elders shared how important the topic of environmental justice is to them, their people, and their land. DNR staff briefly summarized the procedural requirements for preparing an EIS under WEPA, and the main points of the CEQ guidance on environmental justice under NEPA. This was followed by summary of what the DNR had gathered and heard to that point which were noted as different types of "environmental justice (EJ) effects" associated with the proposed project. These were organized under the headings:

- EJ Effects of Legacy/History (Historical Factors)
- EJ Effects of Pipeline Construction (Social Factors)
- EJ Effects of Pipeline Operation (Cultural Factors)
- EJ Effects of Potential Spills (Social & Cultural Factors)
- EJ Effects of Pipeline Decommissioning

From there, the meeting was turned over to tribal and GLIFWC participants to identify additional effects that the DNR had missed and to elaborate on different factors based on their experiences, knowledge, and insights. Following the release of the Draft EIS and the close of the public comment period, the DNR also reviewed comments from tribal resource agencies and GLIFWC with an eye toward factors related to environmental justice. The results of these efforts are summarized in the next section. In keeping with the CEQ guidance, this section identifies considerations in relation to historical, cultural, and social factors that could amplify the environmental effects.

4.3.4 Environmental Justice Considerations

4.3.4.1 Effects of Legacy/History (Historical Factors)

Discussions regarding environmental justice must be viewed in the context of historical injustices, genocide, colonization, racial discrimination, cultural suppression, theft of land, forced relocation and displacement, forced assimilation, etc. The topic of legacy, history, and cumulative effects was raised but was not discussed with tribal members. A written comment shared with the DNR prior to the meeting noted that:

> *"Existing and proposed impacts to tribal lands, Ceded Territories, animals, birds, fish, insects, plants, trees, air, water and soils...due to [the] cumulative operations of extractive industries and other toxic waste operations...must all be considered and quantified to assess the cumulative negative effects in Creation that will reciprocally affect generations of Tribal members and their ability to implement their inherent and Treaty reserved rights to access, take, and use [these] resources."*

In their comments on the Draft EIS, the GLIFWC commented at length on the lingering effects of historical injustices and cultural suppression (Chiriboga, 2022, 61–63), noting,

> *"It is important to consider the risk posed by Line 5 and the fear it causes in the Anishinaabeg. Traditionally, risk is quantified in statistical terms without considering how that risk may be perceived by different groups of people. The Anishinaabeg have notably been absent from the conversation regarding the significance of the risk of industrial activities to their traditional lifeways and treaty harvest rights."*

and,

> *"Anishinaabe history and sense of place are best protected through holistic analysis of projects that would affect these socio-cultural relationships. Community leaders have voiced their concerns on pipelines in the past but these perspectives have not been given the attention they deserve."*

4.3.4.2 Safety & Security in Relation to Pipeline Construction (Social Factors)

Several participants shared and elaborated on concerns about tribal safety with the influx of workers. Tribal police are already spread thin and would be hard-pressed to respond to an increased volume of public safety and law enforcement issues. Concern was raised about the potential for an increase in drugs brought into the area's reservations, which have already experienced an increase in alcohol and drug abuse during the COVID-19 pandemic and continues to be a growing concern.

> *"We [currently] have two emergencies: The pandemic and [the drug] epidemic. Increases in drug use, increases in drug trafficking, kids are getting younger in usage... [Tribal] police are*

> *overburdened. The casino is a place where lots of people are coming in and out of [our] communities that we don't know... Different government has different ways of dealing with it. People are getting out of jail with bonds but little accountability and going back into our communities. [There's] no time to mitigate the situation because we're always responding to emergencies."*

Drug use increases vulnerability to sexual assault, abduction, and trafficking. It was noted that not only women and girls, but also boys, are vulnerable. The ease of highway transportation out of the area was noted as exacerbating the vulnerability to abduction. Duluth, MN and Superior, WI were identified as a hub of trafficking.

> *"The concern is the location of the reservation; how it's only 30-some-minutes from the state of Michigan and a little over an hour from the state of Minnesota, and the main thoroughfare runs right through... There have been numerous concerns about the individuals that travel this road and about how when the casino first [opened] there were [casino] workers who would contact [social services] and express concern about truckers who were parking in the [casino] parking lot... saying "I'm watching this truck driver take this vulnerable woman to his truck and I'm concerned for her safety." [A social service] worker went over to the casino and stood in front of the truck so that he couldn't leave because [they were] too concerned [for] that woman's safety. Where was he planning on taking her?"*

Participants noted the historic pattern of abduction and sexual abuse associated with previous influxes of workers in the region, including loggers and shipyard workers.

> *"I personally have had older women who have been victimized by being taken to the shipyards in Superior and Duluth Minnesota [share] their stories with me in regards to being taken up there when they were younger and then brought back after males had their way with them... My concern is how do we protect those vulnerable women and the girls of this community. Having "men-camps" or something to that effect in the area, we're just setting our vulnerable adults and children up for this type of victimization."*

As noted in Section 4.4, four contractors working on the Enbridge Line 3 replacement project in Minnesota were arrested and convicted in two separate sex-trafficking stings in 2021.

Concern was also raised about how local (non-tribal) law enforcement would respond to protests against the proposed relocation project. Violence and mass arrests at construction sites for the Line 3 replacement project in Minnesota were noted.

In terms of potential construction effects on natural/cultural resources, concern was expressed about the potential for spills of drilling fluids (frac-out) at waterway crossings. This has occurred in the Line 3 replacement project in Minnesota.

> *"Those spills have a physical impact of changing water quality but they also diminish a tribal members ability to exercise their treaty rights and their culture in those places. In addition to physical impact that might be the same for all of us there is an additional cultural and spiritual impact to tribal members*."

4.3.4.3 Concerns in Relation to Pipeline Operations (Cultural Factors)

Reflecting earlier EIS scoping comments provided by GLIFWC, concern was raised about how the proposed relocation of Line 5 would affect tribal members' access to treaty resources. From the GLIFWC scoping comments:

> *"Of particular concern... is loss of access to public lands where treaty protected cultural activities such as hunting, fishing and gathering can be conducted... [O]nce completed, the proposed Line 5 re-route would eliminate tribal access to 43.4 acres of Iron County Forest land [including] 11.71 acres of wetland that would be permanently lost to tribal access for harvest of medicinal plants or other wetland species..."*

The ongoing contribution of products transported through Line 5 to GHG emissions and climate change was raised but not discussed in detail. Participants from the Lac du Flambeau band encouraged the DNR to look at their reservation's Climate Resiliency Plan which is part of its FEMA-required Emergency Management Plan (https://glisa.umich.edu/project/lac-du-flambeau-tribe-climate-change-resilience-plan/). Further discussions of these cultural resources are included in Section 4.2. Environmental justice principles encourage a more holistic Ojibwe tribal perspective to determine how cultural resources are affected, because those effects would be unique to the Native American communities, a historically marginalized and excluded group experiencing disproportionate adverse effects.

4.3.4.4 Concerns in Relation to Potential Spills (Social & Cultural Factors)

An oil spill event would have a significant impact on tribal communities. As described in Section 4.2.1, the areas lakes, rivers, and associated resources are a foundational part of the identity of Native American peoples in the region. Participants described the potential effects of a Line 5 spill as an existential threat to the area's water (Nibi; Section 4.2.1.3) and other natural and cultural resources (reiterating the lack of distinction between the two). A written comment shared with the DNR prior to the August 2021 meetings noted that:

> *"Part of [the] reasoning for requiring Enbridge to remove Line 5 from the Reservation is because of the ongoing danger it presents to the Tribe's waters and natural and cultural resources, as well as the way of life dependent on those resources (or relatives).The [proposal] endangers not just the waters and wild rice beds downstream of the current Line 5 location, but the entire length of the Bad River and numerous other waterways within the Reservation."*

A participant in the meeting added:

> *"[We have] a spiritual connectivity... with the water. [W]e still do a lot of ceremonies near the water, several different things in our culture connected to our spirituality and to our Creation... I don't feel comfortable talking about specifics of ceremonies, but I want it to be known that these ceremonies were done long before the U.S. was the U.S. It's the same ceremonies we do [today]."*

Participants emphasized that the threat of a Line 5 spill and its potential effects on water and other natural/cultural resources is not limited to the Bad River Reservation, but represents a threat to the Red Cliff Reservation, Lake Superior, and the Apostle Islands, as well as natural, cultural, and treaty resources throughout the Ceded Territories.

> *"[T]his 44-mile reroute is not, and cannot, be separated from the whole of [Enbridge's] Line 5 or the rest of the pipeline network that crosses the Ceded Territories. When talking about potential future spills, we need to look not only at the new proposed route, but also the risk for the entire ceded territories. Potential future risk is perpetuated by this new project. Maybe that is detail in the EIS... but there is a distinction from construction impacts, which would be confined to the Bad River Watershed [and] spill risk and other EJ effects [which] extend far beyond that..."*

A worst-case scenario has the potential to sever their cultural lifeways. While the ecological resources are important by themselves, a concern voiced by tribal leaders is how traditional food sources foster intergenerational relationships between tribal elders and tribal youth. If an oil spill was to occur, the ability to foster these important connections could be jeopardized forever. Native American food pathways include the identification of culturally significant plants as well as the practice of harvesting, cooking, and consuming, traditions and knowledge that have been passed down from generation to generation.

A web link was shared to a "story map" recently developed by GLIFWC on pipelines in the Ceded Territories: https://storymaps.arcgis.com/stories/3fc4d29577284948a9ff569bba7f8546. Participants raised additional concerns about Enbridge's track record, including most recently the 2019 leak of 1,400 gallons of diluent from Line 13 in Jefferson County, which went unreported for over a year.

Concerns over the cleanup timeline of an oil spill were also raised by tribal members, specifically related to the remote location of much of the pipeline ROW and the shared uncertainty surrounding Enbridge's oil leak detection technology and the parent company's seemingly unfavorable existing record of oil spill response. Furthermore, the environmental conditions that occur during winter months, such as high winds and ice-covered waters, were noted as points of concern. Tribes also point to past cleanup responses from Enbridge, including an instance in Crystal Falls, MI in 1999 and a 2010 spill in Marshall, MI (Kalamazoo River) as examples of clear failures from the company at effective post-spill cleanup. The tribes frequently reference Enbridge's past responses to oil spills as evidence to question the legitimacy of any adequate cleanup scenario that Enbridge would undertake if a leak were detected.

Release of oil or other petroleum products would not only cause significant damage to Native American nations, but it would also highly likely result in litigation against Enbridge and, potentially, the State of Wisconsin. The extent and nature of legal claims by tribes would likely depend on the amount of the released product, the geography and the size of the affected area, the cleanup time and costs, and many other factors. Although the extent and nature of legal claims are difficult to predict, based on recent history, lawsuits in the event of a spill would be a near certainty. Therefore, this near certain threat of litigation must be considered in decision-making.

4.3.4.5 Environmental Justice in Relation to Pipeline Decommissioning

The topic of the potential effects of decommissioning the portion of the existing Line 5 running through the Bad River Reservation was raised but was not discussed. One participant commented that "we could have a whole other meeting to discuss that."

4.3.4.6 Other Affected Groups, Concerns Related to Public Participation, & Recognition Justice

At several points in the discussions, participating tribal elders made a point of emphasizing that the environmental justice considerations of the proposed project go beyond the tribes. One noted that:

> *"[W]hen we're talking about the vulnerable people in this area, it isn't limited to tribal people. There's non-tribal people living in this area who are vulnerable."*

Another participant shared that:

> *"My dad used to tell us 'you guys are all in the same canoe. You're all in the same canoe, and [you] gotta start paddling in the same direction.' I think what we're dealing with is much bigger than the discussion we're having here today... [T]he way the state is going, the world is going, that water [and] the environment is going – it's going to be very, very crucial for us to work together to come up with the same purpose. It's not just the tribes that have a connection or desire*

> *to protect the resource. It's all people. I believe we're on the cusp of things. I believe things are going to get worse. Things are going to get worse not only here in Wisconsin, but things are getting worse certainly right across the U.S... [Here] we have water – water – which is one of the most highly sought-after elements in the world. And we live, not just the tribes, we live in a place here in Wisconsin that is, I mean...I look at water as more valuable than oil running through a pipeline. We better get it together. As people, we better get it together here; otherwise, our Earth is going to be destroyed. When I started out earlier this morning, I said yesterday we had a little bit of rain. That was the first raindrops I'd felt all month! What I see out there in the environment is real... Climate change, pollution; it doesn't matter the color of your skin. We all need water..."*

Several participants expressed confusion and frustration about the purpose of the EIS. (Under sec. NR 150.30(1)(b) of the Wisconsin Administrative Code, "The purpose of an EIS is to inform decision-makers and the public of the anticipated effects on the quality of the human environment of a proposed action or project and alternatives to that action or project. The EIS is an informational tool that does not compel a particular decision by the agency...")

One participant shared that:

> *"Lots of this conversation is making me think about 2017 and other... projects approved by DNR, and the project in Minnesota. How similar the process Minnesota saw is to what we're [seeing] right now – and having a fear of a similar outcome. Fear about violence against women and other relatives and drugs. Violence we're seeing to relatives to the west right now. [Enbridge] Financing violence and imprisonment against relatives to the west who are holding ceremonial water crossings. [A] cease and desist order [had to be issued] so they could hold their ceremony. This is all happening after they went through the same process [we're going through now]. In a historical framework, many share a concern of what might play out here."*

Recognition justice refers to "recognition of the diversity of the participants and experiences in affected communities" (Ulibarri, Figueroa, and Grant, 2022). Ulibarri et al. (2022) outline how, "Ensuring an inclusive and just process entails considering the relative experiences and abilities of participating stakeholders." In other words, for everyone to be included in decision-making, varying approaches must be used to ensure full access to processes, and differing experiences must be considered to determine how impacts might affect different communities. These concepts emerged as a theme throughout the discussions with tribal members. As one participant concluded:

> *"I have a question relative to where this is all going. What I mean by that is, [we're] about ready to pour our hearts out on these issues of MMIW and also environmental concerns relative to [the] reroute, but who am I talking to? Where does this go? You're gathering information here to express something to who? Does this go to decision-makers, right up to the governor, Secretary of DNR? Who's listening to us? Who's going to read this? Is Enbridge going to read this?... I get concerned with how information is gathered, how it's shared, how it's communicated, etc. Where is this going?"*
>
> *"It's crucial that we use our voice. If it's going to be through this document, well then it's going to be through this document. It has to be voiced, though. We can't be romantic about it, just so we meet the intent of the law. I appreciate the discussion here that we're having, and I can see the importance of it. I know it's hard sometimes to practice the art of listening. What is being said? Put it in this document. Put it in there. We've gotta tell the truth. There's such a thing as Universal Truths. That needs to be in this document."*

> *"Does water, does a tree have a right to live? Does a deer have a right to live? What about the rights they have? That is the Universal Truth of all: [That from] the Anishinaabe point of view, Creation, the environment, comes before we do. We're at the bottom rung... I get very emotional and I want to speak the truth. Even though we may have some opinion differences, I think it's important that you practice the art of listening. Also, take a really close look: Why are the tribes opposed to this? Why? Give some thought. Why do you think tribes are opposed to this? That could answer a lot of questions."*

4.4 Missing & Murdered Indigenous People

During public scoping of the Draft EIS, numerous commenters expressed concern over the effect that an influx of temporary workers could have on existing patterns of sexual assault, abduction, and other violent crimes committed against tribal women and other vulnerable populations in the Bad River Reservation and surrounding area. The issue of Missing and Murdered Indigenous Women (MMIW) has received growing attention nationwide, including the establishment of an MMIW Task Force by the Wisconsin Department of Justice in 2020. According to the FBI's National Crime Information Center, 5,600 Native American women were reported missing in 2019 (Lee, 2020). This figure is likely an undercount, due to significant underreporting, problems with correctly listing victims' ethnicity, and other gaps in reporting and data collection (Urban Indian Health Institute, 2018). A 2016 study funded by the National Institute of Justice found that nearly 85% of Native American women have experienced violence at some point in their lives, with over 56% experiencing sexual violence (Rosay, 2016). In a 2024 proclamation, Wisconsin's Governor Evers declared "there is still an epidemic of missing and murdered indigenous women and girls in Wisconsin and across the United States, yet these incidences often go unreported, uninvestigated, or unaddressed" (Evers, 2024).

Justin E. Brooks (2023) recently published "Two Countries in Crisis: Man Camps and the Nightmare of Non- Indigenous Criminal Jurisdiction in the United States and Canada" in the *Vanderbilt Journal of Transnational Law*. He concluded:

> *"Indigenous communities in both countries often lack the jurisdiction to prosecute violent crimes committed by non-Indigenous offenders against Indigenous victims on Indigenous land. Extractive industries—businesses that establish natural resource extraction projects—aggravate the problem by establishing temporary housing for large numbers of non-Indigenous, primarily male workers on or around Indigenous land ("man camps"). Violent crimes against Indigenous communities around extractive industry projects have increased with the establishment of man camps while the current legal systems leave Indigenous communities vulnerable against this clear threat. Both the United States and Canada have endorsed international declarations of Indigenous rights, agreeing to protect Indigenous communities from violence, yet the MMIW Crisis in both countries continues"*

In the Bakken oil fields of North Dakota and Montana, influxes of oil and gas workers housed in so-called "man camps" near tribal reservations and other rural communities correspond with increased rates of murder, abduction, sexual assault, sex trafficking, and other violent crimes, especially perpetrated against Native American women and children (Stern, 2021). A 2019 study by the U.S. Bureau of Justice Statistics found that increased violence in the Bakken region coincided with the population boom related to oil production between 2006 and 2012 (K. Martin et al., 2019). Based on data from the FBI, the study found that reports of aggravated assault and of violence committed by strangers increased by 70% and 53%, respectively, and that women experienced a 54% increase in unlawful sexual contact. According to a review in the *Harvard Journal of Law and Gender*, sex trafficking in the region is underreported, owing to the complex nature of criminal jurisdiction between tribal, state, and federal law enforcement (Finn et al., 2017).

In terms of scale and duration, the proposed Line 5 relocation project is significantly smaller than the oil and gas extraction operations in the Bakken oil fields. Enbridge indicates that they would employ approximately 700 workers for the proposed project and that many of these would be hired from the local area. Notwithstanding, Enbridge plans to establish a Human Trafficking Awareness and Prevention Program for the proposed project, like the program developed for the Enbridge Line 3 replacement project in Minnesota. That program requires all Enbridge employees and contractors working on Line 3 to complete awareness training on how to identify and report suspected trafficking. However, this training has been criticized as being insufficient for safeguarding Native women and girls (Zoledziowski, 2021). Enbridge has indicated the company would also support the development of a public awareness campaign like the "Your Call Minnesota" campaign (www.yourcallmn.org).

In 2021, four contractors working on the Enbridge Line 3 replacement project in Minnesota were arrested in two separate sex-trafficking stings. The first set of arrests occurred in February of 2021 (Lovrien and Johnson, 2021). The second occurred in June of 2021 (Minnesota Public Radio News, 2021). The individuals involved were later convicted in court (Minnesota Judicial Branch, 2024).

The Minnesota MMIW Task Force reports that a disproportionate percentage of the women and girls who were murdered (9%) and reported missing (15%) in Minnesota were Native American, while Native Americans make up 2% of the state's female population (Rogers, Pendleton, and Pendleton, 2020). The Task Force identified several systematic risk factors that "put many Indigenous women and girls at higher risk of violence and exploitation, going missing, or being murdered" (pg.7) These include poverty and homelessness, involvement in the child welfare system, domestic violence, sex trafficking, and prostitution. In its report, the Minnesota Task Force states (pg. 8) that:

> *"Indigenous women, girls, and two spirit people are more likely than people from other racial groups to be trafficked, both because they are more likely to experience the risk factors listed above that make them vulnerable to predators, and because of gender- and race-based stereotypes that portray Indigenous women as highly sexualized and available for men. The perpetrators who exploit Indigenous women, girls, and two spirit people may also be aware of jurisdictional issues that may impede investigation and prosecution when Indigenous people are trafficked in Indian Country. A focus on entertainment and extractive industries is also warranted due to increased prostitution and trafficking activity at hotels and casinos, in areas with "man camps" [and] other places where lots of men tend to congregate. Indigenous people who are being trafficked may not have access to adequate, trauma-informed, non-judgmental, culturally responsive services to help them escape from their abusers and heal from the many negative physical and emotional consequences of being exploited and abused."*

A report by the Tribal Law and Policy Institute (Deer et al., 2007) examined the role that Public Law 280 (PL 280) plays in addressing the MMIW crisis. The report states,

> *"Since [PL 280's] passage over fifty years ago, tribes and state/local governments have experienced many problems related to state criminal jurisdiction in Indian country, such as lack of funding to county sheriff's departments to take on the extra jurisdiction, poor response times to reservation communities, jurisdictional uncertainties, and infringement on tribal sovereignty. Some of the most significant problems with Public Law 280 stem from misunderstandings about the law."*

The report further highlighted areas of concern including data collection issues, lack of reporting of sexual assaults, not enough use of Sexual Assault Nurse Examiners, Sexual Assault Response Teams, or sexual assault protocols, lack of understanding at the state level of tribal culture and PL 280, and problems with policies within the Indian Health Service (Deer et al., 2007).

Deer et al. (2007) also highlight that PL 280 has never received special federal funding to support law enforcement and criminal justice. The result has been tribal communities are often some distance from other populations which include the county courts and policing agencies; meaning patrolling is not conducted regularly, and response times to calls for service can be long. While the U.S. DOJ has been increasingly providing funding for tribal justice systems, there is still a gap in tribal law enforcement and tribal courts on PL 280 reservations, leaving barriers to having enough trained law enforcement, adequately trained prosecutors, and adequately trained court personnel. And like with other non-tribal law enforcement entities, recruiting and retaining qualified personnel can be difficult. Many tribes struggle with losing officers to other departments for better pay.

Finally, Deer et al. (2007) emphasizes,

> *"Hostility to tribes and prejudice toward tribal members from off-reservation communities are mindsets sometimes incorporated into the state law enforcement and court system. These animosities may be born of conflict over resources (e.g., water, fish and game), disputes relating to tribal economic development such as gaming, or the product of racism. They translate into a lack of respect for tribal law enforcement, tribal courts, and tribal leaders…A lack of tribal community trust in the state system presents formidable challenges for law enforcement and criminal justice. If reservation residents do not believe in the legitimacy of state jurisdiction, do not trust state officials, or do not believe they will receive an effective response when a crime has occurred, it is very difficult for the state criminal justice system to function."*

A recent proclamation from Wisconsin's Governor stresses "while there is still little data on the true scope of this epidemic, the state recognizes that there have been reported instances of violence towards indigenous women and girls from the 12 Native Nations in Wisconsin" (Evers, 2024). The Wisconsin MMIW Task Force is charged with examining the factors that contribute to MMIW and specifically to focus on the roles federal, state, and tribal jurisdictions play and how to improve data collection and reporting methods. The Task Force has created subcommittees to gather data and address specific areas of concern: data objectives, systems objectives, community/family impact objectives, and legal/policy and institutional objectives. One important product from the Task Force's Data Subcommittee is a Knowledge Gatherers & Caretakers Research Guidance Document (Bowman Performance Consulting, 2022). At the time of this writing, the Task Force is meeting regularly to formulate recommendations for how to address the crisis in Wisconsin.

Tribal insights regarding the history and risks of MMIW in the area of the proposed Line 5 relocation project, as well as other environmental justice considerations, were shared with DNR staff during the discussions described above.

4.5 Enbridge's Environmental Justice Commitments

Enbridge prepared an Environmental Justice Commitment Plan in August 2021 to address goals in its Corporate Social Responsibility and Indigenous Peoples policies. Enbridge submitted the Environmental Justice Commitment Plan to the DNR as part of its permit application. This plan summarizes the company's community outreach efforts since 2019 and its current plans and stated commitments with respect to the following topics: environmental controls, spill prevention and response, invasive species mitigation, tribal monitors, cultural resources identification and avoidance, tribal economic participation and workforce development training, Enbridge's Human Trafficking Awareness and Prevention Program, and authorized hunting, fishing, and gathering.

In April 2022, Enbridge submitted a revised Environmental Justice Commitment Plan as part of the company's comments on the Draft EIS (Appendix J). The revised plan included the sentence: "Enbridge plans to spend $46 million dollars with Native owned businesses and contractors, and have Native Americans make up at least 10% of the project workforce." Additionally, Enbridge's comment letter stated, "Enbridge will make its best efforts to accommodate requests for access to the ROW for all such lawful activity [hunting, fishing, and gathering rights], and will identify a point of contact to coordinate access locations and timing to ensure public safety."

In July 2023, Enbridge submitted an update to the Environmental Justice Commitment Plan that included an Environmental Justice Assessment report and a summary of Enbridge's community outreach completed to date (Appendix J). The Environmental Justice Assessment identified potential communities with EJ concerns, or communities which could disproportionately feel effects from Enbridge's operations. Enbridge's consultants used the CEQ's Climate and Economic Justice Screening Tool (CEJST), EPA's EJ Screen Tool, U.S. Census Bureau data, and Wisconsin Department of Health data to identify the potential EJ communities. Enbridge's Environmental Justice Commitment Plan and Environmental Justice Assessment are included in Appendix J and are discussed in more detail in Section 4.1.8.4.

In Minnesota, state regulators required Enbridge to create a trafficking awareness plan and provide training to its employees to receive the initial permit to begin construction on its Line 3 project. In the company's comments on the Draft EIS, Enbridge discussed its project-specific Human Trafficking Awareness and Prevention Program (HTAPP). The HTAPP began in October 2020 and is managed by Perodigm, a Bad River Native-owned media company. An Advisory Group provided recommendations for the training. In addition to ongoing training for all employees and contractors working on the line 5 relocation project throughout the term of construction, Enbridge has indicated there will also be an outward facing public campaign to raise awareness in the greater region.

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5 EFFECTS OF PIPELINE RELOCATION

This chapter describes the environment present along Enbridge's proposed Line 5 relocation route and route alternatives. Construction of the proposed pipeline relocation would affect the "human environment" due to various environmental and socioeconomic effects. The DNR is responsible for identifying and disclosing such effects for the proposed relocation and route alternatives. This chapter summarizes the extensive information used by the DNR, describes the DNR's analyses to identify anticipated effects, and reports the DNR's conclusions regarding anticipated direct, indirect, and cumulative effects on the geophysical, biological, and socioeconomic resources of Wisconsin. Following each description of current conditions, a summary of anticipated effects from construction of the proposed route and route alternatives on the environment is provided. The first four sections of this chapter (5.1 to 5.4) address temporary direct effects of construction related activities. The following sections (5.5 to 5.14) describe temporary direct effects, as well as long-term direct, indirect, and cumulative environmental and socioeconomic effects associated with the construction and operation of a relocated pipeline. Section 5.15 summarizes the positive and negative effects of the proposed pipeline relocation as required by WEPA. Chapter 4 discloses effects to cultural resources and related Native American tribal concerns. Chapter 6 describes the risk and anticipated effects of liquid petroleum spills during pipeline operations. Chapter 8 describes the effects of the No Action alternative.

5.1 Noise & Vibrations

Noise[6] is "unwanted or disturbing sound" (EPA, 2022b). Sound becomes unwanted when it either interferes with normal activities like communication, sleep, work, or recreation, or produces physiological or psychological damage that disrupts or diminishes one's quality of life. Major sources of noise include transportation vehicles and equipment, machinery, appliances, and other products in commerce (EPA, 2022c). Vibrations refers to ground-borne noise and perceptible motion. A significant increase in noise over existing conditions could constitute a noise impact (EPA, 1982; FTA, 2006). When some of the quiet of undeveloped/rural areas is lost, the quality of the environment is lowered. To determine anticipated noise effects, one must consider noise generation mechanisms (sources), noise paths and attenuating mechanisms, and receiver responses to noise.

5.1.1 Characteristics & Measurement of Sound

Sound has two significant characteristics, pitch (frequency) and loudness (intensity), which can be measured precisely with instruments. Pitch refers to the number of complete vibrations of a sound wave (cycles per second, measured in Hertz [Hz]) resulting in the tone's range from low (10-200 Hz) to high (>2,000 Hz). Loudness describes the relative strength of a sound (quiet or noisy) as measured by the amplitude of the sound wave (the amount of energy transferred by the wave). Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear and is measured in decibels (dB). The dB system gives a rough connection between the physical intensity of sound and its perceived loudness. Decibels are measured on a logarithmic scale (e.g., 10 dB are 10 times more intense than 1 dB, 20 dB are 100 times more intense than 1 dB, etc.). The lower threshold of human hearing is 0 dB at 1 kHz. A sound as soft as human breathing is about 10 times greater than 0 dB. A 10 dB increase in sound level is perceived by the human ear as a doubling of the loudness of the sound.

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[6] The terms "noise" and "sound" are used interchangeably in this section since there is no physical difference between them. Vibrations are a subset of noise and as such when the term "noise" is used in this section it is inclusive of both noise and vibrations. The term "vibrations," however, is used to refer specifically to ground-borne noises.

Human hearing systems do no respond equally to all pitches; low pitches below 250 Hz (with long wavelengths) and very high pitches above 10,000 Hz (with very short wavelengths) are less audible frequencies than those in between. Acoustical scientists have developed response curves to correct for the relative pitch response of the human ear. Referred to as A-, B-, and C-weighted curves, these scales represent responses to normal, very loud, and extremely loud sounds, respectively. Environmental noise generally falls into the "normal" category so that the A-weighted sound level (dBA) is considered best to represent the human response (i.e., the A-weighted noise level de-emphasizes low and very high pitches like the human ear's de-emphasis of these frequencies). Ambient sounds generally range from 30 dBA (very quiet) to 100 dBA (very loud). Table 5.1-1 lists some common noise sources and their typical sound levels.

Table 5.1-1 Common noise sources and their typical sound levels.

Noise source	Level in dBA	Noise environment	Subjective evaluation
Near jet engine	140	Deafening	128 times as loud
Civil defense siren	130	Threshold of pain	64 times as loud
Hard rock band	120	Threshold of feeling	32 times as loud
Accelerating motorcycle (< 10' away)	110	Very loud	16 times as loud
Pile driver	100	Very loud	8 times as loud
Heavy city traffic	100	Very loud	
Gas-powered lawnmower	90-100	Very loud	4-8 times as loud
Weed trimmer	90-95	Very loud	
Kitchen blender	95	Very loud	
Emergency vehicle siren	95	Very loud	
Garbage disposal	90	Very loud	4 times as loud
Freight cars	85	Loud	
Vacuum cleaner	80	Loud	2 times as loud
Alarm clock	60-80	Loud	
Air conditioner	60-80	Loud	
Busy restaurant	75	Moderately loud	
Dishwasher	60-75	Moderately loud	
Freeway auto traffic (at 50')	70	Moderately loud	**Reference level**
Average office	60	Quiet	½ as loud
Suburban street	55	Quiet	
Light traffic	50	Quiet	¼ as loud
Average residence (without radio/stereo playing)	40	Faint	⅛ as loud
Soft whisper	30	Faint	
Rustling leaves	20	Very faint	
Human breathing	10	Threshold of hearing	
	0	Silence	

Rounded values, adapted from Berger et al. (2015) and LSA (2018)

Pitch, wavelength, and air temperature affect the speed of sound. In typical conditions, sound travels at approximately 1,000 feet per second; a pitch of 1,000 Hz has a wavelength of 1 foot and a pitch of 50 Hz has a wavelength of 20 feet. The FTA (2006) notes that the scale of sound waves explains in part the reason humans perceive sounds of 1,000 Hz better than those of 50 Hz–the wavelengths are roughly the size of the receiver's head. "Waves of 20 feet in length at 50 Hz are house-sized, which is why low-frequency sounds, such as those from idling locomotives, are not deterred by walls and windows of a home. These sounds transmit indoors with relatively little reduction in strength" (FTA, 2006).

5.1.2 Characteristics & Measurement of Vibrations

Vibration refers to ground-borne noise and perceptible motion, typically described in terms of velocity, which is useful for describing the response of humans, buildings, and equipment to vibration. Velocity represents the instantaneous speed of the ground/floor movement and is usually measured in terms of either the peak particle velocity (PPV) or root-mean-square (RMS) velocity. Peak particle velocity is defined as the maximum instantaneous positive or negative peak of the vibration signal and is used to characterize potential for damage. The root-mean-square is best for characterizing human response to building vibration. Figure 5.1-1 illustrates common vibration sources and the human and structural response to ground-borne vibration. Enbridge's General Blasting Plan (Appendix F) limits vibrations from blasting to a maximum peak particle velocity of 12.0 inches per second in any of three mutually perpendicular axes, measured at the lesser distance of the nearest facility or the edge of the permanent ROW easement.

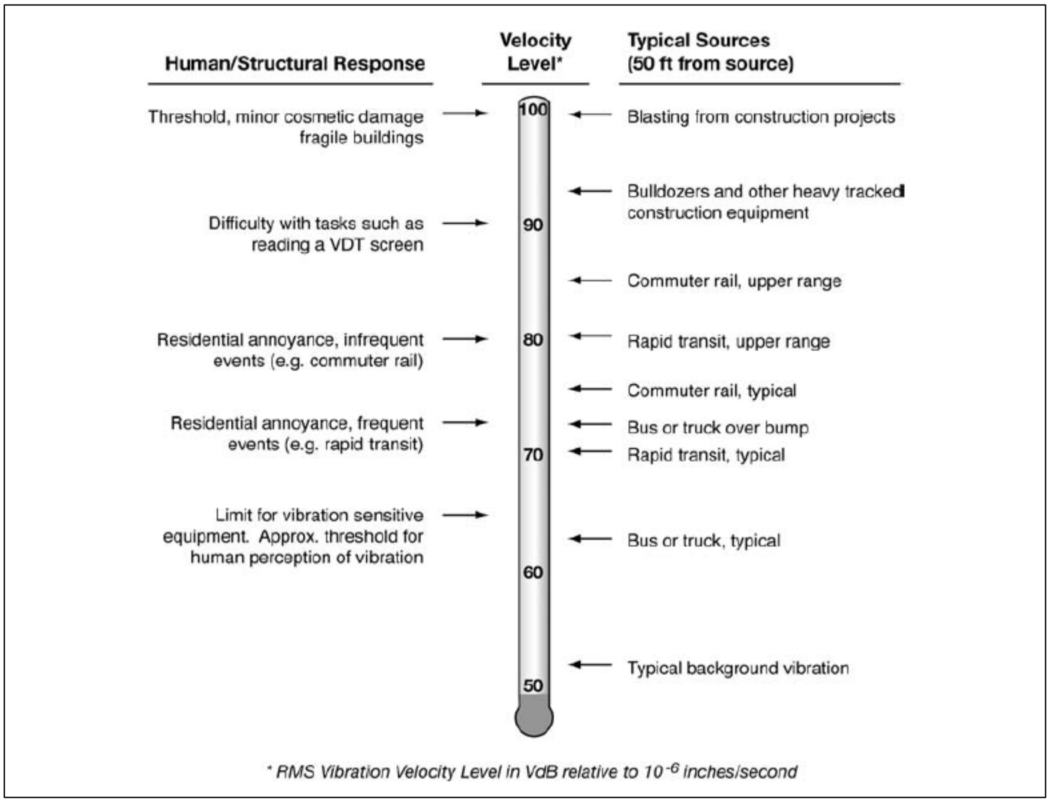


Figure 5.1-1 Typical levels of ground-borne vibrations.
Source: FTA (2006)

Factors that influence ground-borne vibration include:

- **Vibration Source:** Vehicle suspension, wheel types and condition, roadway surface, vehicle speed, vehicle idling, impact, and depth of vibration source.
- **Vibration Path:** Soil type, rock layers, soil layering, depth to water table, and frost depth.
- **Vibration Receiver:** Foundation type, building construction, and acoustical absorption.

Building vibration could be perceived by occupants as the motion of building surfaces, the rattling of items on shelves or hanging on walls, or a low-frequency rumbling noise. The rumbling noise is caused by the vibration of walls, floors, and ceilings that radiate sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 dB or less. This is an order of magnitude below the damage threshold for normal buildings. Vibrations from blasting can also affect groundwater movements (Section 5.5.2) and underground infrastructure (e.g., private wells; Section **Error! Reference source not found.**). Enbridge's General Blasting Plan (Appendix F) requires blasting contractors "to exercise control to prevent damage to aboveground and underground structures, including buildings, pipelines, utilities, springs, and water wells" and provides implementation procedures to ensure this objective is met.

5.1.3 Noise Attenuation

A noise source's dB level decreases as the distance from its source increases. Sound dissipates exponentially with distance from the noise source. For a single point source, sound levels decrease approximately 6 dBA for each doubling of distance from the source. Sound paths are sometimes interrupted by man-made noise barriers, by terrain, by rows of buildings, or by vegetation. At very large distances, wind and temperature gradients sometimes modify the ground attenuation. Low-pitch sounds are less deterred by walls and windows and can transmit indoors with relatively little reduction in strength. The drop-off rate of 6 dBA for each doubling of distance is appropriate for assessing noise generated by stationary equipment. If noise is produced by a line source (e.g., highway traffic or railroad operations), the sound decreases 3 dBA for each doubling of distance in a hard-site environment and 4.5 dBA for each doubling of distance in a relatively flat environment with absorptive vegetation.

5.1.4 Existing Noise Environment & Noise-sensitive Land Uses

Environmental noise generally derives, in part, from a conglomeration of distant noise sources. Such sources can include distant traffic, wind in trees, and distant industrial or farming activities, all part of our daily lives. These distant sources create a low-level "background noise" in which no particular individual source is readily identifiable. The FTA (2006) notes that "background noise is often relatively constant from moment to moment but varies slowly from hour to hour as natural forces change or as human activity follows its daily cycle. Superimposed on this low-level, slowly varying background noise is a succession of identifiable noisy events of relatively brief duration. These events could include single vehicle passbys, aircraft flyovers, screeching of brakes, and other short-term events, all causing the noise level to fluctuate significantly from moment to moment."

Certain land uses are considered more sensitive to noise than others. For some uses, quiet is an essential element in their intended purpose, such as residences and buildings where people sleep. Quiet is also an important element of the environment for institutional uses such as schools, libraries, and places of worship. These types of land uses are referred to as noise-sensitive receptors. Most commercial or industrial uses are generally not considered sensitive because, in general, the activities within these buildings are compatible with higher noise levels (FTA, 2006). The DNR assessed the anticipated effects from pipeline construction and operation noise in the context of surrounding land uses, the region's existing ambient noise levels (i.e., the composite of sound from many sources at many directions, near and far), and the proximity of noise-sensitive receptors.

5.1.4.1 Existing Noise Environment

Enbridge's proposed Line 5 relocation route and all three route alternatives are located primarily within an undeveloped, rural landscape and are surrounded by a mix of land uses including forests, wetlands, and agricultural lands, with scattered residential, commercial, and industrial uses. Existing ambient sound levels have not been measured in the project area, but undeveloped lands typically have quiet ambient noises (e.g., rustling leaves = 20 dB; birds singing/calling = 30-50 dB; creek with rapids [at 15'-50'] = 45-60 dB; (Berger, Neitzel, and Kladden, 2015)). Beyond these quiet sounds, primary existing noise sources in the project area include nearby roadway traffic, railroads, forestry operations, and farming operations.

Motor vehicles with their distinctive noise characteristics are a major source of noise in the three-county project area. The amount of noise varies according to many factors, such as traffic volume, vehicle mix (percentage of cars and trucks), average traffic speed, and distance from the receiver. Major contributing roadway noise sources in the project vicinity include U.S. Highway 2 and State Highways 13, 77, 112, 118, 122, 137, and 169, as well as other arterial and collector roadways throughout the three-county area. According to DOT traffic counts, average daily traffic generally ranges from around 1,600 to 3,000 vehicles per day on the state highways and from 4,200 to 4,800 vehicles per day on U.S. Highway 2. Sound levels associated with highway trucks typically range from 70 to 100 dBA at 15 m (Berger, Neitzel, and Kladden, 2015). When roadways are smooth, vibrations from traffic, even heavy trucks, are rarely perceptible.

The principal railroad in the area is the Fox Valley & Lake Superior Rail System (FOXY) line, which runs northwest through central Ashland County from Butternut in the south to Ashland in the north, with a spur extending east from Marengo Junction through Iron County to White Pine Mine, Michigan. The FOXY operates three thru trains at night and two switching trains per day over its Ashland Subdivision mainline at a maximum timetable speed of 40 mph with reported typical speeds ranging from 1 to 20 mph (Office of the Commissioner of Railroads, 2018). Freight trains generate noise levels in the 85 to 100 dBA range at 50 feet and their locomotive horns can produce blasts of 110 dBA (Berger, Neitzel, and Kladden, 2015). Other than passing through Butternut, Glidden, Mellen, Marengo Junction, and Ashland, most of the railroad route crosses rural areas, limiting the effects of noise on people.

Forestry operations involve the mechanical harvest, processing, and off-road and on-road transport of timber and timber products. Noise sources from typical forestry operations include harvesters, forwarders, skidders, processors, and loaders. Small motors (e.g., mowers, chainsaws) also contribute to the noise of forestry operations. Ground preparation and planting activities for reforestation also generate noise. Most of the equipment and activities involved in forestry operations generate noise levels ranging from 80 dBA to 95 dBA. For example, skidders operate with an average noise level of 104 dBA, varying between 90 dBA and 112 dBA (Myles et al., 1971). Log loaders typically operate at 80 to 95 (Berger, Neitzel, and Kladden, 2015). There are also machines with comparatively low levels of noise that generate significant noise because they are used regularly or for extended periods of time. Forestry operations tend to occur in rural landscapes where sounds are largely attenuated by surrounding vegetation and topography, thus limiting the effects to localized areas.

Typical noise sources on a farm include tractors, combines, hay bailers, grain dryers, milking parlor pumps, workshop tools, small motors (e.g., lawnmowers, chainsaws, augers, pumps) (Depczynski et al., 2005). Livestock (e.g., pigs, chickens) can be a significant source of noise. Other sources of excessive noise on farms can include radios in milking parlors or shops, the shooting of guns, and the use of ATVs/UTVs, motorcycles, or snowmobiles. Noise from a typical farm tractor can range from 75 dB to 115 dBA (Depczynski et al., 2005; Berger, Neitzel, and Kladden, 2015). Machines with comparatively low levels of noise generation can also be significant sources of noise because they are used regularly or for extended periods of time. For example, small motors, such as augers and pumps, can have high noise levels (93 dBA) and be significant sources of noise. Farm practices and design significantly influence the amount of noise generated by farming operations. For example, the use of automatic feeders helps avoid arousal of pigs in a feedlot resulting in lower noise levels compared to manual feeding operations (Depczynski et al., 2005). As with forestry operations, most farming tends to occur in rural landscapes where sounds are largely attenuated by surrounding vegetation and topography, thus generally limiting the effects to the farmstead and immediately adjacent areas.

5.1.4.2 Noise-sensitive Land Uses

Noise-sensitive land uses include both residential and non-residential uses. In commenting on the draft EIS, the EPA (Westlake, 2022) encouraged the DNR to assess effects on the following potential non-residential, noise-sensitive receptors:

- Areas where cultural events and tribal gatherings occur.
- Schools.
- Day care centers.
- Senior centers.
- Community centers.
- Medical facilities.
- Areas where tribal treaty rights are exercised.

In addition to the EPA recommendations, the DNR identified the following land uses as potential noise-sensitive receptors:

- Government offices.
- Educational institutions (colleges, universities, libraries, and museums).
- Public gathering places (community centers, meeting halls, theaters, auditoriums, concert halls, and amphitheaters).
- Places of worship.
- Cemeteries.
- Amusement parks and outdoor spectator sports venues.
- Outdoor recreation sites, including parks, playgrounds, golf courses, campgrounds, trails, picnic areas, and recreation or conservation areas.
- Outdoor points of interest (e.g., waterfalls, undisturbed forested lands).

The DNR conducted a GIS analysis to locate the full range of potential residential and non-residential, noise-sensitive receptors within a 250-foot, 500-foot, and half-mile radius of Enbridge's proposed Line 5 relocation route and route alternatives. The DNR overlayed statewide parcel data on the routes to identify and inventory potentially sensitive receptors. Eight thousand parcels were evaluated. The DNR used the primary owner's name, reported class of property (e.g., residential), and auxiliary class of property to identify noise-sensitive receptors. To supplement the overlay, the DNR used ESRI's "USA Institutions" layer package to identify the locations of hospitals, government offices, places of worship, cemeteries, educational institutions, libraries, and museums. The following sections describe the results of DNR's effort to identify noise-sensitive receptors.

5.1.4.3 Residences

The primary sensitive receptors in the project area are private residences (i.e., places where someone lives). The DNR identified all parcels with a residential class of property—including those with other classes of property assigned, such as commercial or agricultural—within 0.5 mile of Enbridge's proposed

Line 5 relocation route and each route alternative (Table 5.1-2; Table 5.1-4). These parcels may have a single-family residence or multiple residential structures. Such parcels would be the most likely to be affected by increased noise during the days and weeks that construction activities would occur in their area. The DNR desktop analysis identified 62 residential parcels within 250 feet of Enbridge's proposed pipeline relocation ROW. Enbridge's fieldwork previously identified 129 residences within 300 feet of the proposed pipeline route, and of these residences, 10 are within 25 feet of the route. This difference is likely due to some parcels having multiple residential structures that are not accounted for in the DNR's analysis. Residents of these homes could be considered the most sensitive receptors because of their proximity to localized sources of noise.

Table 5.1-2 Number of residential parcels within 250 feet, 500 feet, and one-half mile of Enbridge's proposed Line 5 relocation route and route alternatives.

Buffer	RA-01	Proposed Route	RA-02	RA-03
0.5 miles	394	578	1542	1829
500 feet	153	99	271	273
250 feet	117	62	150	171

Note: Parcels may have a single-family residence or multiple residential structures.

Enbridge also conducted an acoustic analysis of its proposed HDD/direct bore locations to determine where noise abatement would be required should HDD drilling operation hours be extended beyond the planned daylight hours and limited timeframe for the pipe pull back (Appendix O). The assessment considered the distance to the nearest residence from each proposed HDD site. Enbridge conservatively used the closest residence to either the HDD entry or exit and conservatively assumed that the noise levels would be the same at either the entry or exit. Residences are 155 to more than 3,000 feet away from the proposed HDD entry and exit sites.

Table 5.1-3 Distances from Enbridge's proposed HDD/direct bore sites to nearest residences.

HDD/direct bore site	Distance from entry (feet)	Distance from exit (feet)
White River	2,352	1,698
Deer Creek	1,516	927
Marengo River	1,513	480
Brunsweiler River	445	568
Highway 13	470	1.686
Trout Brook	155	398[1]
Billy Creek	585	1,410[1]
Silver Creek	1008[1]	1,140[2]
Krause Creek	938	407
Bad River	512[1]	398
Tyler Forks	>3,000	>3,000
Potato Rover	>3,000	1,960
Vaughn Creek	2,510	763

[1] Excludes non-occupied structures; [2] Excludes commercial facilities.
Source: Enbridge (2024)

5.1.4.4 Noise-sensitive Institutional Receptors

The DNR analysis identified 17 noise-sensitive institutional receptors within one-half mile of Enbridge's proposed Line 5 relocation route (Table 5.1-4; Figure 5.1-2). One health care facility, two places of worship, and a cemetery are within one-half mile of proposed HDD locations. The corridor for RA-01 has the fewest (5) noise-sensitive institutional receptors. The corridors for RA-02 and RA-03 have 20 and 15 noise-sensitive institutional receptors, respectively.

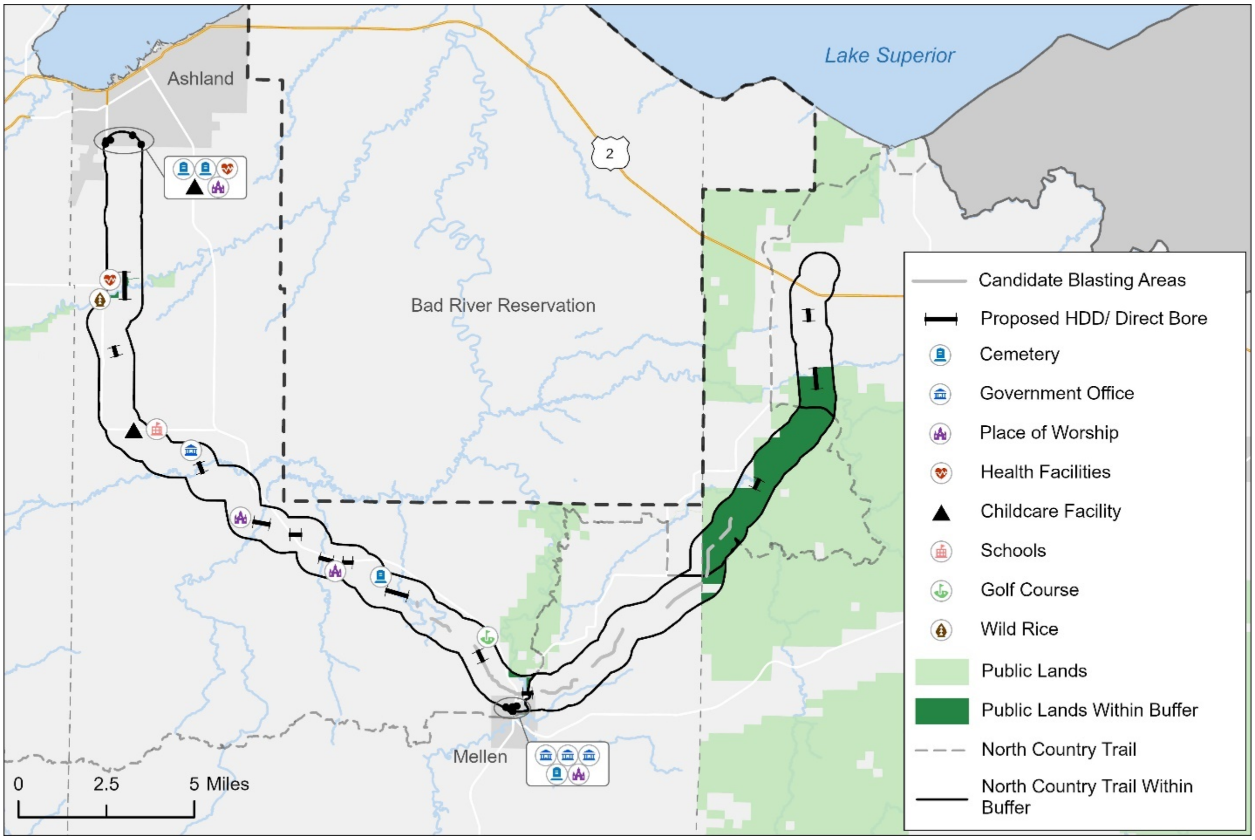


Figure 5.1-2 Noise-sensitive institutional receptors, public lands, proposed HDD locations, and candidate blasting areas along Enbridge's proposed Line 5 relocation route.

Table 5.1-4 Number of noise-sensitive institutional receptors within 250 feet, 500 feet, and one-half mile of Enbridge's proposed Line 5 relocation route and route alternatives.

Sensitive Receptor Type	Route Alternative 1			Proposed Route			Route Alternative 2			Route Alternative 3		
	0.5 Miles	500 Feet	250 Feet	0.5 Miles	500 Feet	250 Feet	0.5 Miles	500 Feet	250 Feet	0.5 Miles	500 Feet	250 Feet
Cemetery	2	1	0	4	0	0	3	0	0	1	0	0
Childcare Facility	2	1	0	2	1	1	0	0	0	2	0	0
School	0	0	0	1	0	0	3	1	1	0	0	0
Community Center	0	0	0	0	0	0	5	0	0	3	1	1
Government Office	0	0	0	4	0	0	6	1	1	6	3	1
Healthcare Facility	0	0	0	2	0	0	1	1	0	1	0	0
Place of Worship	1	1	1	4	0	0	2	1	1	2	0	0
TOTAL	**5**	**3**	**1**	**17**	**1**	**1**	**20**	**4**	**3**	**15**	**4**	**2**

5.1.4.5 Noise-sensitive Outdoor Recreation Receptors

The DNR identified parks and outdoor recreation properties along Enbridge's proposed route and route alternatives. Whether a park or outdoor recreation space is noise sensitive depends on how it is used. Many parks that are used primarily for active recreation would not be considered noise sensitive. Parks that are used for passive recreation, however, are valued as havens from the noise and rapid pace of everyday life and should be treated as noise sensitive. In 2017, the National Park Service found that human-caused sounds at least doubled natural noise levels in 63% of protected lands in the United States, such as parks and forests (Hausheer, 2017). The DNR analysis identified a variety of public lands within one-half mile of Enbridge's proposed Line 5 relocation route and route alternatives (Table 5.1-5). Some of these public lands include vast acres of undisturbed forest that recreationists visit for solitude. Some have campgrounds, trails, waterfalls, and other points of interest within their boundaries. At least one campground is located within the 250-foot buffers around RA-02 and RA-03. Waterfalls were identified within the buffers of all route alternatives: one within the 250-foot buffer of RA-03; two within the 250-buffer and a third within the one-half mile buffer of RA-02; and one within the half-mile buffer of RA-01. In addition to the public lands, portions of RA-02 and RA-03 are within one-half mile of a golf course. RA-03 is also within one-half mile of an outdoor spectator sports facility.

Table 5.1-5 Public land acreage and trail mileage within one-half mile of Enbridge's proposed Line 5 relocation route and route alternatives.

	RA-01	Proposed route	RA-02	RA-03
Trails (miles)				
North Country Trail	9.5	4.6	1	2.3
Public lands (acres)				
Ashland County Forest	0	0	0	2,696
Ashland County Memorial Forest	144	0	0	0
Bayfield County Forest	0	0	0	9,122
Caps Creek Fishery Area	0	0	0	19
Chequamegon-Nicolet National Forest	0	0	0	18,868
Copper Falls State Park	489	70	0	0
Devil's Creek Fishery Area	0	0	13	0
Great Northern Conservation Easement	0	0	0	592
Interstate Falls Park	0	0	42	0
Iron County Forest	1,069	4,220	1,193	7,250
Island Lake Hemlocks State Natural Area	0	0	0	113
Lake Michelle Lake District	0	0	39	0
Namekagon River Fishery Area	0	0	0	5.8
Rem-Devil's Creek Fishery Area	0	0	<1	<1
Saint Croix National Scenic Riverway	0	0	0	228
South Shore of Lake Superior Fishery Area, Fish Creek Unit,,	0	0	139	0

	RA-01	Proposed route	RA-02	RA-03
State Owned Islands	0	0	0	<1
Town of Morse State Habitat Area	387	0	0	0
Twin Lakes Forest Legacy	0	0	0	456
Upson Community Park and Campground	0	0	29	0
White River Fishery Area	0	37	85	0
White River Wildlife Area	297	0	0	0
TOTAL	2,386	4,327	1,540	39,350

5.1.4.6 Noise-Sensitive Cultural Resources

Members of the Ojibwe tribes can exercise their treaty rights on public lands and waters within the Ceded Territories. There are many areas throughout the Ceded Territories where spiritual offerings, cultural events, or tribal gatherings occur (Section 4.2.1.8). The locations of such sites are not included in publicly available GIS datasets, so the DNR was unable to identify such sites for its noise analysis. However, data from the GLIFWC indicated the presence of a waterbody known to support wild rice and a river segment available for open water spearing and netting within one half-mile of RA-03.

5.1.5 Applicable Noise & Vibration Standards

5.1.5.1 OSHA Noise Standards

OSHA regulations help ensure that employees work in a safe and healthful environment. These standards include the General Industry Occupational Noise Exposure standard (29 CFR § 1910.95), which is designed to protect general industry workers, such as those working in the manufacturing, utilities, and service sectors. The general industry standard establishes permissible noise exposures, requires the use of engineering and administrative controls, and sets out the requirements for hearing conservation programs. The standard establishes a permissible exposure limit of 90 dBA for an 8-hour, time-weighted average sound level and limits short-term (up to 15 minutes) noise exposure to a level not greater than 115 dBA. Exposure to impulsive or impact noise (e.g., from blasting) should not exceed 140 dB peak sound pressure level. Enbridge and its contractors would need to implement administrative and engineering controls to minimize workers' exposure to noise levels exceeding these standards (e.g., require use of appropriate PPE during working hours, implement anti-idling policies for equipment that is not in active use, etc.).

Noise in construction is also covered under OSHA's Occupational Noise Exposure (29 CFR § 1926.52) and Hearing Protection (29 CFR § 1926.101) standards. Under the Occupational Noise Exposure standard, employers are required to use feasible engineering or workplace controls when workers are exposed to noise at or above the permissible noise exposures listed in the standard. The requirements for permissible noise exposures and controls for the construction industry are the same as those under the general industry standard, though other requirements differ. The Hearing Protection standard requires employers to provide hearing protectors that have been individually fitted to reduce noise exposure below permissible levels using engineering or workplace controls. Continuing, effective hearing conservation programs are required in all cases where the sound levels exceed specified values. When a hearing conservation program is required, employers must incorporate elements listed in the standard into their program.

5.1.5.2 Wisconsin Department of Safety & Professional Standards (DSPS) Standards

Wisconsin does not have statewide standards for noise, but the DSPS has adopted rules for the safe use of explosives (i.e., blasting; Subch. IV of ch. SPS 307, Wis. Adm. Code). Specifically, s. SPS 307.44 (1), Wis. Adm. Code, requires blasting to be conducted "so as to prevent injury and unreasonable annoyance to persons and damage to public or private property outside the controlled blasting site area." The code specifies that "An airblast may not exceed 133 peak dB at the location of any dwelling, public building or place of employment outside the controlled blasting site area" (s. SPS 307.44 (3) (a), Wis. Admin. Code). This is slightly lower than the exposure limit for impact noise included in the OSHA regulations (<140 dB peak sound pressure level; 29 CFR 1910.95 (b) (2)). In addition, DSPS requires the blaster to monitor every blast to determine compliance with this limit (s. SPS 307.44 (3) (b), Wis. Adm. Code). Local municipalities could have more restrictive regulations than the DSPS.

The DSPS code also includes regulations to protect structures from damage that could result from ground vibrations (s. SPS 307.44 (4), Wis. Adm. Code). The code provides a blasting level chart to be used in determining the maximum allowable ground vibration at the location of any dwelling, public building, or place of employment outside the controlled blasting site area. The code also requires the blaster to establish a maximum allowable ground vibration limit for all structures in the vicinity of the controlled blasting site area that are not specifically listed elsewhere in the code, such as water towers, pipelines and other utilities, tunnels, dams, impoundments, and underground mines. The blaster must consult with the owner of the structure prior to establishing the limit. In addition, DSPS requires the blaster to keep a seismograph record including both particle velocity and vibration frequency levels, for each blast limit (s. SPS 307.44 (4) (c), Wis. Adm. Code).

DSPS requires the blaster in charge to report any airblast or ground vibration that does not meet the requirements of the code (s. SPS 307.44 (5), Wis. Adm. Code).

5.1.5.3 Local Noise Ordinances

Enbridge and its contractors would need to comply with local noise ordinances. Ashland County has a Noise Ordinance (O05-2017-94) that applies in all unincorporated areas of the county. Per the ordinance, the county prohibits construction activities between 10:00 p.m. and 6:00 a.m. The ordinance limits noise in proximity of schools, institutions of learning, churches, and hospitals.

The City of Ashland's Noise Pollution Prevention ordinance (Municipal Code Chapter 202) prohibits construction activities in any residential or commercial district between 9:00 p.m. and 6:00 a.m. and limits the use of power equipment (e.g., chain saws and equipment used for grounds maintenance) between 10:00 p.m. and 7:00 a.m. The ordinance limits noise in proximity of schools, institutions of learning, churches, and hospitals. The city can also specify sound level restrictions for construction activities in industrial districts within an applicable building permit.

5.1.6 Noise Sources & Effects

The pitch and loudness of sounds can contribute to the effects of noise. Pitch is generally an annoyance, while loudness can affect our ability to hear. Audible increases in noise levels generally refer to a change of 3.0 dB or greater since this level has been found to be the lowest audible change perceptible to humans in outdoor environments. A mix of sounds can also contribute to the effects of noise. A project will normally have significant effects related to noise if it will substantially increase the ambient noise levels for adjoining areas or conflict with adopted environmental plans and goals of the community in which it is located. Construction related sound levels are highly variable due to the locations of the equipment on site, how and when the equipment is being operated, and the specific phase of construction (e.g., clearing, grading, trenching, restoration), as well as the surrounding land uses. For the purposes of this analysis, the project would result in a significant noise effect if it would:

- Expose sensitive receptors (Section 5.1.4) to or generation of noise levels that exceed applicable standards (Section 5.1.5).
- Expose sensitive receptors (Section 5.1.4) to or generate excessive ground-borne vibration or ground-borne noise levels.
- Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
- Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

For some individuals, the persistent and escalating sources of sound can be considered an annoyance. This "annoyance" can have major consequences, primarily to one's overall health. Problems related to noise include stress related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity. Enbridge's EIR indicates "the Project will result in an intermittent and localized increase in perceptible noise during the construction phase..."

Several sources of noise would be associated with project construction:

- Traffic associated with equipment delivery and construction worker commutes
- Construction operations
- Blasting
- HDD/direct bore operations

Sound levels associated with traffic and construction operations would be highly variable due to the time of travel and transport, locations of the equipment on site, how and when the equipment is operated, and the specific phase of construction (e.g., clearing, grading, trenching, restoration). The two construction activities that would result in elevated noise levels above standard construction activities are rock blasting and use of the HDD/direct bore installation techniques, which require stationary equipment operation for extended times at specific locations.

5.1.6.1 Traffic-related Noise

Noise would result from transport of construction equipment and materials to the project worksites and construction worker commutes. These transportation activities would incrementally raise noise levels on access roads leading to work sites. The general vehicle muffler requirements outlined in s. 347.39, Wis. Stat., would apply to all vehicles. Larger trucks used in equipment delivery would generate higher noise effects than vehicles associated with worker commutes. These effects would be temporary and generally localized.

5.1.6.2 Construction-related Noise

Each piece of construction equipment would operate as an individual noise point source. As a construction vehicle approaches, passes by, and then recedes into the distance, the A-weighted sound level would rise, reach a maximum, and then fade into the background noise. The maximum dBA reached during this passby is called the maximum sound level, abbreviated as "L_{max}." L_{max} is commonly used in vehicle-noise specifications and is typically measured for individual vehicles. Table 5.1-6 lists typical construction equipment L_{max} levels recommended for noise impact assessments based on 50 feet between the equipment and a noise receptor. The single-event noise from equipment trucks passing 50 feet from a noise receptor would reach a maximum level of 84 dBA L_{max}. However, the pieces of heavy equipment for grading and construction activities would be moved on site just one time and would remain on site for the duration of each construction phase. Sounds from these types of machines tend to produce relatively low-frequency sounds that are not generally deterred by walls and windows of a home.

Table 5.1-6 Typical construction equipment noise levels.

Equipment description	Acoustical usage factor (%)	Maximum noise level (L_{max}) at 50 feet[1]
Backhoe	40	80
Compactor (ground)	20	80
Compressor	40	80
Crane	16	85
Dozer	40	85
Dump truck	40	84
Excavator	40	85
Flatbed truck	40	84
Forklift	20	85
Front-end loader	40	80
Grader	40	85
Impact pile driver	20	95
Jackhammer	20	85
Pick up truck	40	55
Pneumatic tools	50	85
Pump	50	77
Rock drill	20	85
Roller	20	85
Scraper	40	85
Tractor	40	84
Welder	40	73

Source: FHA, 2006
Note: Noise levels reported in this table are rounded to the nearest whole number.
L_{max} = maximum instantaneous sound level.

In response to a DNR information request, Enbridge indicated, "Enbridge will minimize temporary construction noise increases to the extent practicable by requiring construction equipment to be fitted with standard muffler systems, working to complete construction near homes quickly, and by minimizing idling times near residences for equipment that is not in active use." Nighttime noise levels would not be affected because construction activities generally would not occur between 9:00 p.m. and 6:00 a.m. However, for HDDs, time-restricted waterbody crossings, and road crossings, where construction operations would be undertaken 24 hours per day, seven days per week until completed, Enbridge would seek necessary permits, field any noise complaints, and provide reasonable accommodations such as relocation or sound barriers (Appendix L, Part 2).

5.1.6.3 Blasting-related Noise

Blasting activities would result in localized, short duration (< 1 min) increases in construction-related noise during the detonation process. Enbridge has identified nine locations along the proposed relocation route where blasting would be used for pipeline installation (Table 5.1-7; Figure 2.5-3 and Figure 5.1-2). The DNR conducted a GIS analysis using the proposed blasting locations, parcels classified as residential, and soil characteristics (e.g., bedrock depth, particle size, surface texture, parent material). The DNR created a buffer around the proposed blasting locations at 250 feet and 500 feet. Then, each buffer was intersected with parcels and soils data. The buffer geoprocessing tool created nine distinct polygons named "Buffer A" to "Buffer I," from western-most to eastern-most (Figure 5.1-3). The DNR generated tables separating attributes of interest by each buffer using both acreage and percent area of each of the nine polygons.

Table 5.1-7 Candidate blasting sites along Enbridge's proposed Line 5 relocation route.

Buffer polygon[1]	Milepost start	Milepost end	Provided length (feet)	GIS calculated length (feet)
A	19.78	19.9	609	633
B	20.45	21.12	3,500	3,536
C	22.01	22.14	709	686
D	22.54	23.6	5,610	5,595
	23.66	24.1	2,348	2,322
E	24.68	25.9	6,452	6,440
F	26.5	27.95	7,656	7,654
G	29.4	29.91	2,668	2,692
	29.94	30.6	3,468	3,484
H	30.87	32.79	4,862	4,856
I	32.76	32.76	3,518	3,536
Total length		Feet	41,400	41,434
		Miles	7.8	7.8

[1] Letters A-I refer to polygons depicted in Figure 5.1-3.

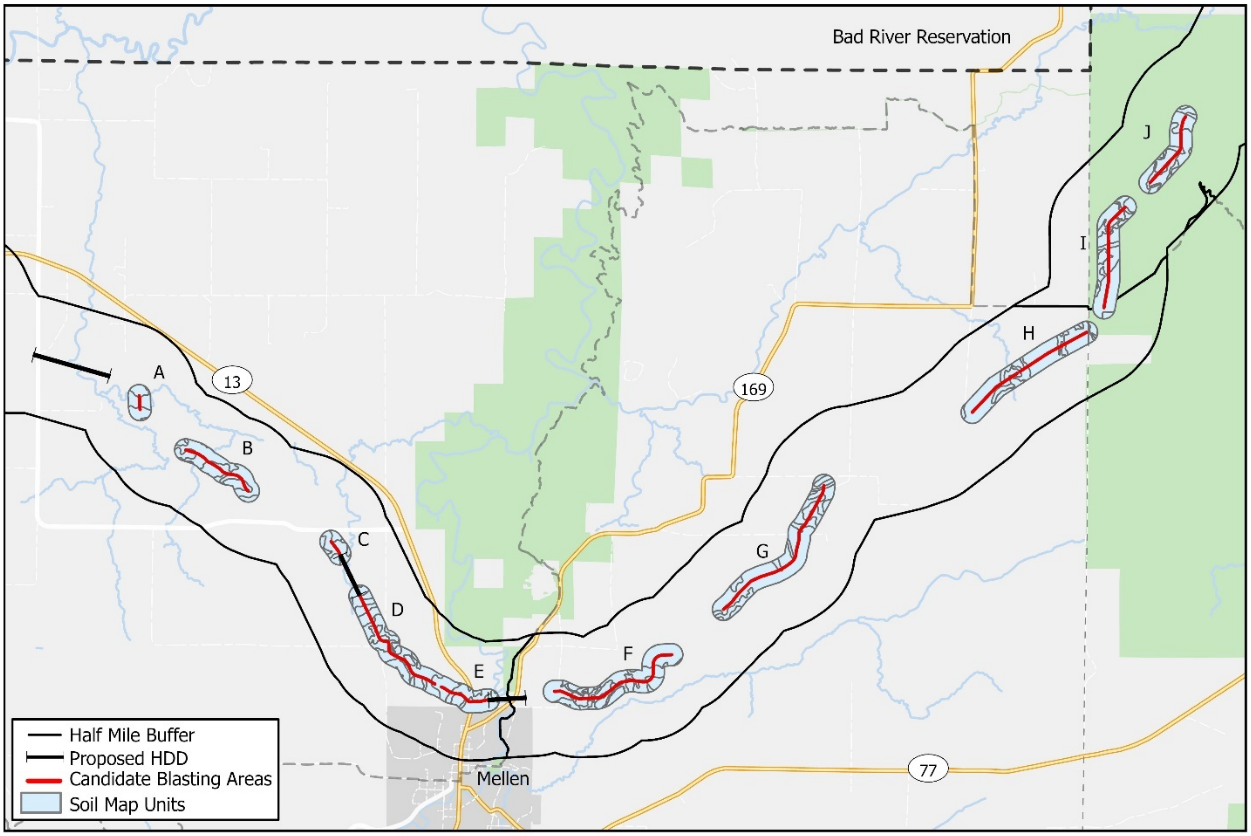


Figure 5.1-3 Soil map units present within a 500-foot buffer and Enbridge's candidate blasting and proposed HDD locations.
Source: DNR

The DNR identified 12 residential parcels within 250 feet and 16 residential parcels within 500 feet of Enbridge's candidate blasting sites (Table 5.1-8). Three of the candidate blasting sites (polygons G, H, and I in Table 5.1-8) intersect with Iron County Forest land and one (polygon H) intersects with the North Country Trail.

Table 5.1-8 Number of residential parcels within 250 feet and 500 feet of Enbridge's candidate blasting sites.

Distance from blast site	Buffer A	Buffer B	Buffer C	Buffer D	Buffer E	Buffer F	Buffer G	Buffer H	Buffer I	Total
500 Feet	0	0	1	8	2	2	3	0	0	16
250 Feet	0	0	1	6	1	1	3	0	0	12

There are significant differences in the vibration characteristics when the noise source is underground compared to when at the ground surface. In addition, soil conditions are known to have a strong influence on the levels of ground-borne vibrations. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock. Experience with ground-borne vibration indicates vibration propagation is more efficient in stiff clay soils than in loose sandy soils, and shallow rock seems to concentrate the vibration energy close to the surface and can result in ground-borne vibration problems at large distances from a source. Factors such as layering of the soil and the depth to the water table can have significant effects on the propagation of ground-borne vibration. Soft, loose, sandy soils tend to attenuate more vibration energy than hard rocky materials. Vibration propagation through groundwater is more efficient than through sandy soils.

Based on the DNR's analysis, the average depth to bedrock at the locations of Enbridge's candidate blasting sites is 31.1 inches (range of approximately 23.7 to 42.4 inches). This shallow rock could concentrate the vibration energy from blasts close to the surface and could allow vibrations to travel beyond the 250-foot analysis buffer, which could affect the residential structures on the parcels included in Table 5.1-8. Soils at these locations are predominantly loamy Eolian deposits over loamy and sandy glacial tills, which would help mitigate vibration propagation due to the relatively low amount of clay soils. Enbridge's General Blasting Plan (Appendix F) specifies "A third-party vibration monitor and an Enbridge representative will inspect all aboveground structures within the distance established by [the blasting] Contractor before and after blasting. In the unlikely event that damage occurs to the aboveground structure, the owner will be compensated."

As noted in Section 5.1.5.2, unless otherwise approved by the DSPS, s. SPS 307.42, Wis. Adm. Code, requires all surface blasting to be conducted between sunrise and sunset. In a response to a DNR information request, Enbridge indicated that "Due to the short duration, no noise abatement between blasting locations and noise receptors is proposed. Enbridge will implement blasting mitigation measures as discussed in the Blasting Plan. These measures include use of blasting mats near residences, conducting blasting only during daylight hours, and notification to nearby residents of the scheduled blasting activities." The blasting contractors would have to notify the management agencies responsible for the Iron County Forest and the North Country Trail in advance of blasting operations on these properties. Recreationists on these properties could experience short-term annoyance from blasting noises at or near these sites, particularly if they are seeking solitude or are unaware of the blasting activities.

5.1.6.4 HDD & Direct Bore-related Noise

The proposed Line 5 relocation route includes 13 locations where Enbridge proposes to use the HDD construction method. HDD construction activities would generate noise at the drill entry and exit sites. HDD activities in any one area would last from several weeks to several months depending on the length of the drill and the hardness of the substrate being drilled.

Typical equipment used at HDD entry sites include:

- A drilling rig and engine-driven hydraulic power unit
- Mud pumps and engine-driven generator sets
- Mud mixing/cleaning equipment with ditch pumps and mud tank pumps
- Fluid system screens/shakers
- Mobile equipment including a crane, backhoe, front loader, and boom truck
- Engine-driven light plants

Typical equipment used at HDD exit sites include:

- Mud pumps
- Mud tank with pumps
- Backhoe and truck(s)
- Welding equipment

- Generators
- Light plants

All equipment used for HDD operations would generate noise. Table 5.1-9 lists the associated noise levels. Sounds form these types of machines tend to produce relatively low-frequency sounds that are not generally deterred by building walls and windows.

Table 5.1-9 Equipment used for HDD operations and associated noise levels.

Equipment	dBA (at 50 feet)
Hydraulic hoe (backhoe)	63
Generator set	55.3
Front end loader	55.3
Mud rig	77.6
Mud pump	75.6
Power unit	79.4
Mud pump	47.6
Power unit	51.9

Enbridge plans to complete HDD and direct bore installations during daytime hours, except during the HDD pipe pullback (installation) process when 24-hour operation could be required. At HDD begin and end sites, expected construction durations range from 21 to 98 days if work is completed in one 12-hour shift per day (Enbridge, 2023d). As noted in Section 5.1.4.3, Enbridge conducted an acoustic analysis of the HDD/direct bore locations to determine where noise abatement may be required should HDD drilling operation hours be extended beyond the planned daylight hours and limited timeframe for the pipe pull back (Appendix O). The assessment was based on the typical construction equipment used at an HDD site and the distance to the nearest residence from the HDD site. Enbridge conservatively used the closest residence to either the HDD entry or exit and conservatively assumed that the noise levels would be the same at either the entry or exit. Enbridge used a calculated L_{dn} (average noise level over a 24-hour period in dB) value above 55 dBA as the basis for identifying where noise abatement would be implemented if 24-hour construction at the HDD locations would be needed. The equipment for an HDD 24-hour operation does not change, so the L_d (average noise level during daylight hours in dB) and L_n (average noise level during nighttime hours in dB) would be the same. L_{dn} levels at the nearest occupied residences ranged from 47.8 dBA to 77.3 dBA and exceeded the 55 dBA level identified for noise abatement at 10 of the 13 HDD locations. Enbridge has indicated that if 24-hour HDD operation is required at these HDD locations, "Enbridge would consult with the closest residents and implement noise abatement, if requested, such as installation of sound barrier walls, to reduce the L_{dn}."

5.1.6.5 Noise from Pipeline Operations

The pipeline itself would generally have no operational noise along any of the route alternatives. However, the associated aboveground facilities (i.e., pump stations) would generate noise on a continuous basis. However, Enbridge has not proposed any new pump stations or noise generating pump station modifications so there would be no noticeable increase in pumping noise. Valve stations have electric driven motors for operating the valve but are not sources of consistent noise. The sound level associated with the operation of the valve sites would be low and would not likely be perceptible outside of the new ROW during normal operations.

Occasional noise would be generated from ongoing pipeline monitoring and maintenance activities. Such noise would be temporary, localized, and intermittent. Longer route alternatives would have somewhat longer periods of interruption as there would be comparatively greater total areas of maintenance being performed. These activities include periodic vegetation clearing on the permanent ROW and ground or air surveillance of the pipeline. Tree removal and vegetation clearing on the permanent ROW would be infrequent and short-term in duration. For example, mowing would have a temporary increase in noise levels at any specific location lasting from minutes to approximately an hour, occurring on an as-needed basis, but generally not more frequently than once every five years. Enbridge uses a helicopter to inspect the Line 5 ROW. Flights occur 26 times per year, with no more than 21 days between flights. Typical noise levels associated with passing helicopters are 90-110 dBA (Berger, Neitzel, and Kladden, 2015).

Noise and duration associated with an operational investigation that would require exposure of the pipeline would be dependent on the length of pipe that would need to be exposed and the type of repair, if any, that would be needed. These noise levels would be like the levels associated with pipeline construction where excavators, welders, generators, small pumps, and vehicle traffic would be needed (Sections 5.1.6.1 and 5.1.6.2).

Noise resulting from response activities should a liquid petroleum spill occur during pipeline operations would be associated with equipment (e.g., trucks, helicopters, response vessels) required to contain and clean up a substantive to very large spill. Noise levels from these efforts would depend on receptor sensitivity and distance from the noise source. The equipment used for spill response would be like the equipment used to construct and maintain the ROW. Noise levels from these efforts would be short-term and localized and would not likely result in major effects to nearby receptors because of the similarity of the equipment to what would be used on a regular basis to maintain the ROW.

5.1.7 Effects of Noise on Wildlife

Animals rely on meaningful sounds for communication, navigation, avoiding danger, and finding food against a background of ambient noise. For birds, in particular, calls are important in the isolation of species, pair bond formation, pre-copulatory display, territorial defense, danger, advertisement of food sources, and flock cohesion. High noise levels can interrupt natural cycles of animals, such as eating habits, breeding, and migration paths. The level of disturbance can be qualified as damage (harming health, reproduction, survivorship, habitat use, distribution, abundance, or genetic distribution), or disturbance (causing a detectable change in behavior). The effects of noise on wildlife were reviewed by Kaseloo and Tyson (2004). The discussion that follows summarizes some of the findings from their review, which was focused primarily on the effects of noise associated with roads and highways.

Little is known about the effects of noise and its effect on invertebrates. Kaseloo and Tyson (2004) report that "few studies have indicated that several species are sensitive especially to low frequency vibration." Fish are capable of reception of sound in the water. The sensitivity of fish varies but is generally in the range of 50 to 2,000 Hz and is best between 200 to 800 Hz. Fish are generally more sensitive to low frequency sounds and a few studies have found a response by fish to noise, but the importance of noise in affecting the behavior of fish populations is not known. Kaseloo and Tyson (2004) also report that "few studies of the response of reptiles and amphibians to noise have been conducted." However, one study found estivating spadefoot toads (*Scaphiopus couchi*, a species not native to Wisconsin) responded to motorcycle sounds (up to 95 dBA at 0.4 kHz to 4.4 kHz) by leaving their burrows, which could have a detrimental effect if it occurred at the wrong time of year. Studies of bird and, to a lesser extent, mammal responses to noise are more common but largely inconclusive.

Early studies of the effect of noise on birds indicated no significant impairment by noise. Kaseloo and Tyson (2004) report that the threshold for hearing in birds is higher than for humans at all frequencies and the overlap in the discernable frequencies between species indicates that birds do not filter out other species by simply being unable to detect them (i.e. birds can hear songs of other species). A more extensive study of 43 species of woodland birds in both deciduous and coniferous forests found that 26 (60%)

showed some reduction in density adjacent to the road. Noise was the only factor found to be a significant predictor and the number of cars and distance from the road (i.e., the sound source and path) were significant factors in the number of breeding birds. No pattern of interference with song calls was found and, thus, the immediate cause of the effect is not apparent. The authors suggested that a supplementary aspect may be stress. The general conclusion of Kaseloo and Tyson's (2004) review is that some (although not all) bird species are sensitive at least during breeding to noise levels and that the distances over which this effect is seen can be considerable varying from a few meters to more than three km.

For mammals the impact of noise has not been as closely studied as in birds. Various mammals will avoid roads and (in some cases) this has been attributed to noise. One group of investigators found white tailed deer (*Oedocoileus virginianus*) avoid snowmobiles but would habituate to these in areas where they had not been hunted. Coyotes (*Canis latrans*) were found to expand (if less cover was available) or reduce (if more cover available) their home range in response to military maneuvers (including overflights, vehicle and truck activity), but the degree to which noise was a factor in these movements was not indicated. Gray wolves (*Canis lupus*) showed no clear avoidance of highways with one pack's range straddling a highway for several years. Further, wolves were less likely to use smaller roads (to an oilfield) possibly due to a more visible human presence.

Finally, the Kaseloo and Tyson (2004) review also notes that the "rate of attenuation of the sound will be affected by the surroundings, but estimates range from 5 dB per meter for a bird 10 meters above ground in an open field to 20 dB per meter for a bird on the ground in a coniferous forest… height and frequency were found to affect sound transmission more than habitat type." Based on the studies examined, Kaseloo and Tyson (2004) suggest the sensitivities of various groups of wildlife can be summarized as:

- Mammals < 10 Hz to 150 kHz ; sensitivity to -20 dB
- Birds (more uniform than mammals) 100 Hz to 8-10 kHz; sensitivity at 0-10 dB
- Reptiles (poorer than birds) 50 Hz to 2 kHz; sensitivity at 40-50 dB
- Amphibians 100 Hz to 2 kHz; sensitivity from 10-60 dB

Clearly there are large gaps in the existing knowledge of the impact of noise on wildlife populations. For invertebrates and lower vertebrates (fish, reptiles, amphibians) there is relatively little study on the effects of noise with no clear indication of a strong adverse response, at least for the levels of noise generally likely to be encountered during pipeline construction. For reptiles and amphibians, effects appear to be localized. For birds, noise can apparently have a significant effect; however, the results are not universal with some species being adversely affected, many unaffected, and still others becoming more common near noise sources like interstate highways. Mammals (particularly large species) may avoid persistent noise sources.

5.2 Transportation

Enbridge's proposed Line 5 relocation route and all three route alternatives cross rural areas. Rural areas typically contain fewer transportation features than urban areas, but the features present are often critical to the community. The proposed route and route alternatives would cross several local, county, and state roads (Table 5.2-1). The proposed route would also cross U.S. Highway 2. All four routes would cross railroad ROWs and various recreational trails.

Table 5.2-1 Number of road and railroad crossings along Enbridge's proposed Line 5 relocation route and route alternatives.

Route	Road crossings	Railroad crossings
Proposed	39	4
RA-01	37	2
RA-02	50	2
RA-03	98	1

As described in Section 1.4.3.19, road-use permits could be required during construction, including for the transport of oversize or overweight vehicles or loads (Chapters Trans 254 and Trans 255, Wis. Adm. Code). Enbridge has acquired road crossing permits required for state road crossings under § 86.07(2), Wis. Stat. and easements for local road crossings (Appendix M).

In some cases, road crossings would lead to temporary congestion of the roadways related to pipeline crossings, transportation of the pipeline and equipment to construction sites, and the increase in traffic due to workers travelling to and from the construction sites. According to DOT traffic counts, average daily traffic generally ranges from around 1,600 to 3,000 vehicles per day on the state highways and from 4,200 to 4,800 vehicles per day on U.S. Highway 2. Smaller traffic volumes would be expected on local and county roads. Traffic related to worker travel to and from construction sites would be anticipated to peak during off-peak hours of early mornings and late evenings. Some road congestion would be anticipated during these travel hours. However, due to the general rural location of Enbridge's proposed project, rush-hour road congestion would not be expected.

Pipeline construction activities would generally not occur between 9:00 p.m. and 6:00 a.m. However, for road crossings, construction operations would be undertaken 24 hours per day, seven days per week until completed to allow the shortest duration of impact to the road and users. When road closures are required for pipeline installation, there is potential for long detour routes. Additionally, detour routes and lane reductions can also lead to increases in road congestion. Enbridge proposes to use HDD for one road crossing (State Highway 13) and direct bore methods for 16 others, which would help minimize travel disruptions at those crossings.

The principal railroad in the area is the Fox Valley & Lake Superior Rail System (FOXY) line which runs northwest through central Ashland County from Butternut in the south to Ashland in the north, with a spur extending east from Marengo Junction through Iron County to White Pine Mine, Michigan. Watco, a rail service provider, began moving commodities on this railroad in 2022, primarily products for the metals, forest products, building materials, chemicals, propane, and fuel industries. The FOXY operates three thru trains at night and two switching trains per day over its Ashland Subdivision mainline at a maximum timetable speed of 40 mph with reported typical speeds ranging from 1-20 mph (Office of the Commissioner of Railroads, 2018). Enbridge proposes to use direct bore methods for the two proposed railroad crossings along the proposed Line 5 relocation route (MPs 16.185 and 39.32), which would help minimize transport disruptions at those crossings.

The four route alternatives would also cross county, snowmobile, and ATV trails. Enbridge identified five snowmobile trail interaction sites along its proposed relocation route and proposed specific actions to manage construction effects (Table 5.2-2). As trails are often located on public lands, Section 5.12.6 discusses measures Enbridge would take to minimize effects on trail users and Appendix AD includes Enbridge's Motorized Recreational Trails Management Plan.

Table 5.2-2 Snowmobile interaction sites along Enbridge's proposed Line 5 relocation route.

MP	County	Crossing type	Description	Proposed action
0	Ashland	Parallel	Summit Road and private field. ROW and access road parallel the trail for 3,100 feet.	Provide snow fence barrier between vehicle travel lane and snowmobile travel lane, trail remains open. Obtain concurrence from Trail Boss.
12.7	Ashland	Off road crossing	Perpendicular crossing.	Manage with singage, Close short period during week for actual pipe install.
17.4	Ashland	Parallel	2.5 miles of meandering crossings between trail, pipeline, and access roads.	Work with clubs Trail Boss to find suitable reroute.
20.7	Ashland	Off road crossing	Two 45-degree crossings back-to-back.	Reroute traffic along the edge of ROW on ditch side.
40.3	Iron	Off road crossing	Old Highway 10 next to U.S. Highway 2. Hwy 10 will be included in road bore.	Manage with signage, no closure should be needed as this trail is within a section of pipe to be installed by boring. No trench required.

5.3 Air Quality

Regional climate and meteorological conditions can influence the transport and dispersion of air pollutants that affect air quality. The climate of Ashland, Bayfield, Douglas, and Iron counties is described as a continental climate, with cold winters and warm summers. The annual average temperature is approximately 41.3° F. Average precipitation in the area ranged from approximately 31 inches to 32 inches annually (DNR, 2015b; 2015c; 2015d; National Weather Service, 2020). Chapter 7 provides additional details regarding state and regional climate.

Federal, state, and local agencies regulate ambient air quality. The EPA has established national ambient air quality standards (NAAQS) for seven criteria pollutants: sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). The NAAQS were developed to protect human health (primary standards) and human welfare (secondary standards). State air quality standards cannot be less stringent than the NAAQS. Wisconsin has adopted the NAAQS in Chapter NR 404, Wis. Adm. Code. Table 5.3-1 lists the NAAQS for the seven criteria pollutants.

Two types of effects on air quality would result from Enbridge's proposed Line 5 relocation: temporary effects from construction-related emissions and long-term effects associated with emissions generated from continued operation of a stationary source (e.g., valves, pumps, and storage tank emissions). Air quality effects associated with construction of the proposed project would include emissions from fugitive dust and emissions from fossil-fueled construction equipment, open burning, and temporary fuel storage and refueling operations.

Table 5.3-1 National ambient air quality standards.

Pollutant	Primary/ secondary	Averaging time	Level	Form
SO_2	P	1-hour	75 ppb	99th percentile, averaged over 3 years[1]
	S	3-hours	0.5 ppm	Not to be exceeded more than once per year
CO	P	1-hour	35 ppm	Maximum, not to be exceeded more than once in a year[2]
		8-hour	9 ppm	
NO_2	P	1-hour	100 ppb	98th percentile, 1-hour daily maximum, averaged over 3 years[3]
		Annual	53 ppb	Annual arithmetic average
O_3	P & S	8-hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour average concentration, averaged over 3 years
PM_{10}	P & S	24-hours	150 ug/m^3	Not to be exceeded more than once per year on average over a 3-year period
$PM_{2.5}$	P	Annual	9.0 ug/m^3	Annual arithmetic mean, averaged over 3 years
	S	24-hours	35 ug/m^3	98th percentile, averaged over 3 years[4]
Pb	P & S	3-months	0.15 ug/m^3	Not to be exceeded

[1] The form of the 1-hour standard is the 3-year average of the 99th percentile of the yearly distribution of 1-hour daily maximum SO_2 concentrations.
[2] For 1-hour standard, second highest, non-overlapping 8-hour average concentration.
[3] The form of the 1-hour standard is the 3-year average of the 98th percentile of the yearly distribution of 1-hour daily maximum NO_2 concentrations.
[4] The level of the 24-hour standard is defined as an integer (zero decimal places) as determined by rounding. For example, a 3-year average 98th percentile concentration of 35.49 µg/m^3 would round to 35 µg/m^3 and thus meet the 24-hour standard and a 3-year average of 35.50 µg/m^3 would round to 36 and, hence, violate the 24-hour standard
Source: EPA

Fugitive dust is a source of respirable airborne particulate matter, including PM_{10} that could result from vehicle traffic on paved and unpaved roads. Construction operations such as wood chipping and grading also have the potential to release fugitive dust. The amount of dust generated would be a function of construction activities, type and moisture content of the soil, wind speed, frequency of precipitation, vehicle traffic, vehicle types, and roadway characteristics. Emissions would be greater during drier months and in fine-textured soils.

Emissions of particulate matter arising from fugitive dust are regulated by state and local agencies and Wisconsin has authority under s. NR 415.04, Wis. Adm. Code, which requires measures to prevent fugitive dust from becoming airborne and leaving the property boundary. Dust control is also a requirement of the Construction Site General Permit (Section 1.4.3.11). Enbridge proposes to address fugitive dust by using control practices including wetting soils on the ROW, limiting working hours in residential areas, and through additional measures as appropriate based on site-specific conditions. The linear nature of pipeline construction and "assembly line" sequencing of activities would limit the duration of fugitive dust emissions at any one location during construction.

In commenting on the Draft EIS, the EPA recommended Enbridge consider the following best practices for controlling fugitive dust sources:

- Stabilize open storage piles and disturbed areas by covering and/or applying water or chemical/organic dust palliative, where appropriate. This applies to both inactive and active sites, during workdays, weekends, holidays, and windy conditions.
- Install wind fencing and phase grading operations where appropriate and operate water trucks for stabilization of surfaces under windy conditions.
- When hauling material and operating non-earthmoving equipment, prevent spillage and limit speeds to 15 miles per hour (mph). Limit speed of earth-moving equipment to 10 mph.

Large earth-moving equipment, skip loaders, trucks, and other mobile sources could be powered by diesel or gasoline and would be sources of combustion emissions, including nitrogen oxides, CO, volatile organic compounds (VOCs), SO_2, PM_{10}, $PM_{2.5}$, and small amounts of hazardous air pollutants. Construction equipment also emits GHGs. Gasoline and diesel engines must comply with the EPA mobile source regulations in 40 CFR Part 86 for on-road engines and 40 CFR Part 89 for non-road engines. These regulations are designed to minimize emissions. Furthermore, EPA has established rules to require that sulfur content in on-road and off-road diesel fuel be significantly reduced and these rules now require all on-road and off-road (non-road) diesel fuel to meet a limit of 15 parts per million (ppm) of sulfur.

In 2002, the EPA classified diesel emissions as a likely human carcinogen, and in 2012 the International Agency for Research on Cancer concluded that diesel exhaust is carcinogenic to humans. Acute exposures can lead to other health problems, such as eye and nose irritation, headaches, nausea, asthma, and other respiratory system issues. Longer term exposure may worsen heart and lung disease. In commenting on the Draft EIS, the EPA recommended Enbridge consider the following best practices for minimizing effects from diesel emissions:

- Establish and enforce a clear anti-idling policy for the construction site.
- Use onsite renewable electricity generation and/or grid-based electricity rather than diesel-powered generators or other equipment.
- Use electric starting aids such as block heaters with older vehicles to warm the engine.
- Regularly maintain diesel engines to keep exhaust emissions low. Follow the manufacturer’s recommended maintenance schedule and procedures. Smoke color can signal the need for maintenance (e.g., blue/black smoke indicates that an engine requires servicing or tuning).
- Where possible, retrofit older-tier or Tier 0 nonroad engines with an exhaust filtration device before it enters the construction site to capture diesel particulate matter.
- Replace the engines of older vehicles and/or equipment with diesel- or alternatively fueled engines certified to meet newer, more stringent emissions standards (e.g., plug-in hybrid-electric vehicles, battery-electric vehicles, fuel cell electric vehicles, advanced technology locomotives, etc.), or with zero emissions electric systems. Retire older vehicles, given the significant contribution of vehicle emissions to the poor air quality conditions. Implement programs to encourage the voluntary removal from use and the marketplace of pre-2010 model year on-highway vehicles (e.g., scrappage rebates) and replace them with newer vehicles that meet or exceed the latest EPA exhaust emissions standards, or with zero emissions electric vehicles and/or equipment.

Enbridge proposes burning materials cleared from the ROW. Open burning of cleared materials from construction activities would be anticipated to affect air quality, particularly with the large volume of trees that would be removed from the ROW (approximately 410 acres of forest lands for the proposed route; Table 5.9-3and Table 5.9-4). Burning of wood material releases large volumes of particulate matter, as well as CO, carbon dioxide (CO_2), SO_2, hydrochloric acid, formaldehyde, PAHs, and dioxin (American

Lung Association, 2023), some of which are GHGs. If a large amount of burning occurred, effects on air quality could be moderate but temporary, resulting in respiratory irritation and similar effects for susceptible people.

Open burning and malodorous emissions are regulated under Chapter NR 429, Wis. Adm. Code. Burning of wet wood can produce very smoky (high opacity) and poorly burning fires that can be a source of malodorous emissions as well as particulate matter and hazardous air pollutants that can harm human health. The burning of mature trees (with a minimum diameter at breast height of six inches) would not be allowed. Mature trees would instead be sold or chipped in place. Wood chips would be scattered along the permanent ROW in appropriate areas (not in wetlands) or removed. Temporary fuel storage tanks and refueling operations have the potential to release VOC emissions, although most construction equipment would use diesel fuel with a low vapor pressure (<0.01 pounds per square inch), resulting in minimal releases of VOCs.

Since pipeline construction moves through an area relatively quickly, air emissions typically would be localized, intermittent, and short term. These temporary effects would occur twice if two adjacent sections are not constructed concurrently. At HDD begin and end sites, expected construction durations range from 21 to 98 days if work is completed in one 12-hour shift per day (Enbridge, 2023d). Emissions from fugitive dust, construction equipment combustion, open burning, and temporary fuel storage and refueling operations would be controlled to the extent required by state and local agencies. Enbridge's proposed relocation of Line 5 would not be expected to significantly affect local or regional air quality.

For pipeline operations, electricity would be used to power the system's pumping stations and other infrastructure. Emissions from the electricity used to power the pumping stations would be small in comparison to either the lifecycle emissions or only the downstream combustion of the material carried by Line 5 (Chapter 8). The proposed project would result in fugitive VOC, GHG, and hazardous air pollutant emissions from valves, pumps, and connectors. The additional components from the longer pipeline would result in additional long-term VOC, GHG, and hazardous air pollutant emissions increases from the valves, pumps, connectors, and other fugitive piping components. The proposed project includes ten new mainline valve sites. Each valve site would include associated connectors and flanges and valves that could emit VOCs. Enbridge estimates that the potential VOC emissions at each mainline valve site would range from 0.007 to 2.10 tons/year. The east and west tie in locations would release an estimated 0.007 to 0.83 tons/year of VOC, and GHG emissions would range from 0.18 to 19.39 ton/year (Table 5.3-2).

There are no ambient air quality standards or increments for VOC, GHG, or hazardous air pollutant emissions. There are, however, ozone standards for which VOCs are a precursor, and state requirements for hazardous air pollutants. Operation of a relocated Line 5 pipeline would not be expected to cause or contribute to a violation of federal, state, or local air quality standards.

Commissioning of a new pipeline segment would generate emissions when the pipeline is initially filled. Nitrogen gas is injected into the pipeline and multiple pigs are place between the nitrogen and the crude oil. Emissions would be generated when the pipeline fill process was nearly completed, and nitrogen gas would be vented through temporary pipe and manifolds and separator vessels and frac tanks and then to the atmosphere. The separators would remove crude oil from the nitrogen gas. The frac tanks would be used to temporarily store crude oil that is separated out.

Decommissioning the existing pipeline would generate emissions during the pipeline purge and cleaning process. Nitrogen would again be used to purge crude oil from the pipeline by pushing cleaning pigs and cleaning solutions through the pipeline. Once cleaning pigs are removed from the pipeline the nitrogen and entrained VOCs would be vented through temporary piping, manifolds, separators, and frac tanks. Following separation, nitrogen would be discharged to the atmosphere. Some additional emissions would be generated from the loading of tank trucks used to haul the used cleaning solution to an offsite facility.

Table 5.3-2 Potential valve site and tie-in VOC, hazardous air pollutant, and GHG emissions.

Facility ID	MP location	Potential VOC emissions[a]	Potential total hazardous air pollutant emissions[a]	Potential GHG emissions[b]
MLV 1	1,149.71	0.030	8.61E-04	0.72
MLV 2	1,152.16	1.290	4.84E-02	12.56[c]
West Tie-in	1,155.92	0.007	4.78E-04	0.19
MLV 2.5	2.37	0.007	2.17E-04	0.18
MLV 3	5.56	0.007	2.17E-04	0.18
MLV 4	9.35	0.007	2.17E-04	0.18
MLV 5	16.08	0.007	2.17E-04	0.18
MLV 5A	21.85	0.007	2.17E-04	0.18
MLV 5B	28.15	0.007	2.17E-04	0.18
MLV 6	40.00	0.007	2.17E-04	0.18
East Tie-in	1,176.37	0.830	0.05	19.39[c]
MLV 7	1,177.68	2.100	0.06	13.21[c]

[a] Tons per year
[b] MT CO_2 equivalents
[c] Values account for increased emissions during pipeline interconnect between the existing Line 5 pipe and the relocation pipe as well as decommissioning the respective segment of the existing pipeline. Once decommissioning is completed, the emission values will match MLV2.5- 6 emissions.

No air pollution permits would be required for Enbridge's proposed Line5 relocation since there would be no changes to the Superior Terminal's throughput, or capacity on the existing Line 5 system, that would increase air pollution emissions. There are no applicable state or federal air pollution requirements with respect to GHG emissions for sources exempt from air permitting requirements. Regulated hazardous air pollutants from the valves, pumps, and connectors are subject to regulation under Chapter. NR 445, Wis. Adm. Code.

Hazardous air pollutants would be a concern if a liquid petroleum spill were to occur. Monoaromatic and polycyclic aromatic hydrocarbons would be released, the most volatile include BTEX (benzene, toluene, ethylbenzene, and xylene). Directly after a spill, they would pose air pollution and fire concerns to the immediate spill area. Because of this, at the discovery and notification of a spill, the nearby area would be immediately evacuated for human safety. Air pollution risks associated with a plume would likely dissipate quickly after the release but would require rigorous monitoring to end the evacuation and would remain a major concern in the initial cleanup phase.

5.4 Public Health & Safety

Enbridge has procedures in place for the safety of its employees and contractors and the public. Prior to start of construction activities, Enbridge would ensure that the limits of the proposed workspace and access roads are clearly marked. Construction crews would be informed regarding the construction workspace during project kick-off training and during daily tailgate meetings throughout the duration of construction. Enbridge would ensure construction activities are limited to approved work areas and any incidence of trespass by Enbridge or its representatives (contractors and assigns) would be investigated immediately. All construction activities would adhere to Enbridge's health and safety plans to ensure worker safety during all phases of construction. All contractors are required to submit a Project Safety Plan, Project Hazard Assessment, and Emergency Response Plan for Enbridge's review. These plans are submitted and reviewed prior to the contractor being allowed to start work (Enbridge, 2021b). The contractor's plans must meet or exceed Enbridge's LP Contractor Safety Specifications.

Regarding public safety, warning signs would be posted during construction to inform the general public of construction area restrictions. Public access to the ROW would be restricted with the use of signs to prevent the general public from entering construction areas and to minimize the potential for accidents and injuries. Physical security measures such as fencing, security cameras and security guards would be used when deemed necessary by Enbridge, to prevent and respond to the potential for trespass during construction. Enbridge would work with local authorities to prohibit public access to ROW during construction to promote public safety and security, as needed. Enbridge has indicated in its comments on the Draft EIS and in its Environmental Justice Commitment Plan (Appendix J) that it "will not impede the lawful exercising of the right to hunt, fish, or gather on property open to the public. In areas where the rerouted Line 5 crosses public land, members of the Signatory Tribes and public can lawfully hunt, fish or gather; however, to ensure public safety, access to the right-of-way will be temporarily restricted during active pipeline construction or maintenance activity. During active construction or maintenance activity, Enbridge will make its best efforts to accommodate requests for access to the ROW for all such lawful activity, and will identify a point of contact to coordinate access locations and timing to ensure public safety." During operations, the facilities, equipment, and public safety would be protected through the implementation of the Operations Security Plan.

Necessary security measures for both construction and post construction are determined by a threat and risk identification process. This process includes a vulnerability assessment. Risk identification has shown to reduce the number and severity of incidents. Any incidents that occur are reviewed and additional physical measures could be taken to mitigate the risk. Enbridge Enterprise Security assesses threats and will issue a project notice if increased risks dictate that additional security and countermeasures are needed.

Construction of the proposed route could result in the possibility of fatal and nonfatal accidents and injuries in two populations: construction workers (occupational injuries) and the general population (non-occupational injuries). Occupational safety risks to pipeline construction workers would be managed through the implementation of safety and emergency plans. All construction activities would adhere to Enbridge's health and safety plans to ensure worker safety during all phases of construction. Enbridge implements various programs to protect worker safety including the following:

- Employees have completed environmental health and safety training and their training is current.
- Establishment of Health and Safety Committees to promote safety engagement and decision-making communication.
- Maintenance of industrial hygiene programs that identify workplace stressors and that recommend steps to prevent injury and illness.
- Contractors are required to meet the decontamination measures stated in Enbridge's LP Contractor Safety Specifications (Enbridge, 2021b).

Employee training and the implementation of construction manuals and safety plans and procedures would reduce risks to construction workers, resulting in minor effects during construction of the proposed route. Policies requiring the use of personal protective equipment while in the work areas are commonly part of the health and safety training and plans.

Although the potential for worker accident or injury during construction of the proposed route is considered to be low to moderate, if an accident did occur, effects would range from minor (in the event of a small injury) to major (in the event of a fatality).

The handling of hazardous materials could result in worker injury. Enbridge's EPP (Appendix D) includes information on worker training and safety procedures to follow when handling hazardous materials, which would reduce the potential for accidents and resulting injuries. Measures include training of all employees to follow spill prevention procedures including following proper fuel storage practices, fuel dispensing operations, and other hazardous materials handling processes. In the event of a spill of hazardous material during construction, cleanup measures contained in Enbridge's EPP (Appendix D) would reduce the extent of contamination. Such measures include immediate response actions (e.g., assessments and notifications), mobilization of response personnel, equipment, and materials for containment and/or cleanup, and storage and disposal of contaminated material. See Chapter 10 of Enbridge's EPP (Appendix D) for further details on spill prevention and response.

Disturbance of contaminated areas during construction could lead to exposure of workers or the public to contaminated materials. Due to the distance of known contaminated sites from the proposed route, it is unlikely that they would be affected during construction and operation. However, there is a potential that unknown previously contaminated soils could be discovered during construction. In that event, work would stop immediately, and Enbridge would inform the appropriate agency and notify the landowner. If heavily contaminated soils are discovered during construction, Enbridge may alter the route slightly to avoid the contaminated area.

5.4.1 Trespass/Injury during Pipeline Construction & Operation

Injury can occur when unauthorized vehicles or people enter the ROW during construction activities. Enbridge would install and maintain measures to control unauthorized access to the ROW such as installing fences and gates, as well as security cameras and security guards during construction, where deemed necessary. This would generally be at times when Enbridge is constructing or actively maintaining its facilities and there is excavation and heavy machinery around exposed pipelines.

Enbridge's Field Emergency Response Plan (Appendix AG) indicates "Security hazards present themselves in a variety of ways including, bomb threat, suspicious package, suspicious activities, protestors, security events. Often the main objective of these actions is to halt or disrupt normal operations. For these reasons Enbridge has established security protocols. Security protocols and response actions are further supported by an active Security Management Program." The plan specifies that "in the event that a substantial security incident results in an impact to operations there is a strong likelihood that the Incident Management Team and Emergency Response Plans are activated." The Field Response Plan provides a brief overview of common security hazards and response actions.

5.4.2 Bedrock Blasting Effects

Enbridge has identified nine locations along the proposed relocation route where blasting would be used for pipeline installation (Table 5.1-7; Figure 2.5-3and Figure 5.1-2). Enbridge determined that approximately one percent of the RA-02 corridor and two percent of the RA-03 corridor have mapped soils with less than 60 inches to bedrock. RA-01 did not have any areas mapped as having bedrock shallower than 60 inches, and as such would not require blasting. The same safety standards would apply to blasting on the proposed route and alternative routes. In that regard, there would not be a significant difference among the routes, except for RA-01. Should blasting be required to accomplish rock excavation, the blasting would be performed in accordance with Enbridge's General Blasting Plan (Appendix F), which was designed to meet federal and state regulations pertaining to the use, storage, and transportation of explosives (Sections 1.4.1.13 and 1.4.3.18).

All blasting operations must be conducted under the direction and constant supervision of personnel certified and legally licensed as specified in s. SPS 305.20, Wis. Adm. Code. Enbridge's General Blasting Plan includes the following provisions for the protection of construction personnel:

> *Contractor must include in its procedures all federal, state, county, and local safety requirements for blasting. The procedures must address, at a minimum, the following requirements:*
>
> - *The employer shall permit only authorized and qualified persons to handle and use explosives.*
> - *All explosives shall be accounted for at all times.*
> - *Employees authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution including, but not limited to, visual and audible warning signals, flags, or barricades, to ensure employee safety.*
> - *All blasting activities must be conducted only during daylight hours.*
> - *Adequate signs, warning against the use of mobile radio transmitters, are to be prominently displayed on all roads within 1,000 feet of blasting operations.*
> - *Explosives, blasting agents, and blasting supplies that are obviously deteriorated or damaged shall not be used.*
> - *Tamping shall be done only with wood rods or plastic tamping poles without exposed metal parts, but non-sparking metal connectors may be used for jointed poles. Violent tamping shall be avoided. The primer shall never be tamped.*
> - *No explosives or blasting agents shall be left unattended at the blast site.*
> - *No activity of any nature other than that which is required for loading holes with explosives shall be permitted in a blast area.*
> - *No explosive shall be loaded or used underground in the presence of combustible gases or combustible dusts.*
> - *No loaded holes shall be left unattended or unprotected.*
> - *All loading and blasting activity must cease and personnel in and around the blast area will retreat to a position of safety during the approach and progress of an electrical storm irrespective of the type of explosives or initiation system used.*
> - *Fly-rock leaving the ROW must be collected immediately and disposed of at disposal sites approved by Enbridge. This work shall not be left to the cleanup crew.*

Blasting contractor's site-specific blasting plans would be developed to help minimize the risk to health and safety, and as such minimize direct effects on public health and safety. The site blasting plans would address the environmental and site-specific conditions present at a given site. Plans would include specifics on seismic monitoring, permits, blasting means and methods, schedules, distances from a blast that above ground or underground structures could be affected, a listing of all structures within those distances, handling and safety procedures, timing and methods of notifying residences, buildings, and occupied structures, and other precautions.

Enbridge's General Blasting Plan includes provisions for notifying the occupants of nearby buildings in advance of blasting:

> *Blasting cannot begin until occupants of nearby buildings, stores, residences, places of business, places of public gathering, administrators of public recreation areas, and farmers have been notified by Contractor sufficiently in advance to protect personnel, property, and livestock. Contractor must notify all such parties at least 48 hours prior to blasting; the specifics of how this notification will occur will be in the site-specific Blasting Plan.*

An independent third-party seismic contractor would monitor seismographs and supply the results to Enbridge. Peak particle velocities would be recorded at above ground structures, potable water sources, and adjacent pipelines.

No long-term or cumulative effects on public health and safety would be anticipated from rock blasting along Enbridge's proposed route or route alternatives.

5.4.3 Effects on Local Public Health & Safety Infrastructure

As noted in Section 4.3.2, Native American tribal members have expressed concerns about tribal safety with an influx of temporary workers. They note that tribal police and emergency responders are already spread thin and would be hard-pressed to respond to an increased volume of calls for services. Tribal members also raised concern about the potential for an increase in drug trafficking in the area's reservations, which have already experienced increases in substance abuse. Additional increases would place added demands on tribal and county social service and public health agencies.

In addition to the demands placed on under resourced agencies, tribal members raised concerns about how local, particularly non-tribal, law enforcement would respond to protests against the proposed Line 5 relocation project. They noted violence and mass arrests at construction sites for the Line 3 replacement project in Minnesota.

5.4.4 Health Effects of Liquid Petroleum Spills

Human health effects from inadvertent petroleum spills are discussed in Section 6.4.4.12. Aside from the immediate direct effects of exposure to hazardous air pollutants (e.g., benzene, toluene, ethylbenzene, and xylene) and other toxins, an oil spill could affect drinking water resources, local food chains, and recreational opportunities. Research has shown that when spilled on land, oil can enter the groundwater system and effect wells and can remain in the aquifer for decades. Should the spilled petroleum reach surface waters, there would be the potential for far-reaching impacts including the need for new fish consumption restrictions. The impact of a spill would be greatest to the local and Native American people in the Lake Superior basin who rely on subsistence or commercial harvesting practices to sustain their communities and their culture.

5.4.5 Concerns Regarding an Influx of Temporary Workers

One component of the human environment covered in this EIS is the ongoing tragedy of murdered and missing indigenous people (Section 4.4). The concern, which Enbridge addresses in its Environmental Justice Commitment Plan (Section 4.5; Appendix J) is that the influx of temporary workers in the project area could result in an increase in sexual assault, abduction, and other violent crimes committed against tribal women and other vulnerable populations in the Bad River Reservation and surrounding area. These types of crimes would have long-term effects, regardless of when they occur.

5.4.6 Occupational Health

As noted in Section 5.3, the EPA has classified diesel emissions as a likely human carcinogen and the International Agency for Research on Cancer has concluded that diesel exhaust is carcinogenic to humans. Acute exposures can lead to health problems and respiratory system issues. Longer term exposure may worsen heart and lung disease. In commenting on the Draft EIS, the EPA recommended Enbridge consider the following best practices for minimizing effects from diesel emissions to construction workers:

- Reduce exposure through work practices and training, such as maintaining filtration devices and training diesel-equipment operators to perform routine inspections.
- Position the exhaust pipe so that diesel fumes are directed away from the operator and nearby workers, reducing the fume concentration to which personnel are exposed.
- Use enclosed, climate-controlled cabs pressurized and equipped with high-efficiency particulate air (HEPA) filters to reduce the operators' exposure to diesel fumes. Pressurization ensures that air moves from inside to outside. HEPA filters ensure that any incoming air is filtered first.
- Use respirators, which are only an interim measure to control exposure to diesel emissions. In most cases, an N95 respirator is adequate. Workers must be trained and fit-tested before they wear respirators. Depending on the type of work being conducted, and if oil is present, concentrations of particulates present will determine the efficiency and type of mask and respirator. Personnel familiar with the selection, care, and use of respirators must perform the fit testing. Respirators must bear a NIOSH approval number.

5.5 Geology & Groundwater

Enbridge's proposed Line 5 relocation route is located within the Superior Upland physiographic province, which is a southern extension of the Canadian Shield (NPS, 2020). The Canadian Shield is an area generally composed of Precambrian basement rocks (older than 500 million years before present) that have undergone multiple episodes of mountain building and erosion. The region is characterized by geological stability throughout the Paleozoic, Mesozoic, and Cenozoic time periods, the most recent 500 million years. The geologic formations represent the landscape scale, or big picture, of the land through which Enbridge's proposed Line 5 relocation route would go. Within the formations are variations in bedrock, soils, and groundwater aquifers.

5.5.1 Geologic Formations

The rock formations in the locations along Enbridge's proposed Line 5 relocation route and route alternatives are landscape scale geological units that extend vertically into the ground hundreds to thousands of feet. The Copper Falls and Miller Creek Formations in the locations of the proposed route and the three route alternatives are landscape scale geological units that extend vertically into the ground tens of feet. In areas where the Miller Creek Formation is present, the Copper Falls Formation is at a depth under the Miller Creek Formation that would isolate the Copper Falls Formation from pipeline excavations. Wherever these formations are the uppermost geological material, typically, the upper five feet is mantled by soil layers developed over time.

5.5.1.1 Bedrock

Based on a review of the Wisconsin Geological and Natural History Survey geological bedrock mappings, the bedrock units in the area of the proposed and alternative routes include Precambrian rocks (older than 500,000,000 years) of various types, including sedimentary, volcanic, slow cooling igneous and metamorphic (USGS, 1996; WGNHS, 2020); shown in Figure 5.5-1). The bedrock units mapped below the proposed route include the pre-Cambrian Middle Proterozoic age Bayfield Group and Oronto Group feldspathic sandstone, siltstone, shale and conglomerates; the Middle Proterozoic age Powder Mill Group volcanic andesites and basalts; the Middle Proterozoic age Mellen Intrusive Group granites, gabbros, and anorthosites; and the Middle Proterozoic age Bergland Group basalts and andesites (USGS, 1996; WGNHS, 1982).

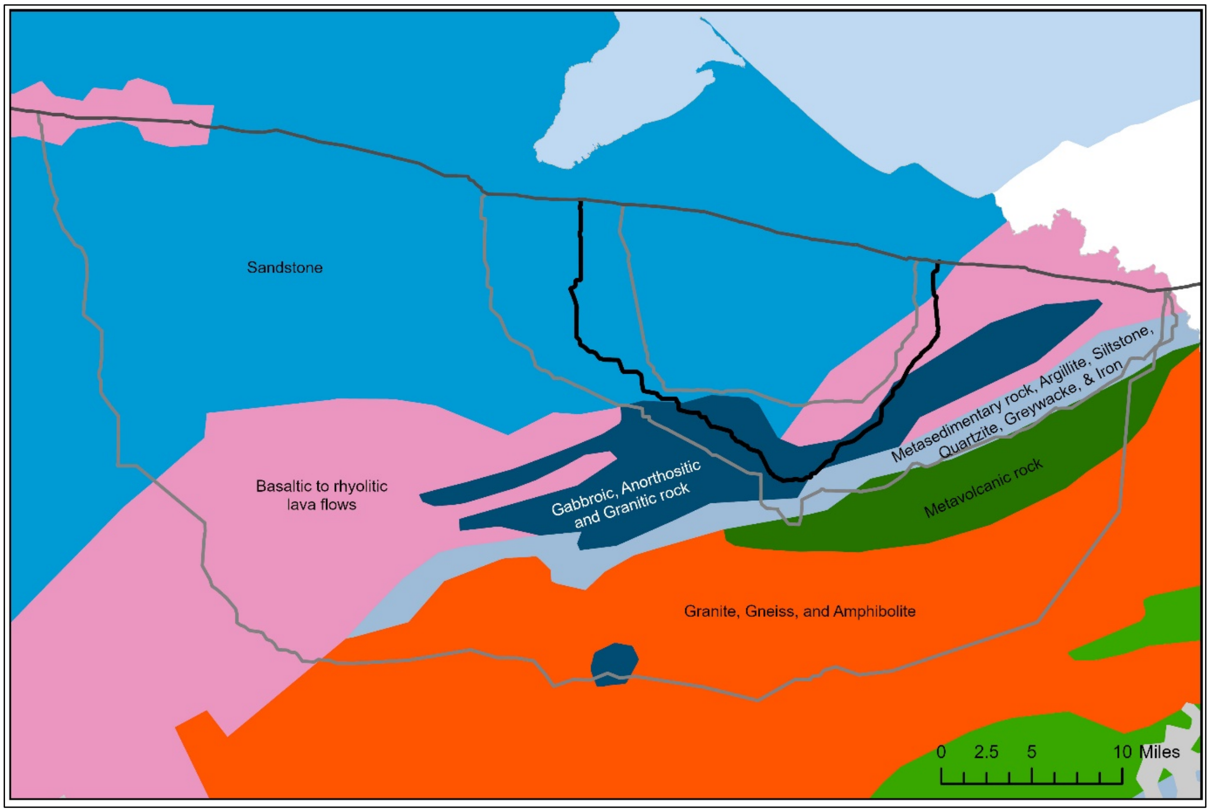


Figure 5.5-1 Bedrock geology around Enbridge's proposed Line 5 relocation route and route alternatives.
Source: (B. A. Brown, Greenberg, and Mudrey, 2005)

The bedrock units mapped below RA-01 include the pre-Cambrian Middle Proterozoic age Bayfield Group and Oronto Group feldspathic sandstone, siltstone, shale, and conglomerates; the Middle Proterozoic age Powder Mill Group volcanic andesites, rhyolites, and basalts; and the Middle Proterozoic age Bergland Group basalts and andesites (USGS, 1996; WGNHS, 1982).

The bedrock units mapped below RA-02 include the pre-Cambrian Middle Proterozoic age Bayfield Group and Oronto Group feldspathic sandstone, siltstone, shale, and conglomerates; the Middle Proterozoic age Powder Mill Group volcanic basalts and andesites; the Middle Proterozoic age Mellen Intrusive Group granites, gabbros, and anorthosites; and the Early Proterozoic age Marquette Range Supergroup graywackes and argillites, and the iron containing Ironwood Formation (USGS, 1996; WGNHS, 1982).

The bedrock units mapped below RA-03 include the pre-Cambrian Middle Proterozoic age Bayfield Group and Oronto Group feldspathic sandstone, siltstone, shale, and conglomerates; the Middle Proterozoic age Bergland Group basalts and andesites; the Middle Proterozoic age Powder Mill Group volcanic andesites, rhyolites, and basalts; the Late Archean age Puritan quartz monzonites and gneisses; the Late

Archean age metamorphosed basalts and andesites; and the Early Proterozoic age Marquette Range Supergroup graywackes, argillites, conglomerates, quartzites, siltstones, and the iron containing Ironwood Formation (USGS, 1996; WGNHS, 1982).

The Precambrian sedimentary rocks of the Bayfield Group and Oronto Group are far less resistant to erosion than the local igneous and metamorphic rock assemblages and, having been eroded, occur beneath a mantle of glacial and lake sediments that extends in thickness to over 200 feet. The igneous and metamorphic assemblages being more resistant to erosion form uplands south of the Lake Superior lowlands and tend to have greater local relief, comparatively shallower depths to bedrock, including areas of near-surface bedrock. Along the proposed route the depth to bedrock is expected to range from less than five feet below grade to greater than 300 feet below grade (Enbridge, 2020e, Appendix AJ; WGNHS, 1973). The depth to bedrock is expected to range from 50 to 300 feet along RA-01, from less than 50 to 300 feet along RA-02, and from 20 to over 400 feet along RA-03. The eastern RA-02 is located within the Penokee Hills–Gogebic Range (Section 5.5.1.3) and would be anticipated to have more frequent areas of bedrock at or near the surface than the other routes (Enbridge, 2020e, Appendix AJ; WGNHS, 1973).

The most recent historical geologic activity in the region occurred during the Pleistocene Era during which there were multiple phases of continental glaciation that further planed regional topography and deposited multiple sequences of glacial sediments over the preexisting bedrock. Topographically, Enbridge’s proposed project route and alternatives cross through areas having different characteristics. The Superior Lowland was inundated by higher lake stages during the retreat of Pleistocene glaciers. The area is characterized by gently undulating areas underlain by a thick red glacial clay. Landward of the Superior lowland the topography rises in elevation toward the outwash sandy ridges along the middle of the Bayfield Peninsula and toward the elevations of Penokee Hills–Gogebic Range. The Penokee Hills–Gogebic Range (Section 5.5.1.3) and areas to the south can be described as rolling hilly topography underlain by sandy glacial till and sands outwash. The topography is characterized as bedrock-controlled hills, end and ground moraines and outwash plains. The highest and most pronounced topography occurring at the Penokee Hills and more subdued topography in areas of ground moraine and outwash plains.

5.5.1.2 Copper Falls & Miller Creek Formations

Along the route alternatives the glacial sediments are identified as being part of two stratigraphic units and these units are the Miller Creek Formation and the Copper Falls Formation (WGNHS, 1984). The Copper Falls Formation, to the south, consists largely of glacial sandy till and fluvial sand and gravel. The distribution of sediment grain sizes in the till is highly variable, ranging from 35 to 80 percent sand, 15 to 50 percent silt, two to 15 percent clay, with a few percent pebbles, cobbles, and boulders. The till deposited in Bayfield, Ashland, and Iron counties averages about 60 percent sand, 35 percent silt, and five percent clay. Copper Falls Formation till is commonly reddish brown and is generally redder to the north and browner to the south in Douglas, Bayfield, Ashland, and Iron counties (Syverson et al., 2011). Locally, the Copper Falls Formation is an important aquifer because of the sand content of the till and associated fluvial sands and gravels (Batten and Lidwin, 1995). The approximate location of the surface expression of the Copper Falls Formation deposits are shown, as cross-hatching, in Figure 5.5-2 (WGNHS, 1985).

The Miller Creek Formation, which is the younger of the two formations, is described as a reddish clay sediment of the Superior lowland, primarily deposited as a glacial till. The formation contains subunits including the Hanson Creek and Douglas Members. The formation also contains offshore sediments, which are generally reddish bedded (layered) silt and clay. The offshore sediments are found to occur above, below, or between the till units (Syverson et al., 2011). The approximate location of the surface expression of the Miller Creek Formation deposits can be seen in Figure 5.5-2 (WGNHS, 1985). These are the deposits between the Copper Falls Formation (to the south) and Lake Superior.

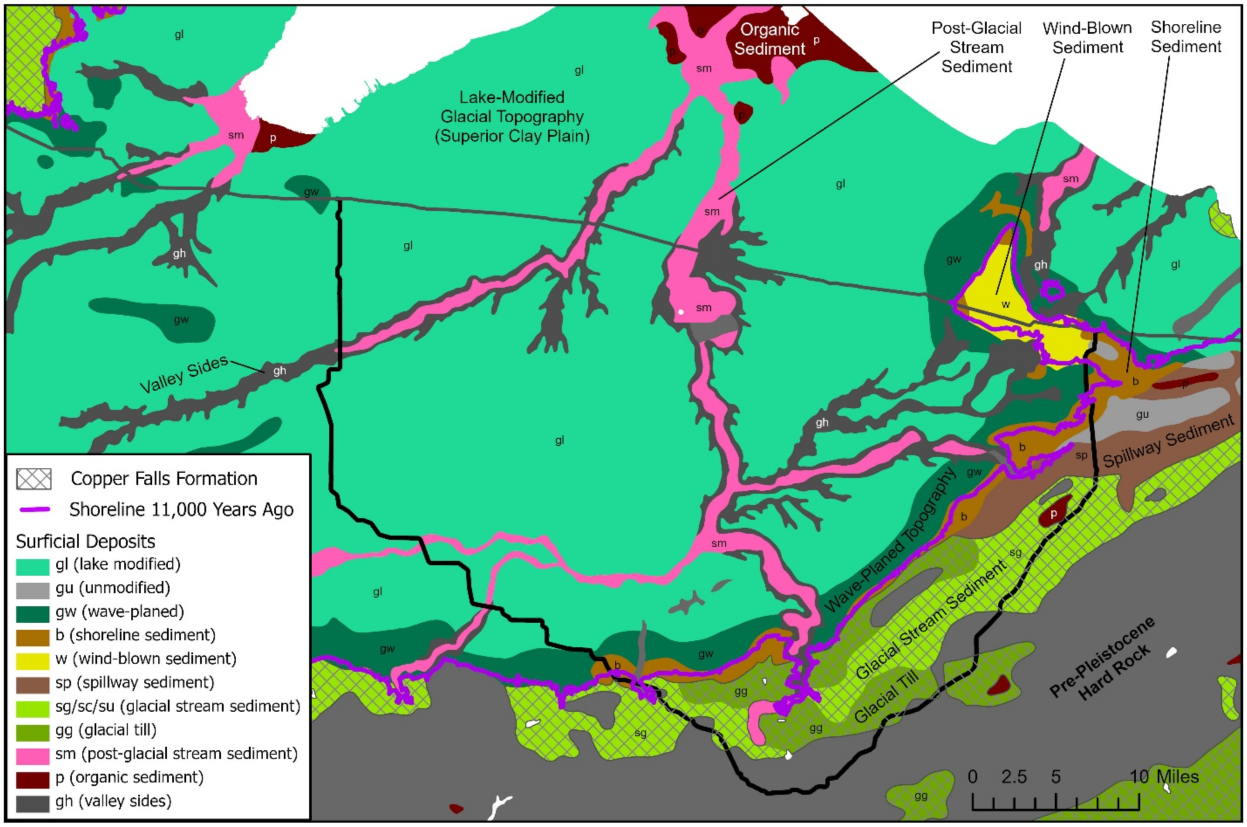


Figure 5.5-2 Geological surface materials along Enbridge's proposed Line 5 relocation route and route alternatives.
Source: (WGNHS, 1984).

5.5.1.3 Penokee Hills

The Penokee Hills refers to the western end of bedrock ridge called the Penokee-Gogebic Range. The ridge resulted from multiple geologic processes including volcanism, metamorphism, erosion, intrusion, continental collision, and rifting. The Penokee-Gogebic Range is located approximately 25 to 30 miles south of Lake Superior and extends approximately 80 miles from Lake Namakagon in Bayfield County, Wisconsin, to Lake Gogebic in Gogebic County, Michigan. The range is typically half a mile wide and rises 100 to 600 feet above adjacent terrain.

5.5.1.4 Transition Zone & Artesian Aquifers

The Bad River watershed contains a geologic area called the transition zone. The transition zone lies between the Lake Superior Clay Plain to the north and the Upper Basin to the south (Figure 5.5-2; Figure 5.6-2); the transition zone is the location where sandy soils from the south mix with northern, clayey soils, resulting in mixed and complex soil profiles that are highly location dependent. These areas are highly geomorphically sensitive due to the mix of clay and sand layers, which are often exposed in the zone's high proportion of ravines. Streams in the area often have steep, unstable banks or flow through valleys entrenched in steep ravines (F. A. Fitzpatrick, 2005a; USGS, 2016) The area also has many springs and seeps.

Artesian aquifers gain water in permeable soils at higher elevations. This groundwater then flows downhill until it flows underneath a confining layer, which keeps it from reaching the surface. The water is then pressurized and can flow onto the lower land surface. Figure 5.5-4 provides a diagram comparing a traditional, unconfined aquifer to an artesian confined aquifer. In the case of the Bad River system, the confining layer causing artesian conditions is the clay plain soil of the surface, and the recharge layer is the Upper Basin sand aquifer to the south. Flowing artesian wells and more typical artesian wells could both occur depending on local conditions in the transition zone.

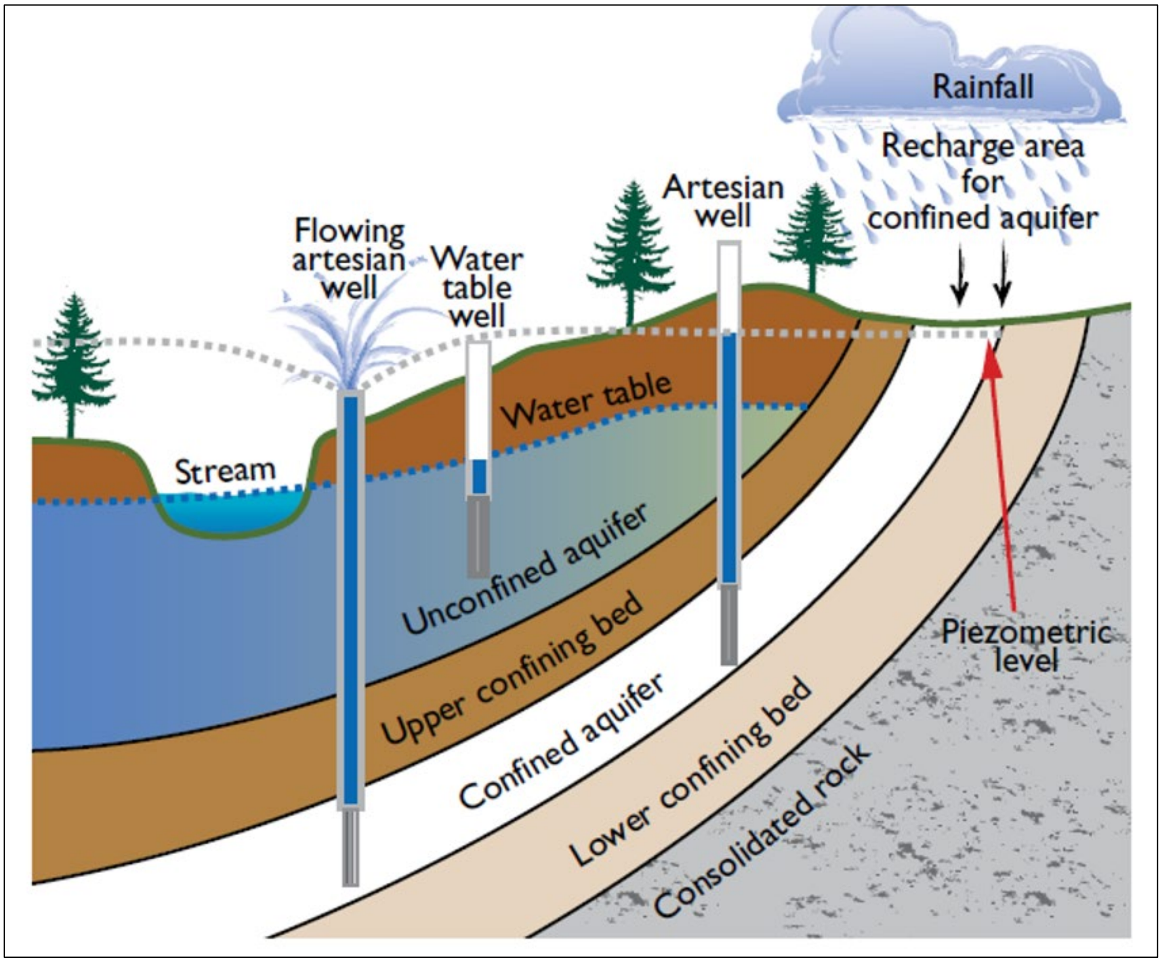


Figure 5.5-3 Geologic conditions leading to an artesian aquifer.
Source: (USGS, 2018)

Soil borings at Billy Creek and Vaughn creek encountered artesian conditions beneath 40 feet of depth during geotechnical boring. The proposed alignment was adjusted away from areas with artesian conditions, and Enbridge's subsequent soil borings at relocation points did not find artesian conditions.

5.5.1.5 Anticipated Effects

Direct effects on bedrock formations in the Miller Creek and Copper Falls formations would be limited to localized effects from HDD operations and blasting where bedrock is shallow (within five to six feet of the surface). While not anticipated, long-term, cumulative, and indirect effects to groundwater flow patterns could occur as a result of an aquifer breach or of trench backfilling that interrupts flows.

5.5.1.6 Effects from Blasting

On a local scale, blasted rocks would be reduced to small rock pieces that would behave more like sediments than rock. Increasing the area over which water could interact with the blasted rock material could locally increase the level of dissolved minerals in waters interacting with the blasted rock. Blasted rock could have a higher capacity to convey water, increasing the possible rate of infiltration in unsaturated areas and increasing the rate of groundwater flow in saturated areas. The blasted rock materials possibly would be more subject to physical and chemical weathering, which are processes that break down rock materials into sediments and soils. And as a result, in a long-term time frame, blasted rock would be more susceptible to erosion.

Blasting plans are formulated to supply sufficient energy to a local rock unit to accomplish an objective and avoid effects on nearby materials and structures. By controlling the number, diameter, spacing and depth of blast holes, the type and quantity of blasting material, timing of ignition and other factors, the effects on local rocks can be controlled.

Rock units have existing cracks, fractures, joints, and fissures resulting from long and complex geologic histories. The relative abundance and nature of such features results from the material properties of the rocks, compressive and tensile strength, for example, and the nature of the stresses the rocks have been subjected to. Rock closer to the ground surface is often more fractured than deeper intervals because of a process referred to as weathering, which is the chemical and mechanical degradation of earth materials from natural processes.

Blasting in the context of pipeline construction is intended to sufficiently fracture the local rock to allow conventual excavation methods to remove the material within the trench. Blasting is a locally destructive process that permanently alters the rock in a local area. The blasting contractor’s site-specific blasting plan would allow Enbridge to review blasting details such as blasting site dimensions, drill hole depths, drill hole diameter, explosive depth, distribution, maximum charge/weight per delay, pattern, and number of holes per delay. Knowledge of the local rock types would allow for appropriate configuration of the blasting parameters for a specific site.

As described above, the comparative effects resulting from blasting bedrock was assessed by determining the presence of soils having less than 60 inches to rock. Blasting is a destructive process that permanently fractures the rock in the vicinity of the blasts. It is anticipated that there would be a local increase in the number of fractures in bedrock adjacent to blasting zones. The blasting contractor’s site-specific blasting plans would be developed to help minimize the risk to nearby above aground and underground structures. The same standards would be applied to blasting on the proposed route and on alternative routes.

Approximately one percent of the proposed route corridor area would be located in areas of bedrock within 60 inches of grade, zero percent of alternate route RA-01 area, one percent of alternate route RA-02 area, and two percent of alternate route RA-03 area. Alternative RA-01 did not have any areas mapped as having bedrock shallower than 60 inches, and as such would not require blasting. Direct and indirect effects on local rock would be managed by controlling the magnitude of the blasting as per the site-specific blasting plans. Indirect effects on bedrock would not be expected from any of the alternatives. Long term effects from blasting would include accelerated weathering of the local bedrock and soil forming processes due to increased capacity for movement of water through the material. Such changes would be anticipated on a very long-time scale. Cumulative effects on bedrock from blasting in any of the routes would not be expected. Figure 5.5-4 shows areas of shallow bedrock for Enbridge’s proposed Line 5 relocation route and route alternatives, as well as candidate blasting areas along the proposed ROW.

In areas where wetlands occur in thin soils over impermeable bedrock, blasting could create new preferential soil moisture movement or groundwater flow paths that could result in changes in wetland hydrology or dewatering of such a wetland relative to conditions prior to the blasting; the trench effectively functioning as a French drain. As described in Section 2.4, measures such as trench blockers would be used to limit water movement in the trench near wetlands and waterways.

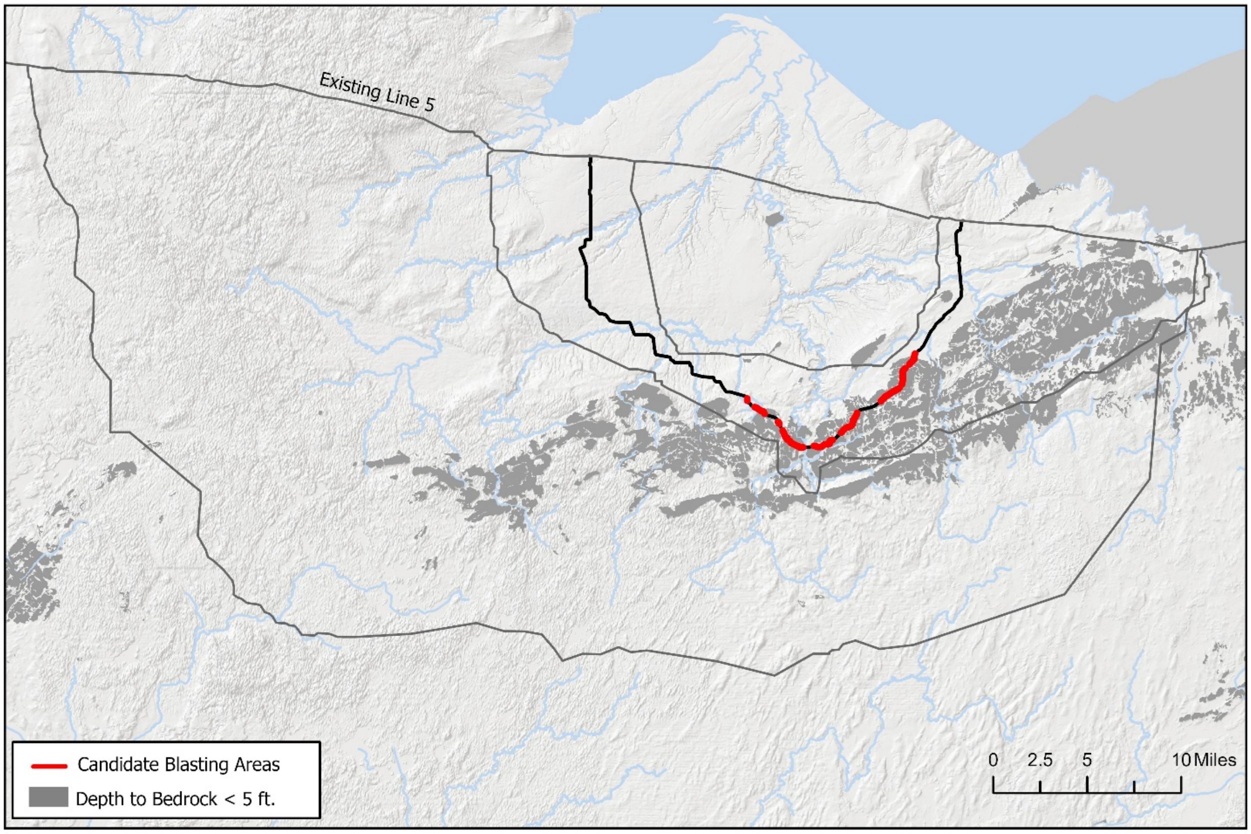


Figure 5.5-4 Candidate blasting areas along Enbridge's proposed relocation route and shallow bedrock across all route alternatives.

5.5.1.7 Effects from HDD & Direct Bore

Six of the 12 proposed HDD waterway crossings (Table 2.5-2) would extend into bedrock. The MP 14 crossing of the Brunsweiler River would extend through the Portwing-Herbster Complex and Freda Sandstone. The MP 17 Billy Creek and MP 19 Silver Creek crossings would extend through Freda Sandstone. The MP 22 Krause Creek crossing would extend through the Ashland Middle Proterozoic Complex. The MP 34 Tyler Forks crossing would extend through Kallander Creek Volcanics. The MP 38 Potato River crossing would extend through Portage Lake Volcanics.

The HDD drill paths would not be expected to affect any bedrock formations due to their size. Where the bedrock is fractured along the drilling path, some HDD drilling fluid would be lost to the formation until the drilling fluid forms a barrier on the outside of the drill hole. This would not be expected to have an effect on ground water quality since Enbridge has committed to using drilling fluid ingredients approved for use in Wisconsin for either potable well drilling or HDD.

5.5.2 Groundwater & Wells

The local hydrogeological system was characterized by the USGS (1995) as having two general flow systems. A shallow upper system, generally at depths less than 50 feet, wherein groundwater generally flows from topographic highs toward local streams, lakes, and wetlands. The flow paths are generally local.

Groundwater generally flows through cracks in the clayey sediments and in sand and silty layers between clayey sediments within the upper fraction of the glacial Miller Creek Formation. The formation is described as a reddish clay sediment of the Superior lowland plain, primarily deposited as glacial tills (Syverson et al., 2011). Lower in the Miller Creek Formation groundwater flow is generally vertical through the clayey materials. Beneath the Miller Creek Formation is a deeper groundwater flow system in the glacial Copper Falls Formation and the Precambrian sandstones. In areas where the glacial sediments are thin or absent, groundwater flow is through fractured bedrock.

An aquifer is a geological formation lying below the ground surface that is partially or entirely saturated with water and permeable enough to allow water to be extracted from a well. In the area of the proposed route and the three alternative routes there are three water bearing units that supply sufficient groundwater to be designated as aquifers, and these are known as the Copper Falls Aquifer (Copper Falls Formation), the Lake Superior Sandstone Aquifer, and the Fractured Crystalline Rock Aquifer.

The groundwater flow directions in the confined groundwater system within the Bad River Reservation in 1995 were mapped as generally to the northwest and north toward Lake Superior (USGS, 1995). The depths to groundwater in supply wells within the reservation were listed as ranging from 376 feet below ground to artesian wells with water levels 20 feet above ground. The flow directions modeled by the USGS (2015) varied considerably in the area of the proposed route; general flow directions range from to the northeast and east along the western leg of the route, to northerly along the southern third and to the northwest along the eastern leg. Overprinted on that pattern was flow toward the major rivers.

Enbridge reported the depth-to-water table for much of the project region between 0 and 50 feet from the surface, based on data from the DNR (Enbridge, 2020e; Appendix AJ). The USGS maintains a network of monitoring wells in aquifers throughout the state. Only one well in the USGS network is located in proximity to the proposed project route alignment, and that well is approximately 5 miles north of the project area. Groundwater-level measurements between 2011 and 2021 had an approximate average depth to ground water of around 29.9 feet from the surface (USGS, 2021b).

Recharge to the groundwater system was evaluated as part of the process of formulating the groundwater model for the Bad River Watershed (USGS, 2015) and is depicted in Figure 5.5-5. The lowest levels were found to be within the area of the Lake Superior Lowlands mantled by the Miller Creek Formation. The recharge rates through clays were on the order of inches per year or less. The highest estimated levels occurred in upland areas underlain by sandy sediments and in the areas of bedrock hills. The estimated range was from 0.0 inches per year to 38.5 inches per year and averaged 6.7 inches per year (USGS, 2015). The areas of highest infiltration were attributed to areas that receive higher than average precipitation, sandy soils and lake effect snows infiltrating upon melting. Table 5.5-1 shows the modeled depth to the water table in the Bad River watershed.

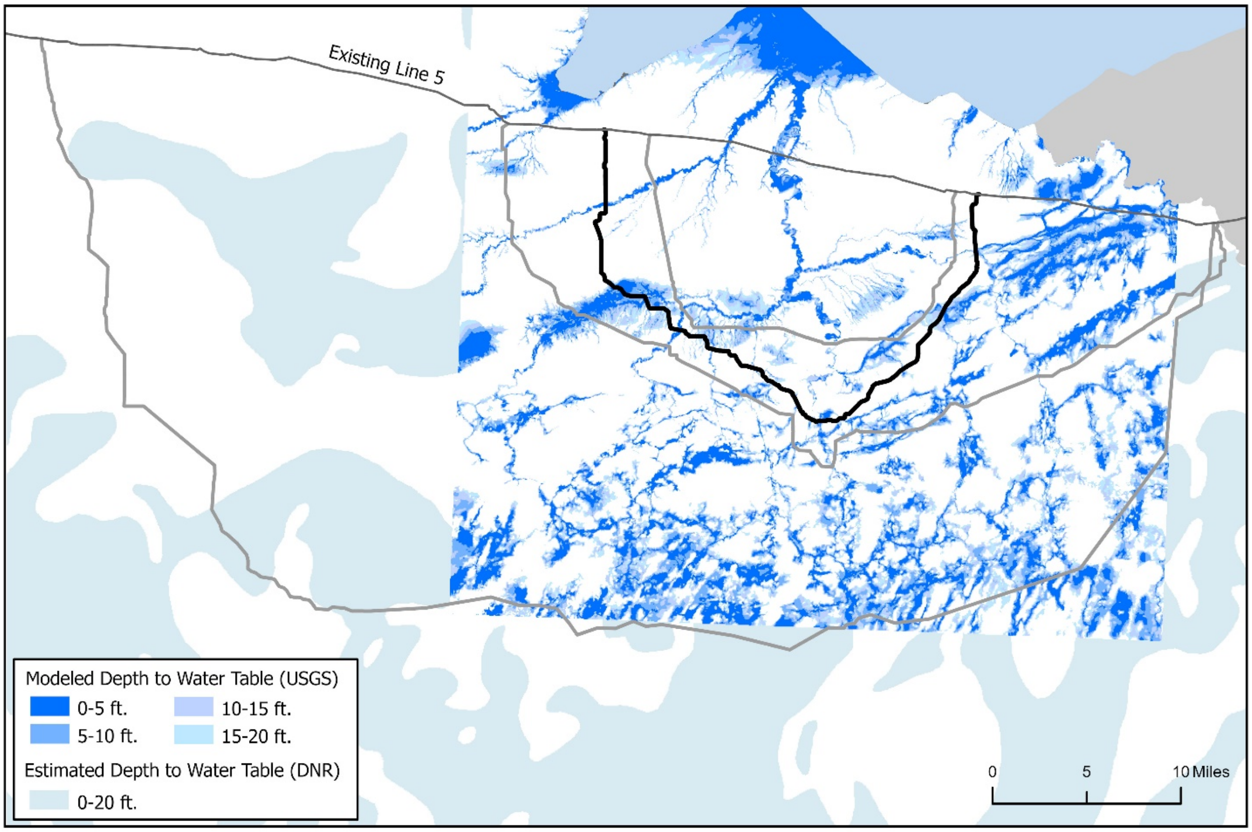


Figure 5.5-5 Modeled depth to water table in the Bad River watershed region.
Source: Leaf et al. (2015)

Table 5.5-1 Depths to water table along Enbridge's proposed Line 5 relocation route and route alternatives.

Scenario	Proposed (acres)	RA-01 (acres)	RA-02 (acres)	RA-03 (acres)
Length of Pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Depth to Water 0-5 feet				
Within Permanent ROW	12	8	20	24
Within Temporary Workspace	12	11	27	34
Depth to Water 5-10 feet				
Within Permanent ROW	9	7	18	34
Within Temporary Workspace	15	9	26	47
Depth to Water 10-15 feet				
Within Permanent ROW	14	15	18	27
Within Temporary Workspace	29	21	25	37
Depth to Water 15-20 feet				
Within Permanent ROW	14	19	20	20
Within Temporary Workspace	23	27	29	30

5.5.2.1 Copper Falls Aquifer

The Copper Falls Aquifer is the name given to the water-bearing portion of the Copper Falls bedrock formation. The formation outcrops on the northern side of the Penokee Hills (Section 5.5.1.3) and extends under the clayey Miller Creek Formation Section 5.5.1.2). The aquifer is also present south of the Penokee Hills. South of the Penokees, the aquifer lacks the overlying cover of the Miller Creek Formation and is not underlain by the Lake Superior Sandstone Aquifer (Section 5.5.2.2). In areas where the formation has groundwater within part of the formation, it functions as a supply aquifer to local water wells.

5.5.2.2 Lake Superior Sandstone Aquifer

The Lake Superior Sandstone Aquifer or Sandstone Aquifer is the name given to the water bearing fraction of Precambrian sandstones of the Bayfield and Oronto Groups (USGS, 2004; USGS, 1995).
The aquifer is typically covered by glacial sediments throughout its extent. Near the project area, the aquifer extends from the northern Penokee Hills to underneath Lake Superior and underlies the Copper Falls Aquifer.

5.5.2.3 Fractured Crystalline Rock Aquifer

Ashland, Bayfield, and Iron counties tap a fractured crystalline aquifer along the Penokee Hills and Gogebic Range where overlying glacial sediments are thin. This aquifer has low water yield because water is stored in larger cracks and joints in the rock as opposed to pores in the bulk material. The USGS estimates that yield from fractured crystalline/volcanic aquifers are between 5 and 25 gallons per minute, depending on the exact geologic conditions (USGS, 1992; USGS, 2020).

5.5.2.4 Tyler Formation

An area of sedimentary rock in the Penokee Hills Located between the crystalline rocks to the south and crystalline rocks to the north is mapped as a Precambrian sandstone unit, the Tyler Formation, that is not part of the Superior Sandstone Aquifer or the Fractured Crystalline Aquifer. RA-02 would cross through this area for a substantial fraction of the alignment, approximately 27 miles. Approximately two miles of RA-03 would cross through the area of the Tyler Formation two miles south of the reconnection point to the existing Line 5.

5.5.2.5 Water Supply

The USGS (2015) estimated that approximately 21 percent of people living within the Bad River watershed obtain their water from public water supply wells, while approximately 36 percent obtain their water from private water supply wells. The City of Ashland accounts for 42 percent of the population in the watershed and obtains its water from Lake Superior. A 1995 study conducted by the USGS in cooperation with the Bad River Band found that all community and private water supply wells are supplied by groundwater in either the buried glacial sand and gravel deposits of the Copper Falls Formation or in Lake Superior (Precambrian) sandstone (USGS, 1995).

Public Water Systems

The proposed corridor and the alternative route corridors avoid population centers where public water utilities are common. The closest municipal community well to the proposed route is a City of Mellen Water Utility well located about 2,200 feet south of the Bad River crossing. Two municipal community wells are located within 120 feet of routes RA-01 and RA-02.

5.5.2.6 Private Wells

As shown in Table 5.5-2, the number of private wells within 1,200 feet of the route alternatives varies, with Enbridge's proposed Line 5 relocation route having the least number of private wells near the route compared with the alternative routes.

5.5.2.7 Artesian Wells

A review of the Wisconsin well drilling records showed that there are five flowing artesian wells within one mile of Enbridge's proposed Line 5 relocation route. In these wells, the static water level was recorded as being one to three feet higher than the ground surface at the well.

Table 5.5-2 summarizes known water supply wells within 1,200 feet of Enbridge's proposed Line 5 relocation route and route alternatives. This includes wells constructed prior to 1988, for which limited digital records are available. Based on the most current information in the DNR's well database, an estimated 94 wells are located within 1,200 feet of either direction of Enbridge's proposed relocation route. All these wells are private wells. An estimated 114 wells are located within 1,200 feet of RA-01, of which two are municipal community wells. An estimated 142 wells are located within 1,200 feet of RA-02, of which two also are municipal community wells. An estimated 189 wells are located within 1,200 feet of RA-03, of which one is a municipal community well. Figure 5.5-6 shows wells near Enbridge's proposed Line 5 relocation route and route alternatives, including artesian wells and wells with subsurface static water levels.

The static water level referenced in Table 5.5-2 is the depth to groundwater in a newly drilled well as reported by the individual that constructed it. Static water level varies depending on the nature of the aquifer in which a well is drilled. Negative static water levels indicate artesian (flowing) conditions. One such well is located within 1,200 feet of Enbridge's proposed Line 5 relocation route. Another 34 wells, for which digital records are available, report static water levels less than 50 feet.

Static water level is not always the best indication of the relative risk of contamination from construction related spills or pipeline spills. The overall depth of a well, and the depth of its casing (typically made of steel or PVC plastic) are additional factors. A well drawing from a shallow water table will have a greater risk of contamination than an artesian well drawing from a deeper aquifer.

Well depth in Table 5.5-2 is the total depth of a well as reported by the individual that constructed it. In general, deeper wells withdraw water from deeper in the earth. Well casing extends downward from the surface to a depth that is determined based on the depth of the aquifer, the nature of the material through which the well is drilled, and regulatory requirements. In general, wells with deeper casings will have a greater level of protection from contamination resulting from construction-related or pipeline spills.

5.5.2.8 Public Water Systems

The proposed corridor and the alternative route corridors avoid population centers where public water utilities are common. The closest municipal community well to the proposed route is a City of Mellen Water Utility well located about 2,200 feet south of the Bad River crossing. Two municipal community wells are located within 120 feet of routes RA-01 and RA-02.

5.5.2.9 Private Wells

As shown in Table 5.5-2, the number of private wells within 1,200 feet of the route alternatives varies, with Enbridge's proposed Line 5 relocation route having the least number of private wells near the route compared with the alternative routes.

5.5.2.10 Artesian Wells

A review of the Wisconsin well drilling records showed that there are five flowing artesian wells within one mile of Enbridge's proposed Line 5 relocation route. In these wells, the static water level was recorded as being one to three feet higher than the ground surface at the well.

Table 5.5-2 Wells within 1,200 feet of Enbridge's proposed and alternate routes.

	Proposed	RA-01	RA-02	RA-03
Length of pipeline (miles)	41.1 mi.	31. 4 mi.	58.0 mi.	101.5 mi.
Estimated total number of wells [1]	94	114	142	189
Well construction date				
1988 to Present	63	58	87	116
Prior to 1988 [2]	31	56	55	73
Well use [3]				
Private potable	65	60	81	117
Municipal community	0	2	2	1
Other community, non-municipal	0	1	0	0
Noncommunity (various)	1	4	7	8
Private non-potable (or *other*)	0	0	1	*(4)*
Not listed [4]	28	47	51	59
Static water level				
Negative (artesian conditions)	1	0	2	0
0-50 ft.	34	37	61	86
50-100 ft	14	15	8	31
100-150 ft	10	3	4	2
150-200 ft..	2	1	3	0
> 200 ft.	0	3	1	0
Not listed [4]	33	55	63	70
Well depth				
< 50 ft.	4	5	6	24
50-100 ft.	20	15	19	49
100-150 ft.	13	14	10	20
150-200 ft.	11	8	11	12
> 200 ft.	16	18	42	18
Not listed [4]	30	54	54	66
Casing depth				
< 50 ft.	14	9	48	51
50-100 ft.	26	17	24	54
100-150 ft.	11	18	12	17
150-200 ft.	10	5	1	1
> 200 ft.	2	10	3	0
Not listed [4]	31	55	54	66

[1] The positional accuracy of well records within the DNR database range from GPS coordinates to public land survey (PLS) areas. The vast majority are at the PLS "quarter-quarter section" level, meaning the well is located somewhere within a 1,320 X 1,320 ft. survey area. If most of the survey area falls within 1,200 ft. of the pipeline (on either side, or both) the well is estimated to be within 1,200 ft. of the pipeline.

[2] Wells constructed before 1988. Digital information for most of these wells is limited, and detailed information such as well depth and well use (if not municipal) may not be available.

[3] Well use categories are based on definitions in the Wis. Adm. Code.

[4] Generally pre-1988 wells, the documentation for which were collected under different regulations or wells that do not have the referenced parameter detailed in records.

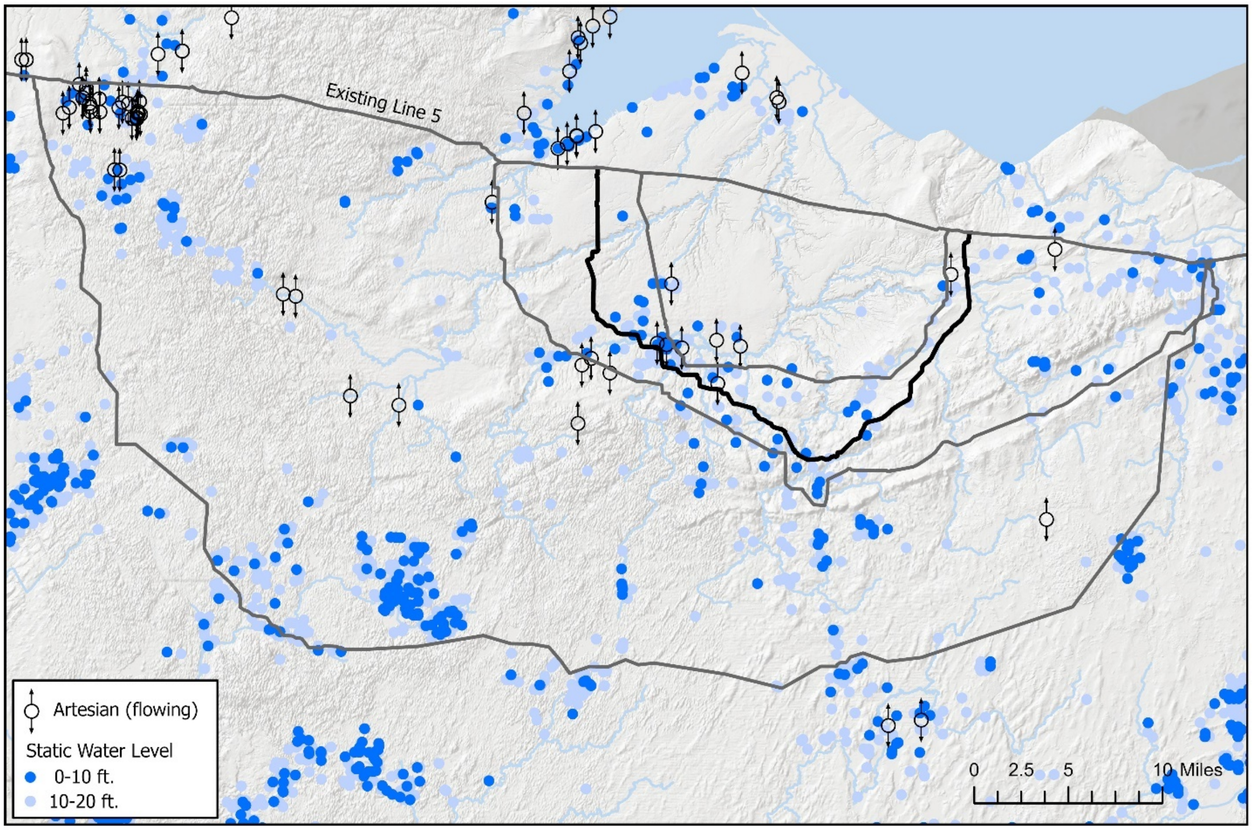


Figure 5.5-6 Static water level of wells in the region of Enbridge's proposed Line 5 relocation route and route alternatives.

5.5.2.11 Effects on Unconfined Aquifers

Anticipated effects on unconfined aquifers include temporary lowering of water levels during dewatering activities and reduction in water recharge. During construction, any water within the trenches dug for pipe installation would require dewatering. Dewatering pumping rates exceeding 70 gpm could require coverage under a temporary high capacity well permit (Section 1.4.3.13). The duration of trench dewatering activities would be limited to that required to install pipe in that location. In its EPP (Appendix D), Enbridge states that the contractor would be required to limit the amount of excavated open trench to three days of anticipated welding production except for tie-in points, valve installation, and specialized installation methods. Lake Superior Consultants identified an area between MP 20 and MP 25 where dewatering activities within the unconfined aquifer could cause a temporary lowering of water levels in nearby wells. There could be other areas within the project boundaries where dewatering could affect private wells due to a localized lowering of the water table. Measures that could be taken to limit anticipated effects include using trench plugs to minimize the length of trench being dewatered at any one time and limiting pumping rates. Mitigation measures could include providing an alternative water source to those using affected wells until the water level in their wells return to usable levels.

Unconfined aquifers could also be affected by reductions in recharge rates. Since the project involves relatively small amounts of new impervious surfaces that are spread throughout the 41-mile corridor and drain to vegetated areas, no measurable effects would be expected to recharge rates. Soil compaction during construction would reduce recharge rates within the construction corridor but are expected to be temporary and are likely to be mitigated in the restoration phase where needed to facilitate revegetation. In section 16.0 of the EPP (Appendix D), Enbridge indicates that a deep tillage device or chisel plow would be used on the subsoil in equipment travel areas. This would be done to a depth of 18 inches in cultivated fields where that depth would not affect drain tile. Other areas would be de-compacted to a subsoil depth of 12 inches. Over time, vegetation and freeze-thaw action are expected to further de-compact soils. Use of low ground pressure equipment or construction mats would also be used in soft soils to reduce soil compaction. Where the permanent ROW is currently forested, local recharge rates would be reduced by the incremental difference in infiltration between tree cover and meadow conditions. This effect is expected to be less than 0.05 inches for one inch of rainfall on vegetated clayey soils (USDA and NRCS, 1986). Water flow within the trenches could also affect where and how the aquifers are recharged. Enbridge has included trench plugs in its construction plans to limit changes in subsurface water movement due to the trench.

Throughout most of the aerial extent of the Copper Falls Aquifer north of the Penokee Hills within the Superior plain, the aquifer is covered by the clayey Miller Creek Formation, which would limit the risk to the aquifer from spills. Sediments of the Copper Falls Formation are exposed by erosion through the Miller Creek Formation in areas adjacent to several rivers. Such areas are found adjacent to the White River, the Bad River, and Vaughn Creek along the proposed route and RA-01, and adjacent to the White River along RA-02. In these areas the Copper Falls Aquifer could be affected by water quality in the streams, including spills. RA-03 is located south of the extent of the Miller Creek Formation. In this area the Copper Falls Aquifer could be more susceptible to water quality effects from spills.

If a significant petroleum release was to occur within the recharge area of the Copper Falls Aquifer, or to streams hydrologically connected to the aquifer, secondary impacts to the aquifer could occur. Chapter 6 discusses the risks and anticipated effects from petroleum spills.

Neither long-term nor cumulative effects on the Copper Falls Aquifer are anticipated from construction of Enbridge's proposed Line 5 relocation route or the three alternative routes.

The Lake Superior Sandstone Aquifer is located beneath varying thicknesses of glacial sediments, including the Miller Creek and Copper Falls formations. These units provide a measure of protection from direct effects on the aquifer from possible spills or leaks, especially where both units are present. If a significant petroleum release was to occur within the recharge area of the Lake Superior Sandstone Aquifer, secondary effects to the aquifer could occur over time. Chapter 6 discusses the risks and impacts of spills.

Long term and cumulative impacts to the Superior Sandstone Aquifer are not anticipated from Enbridge's proposed Line 5 relocation route or the three alternative routes.

There could be direct effects on the Fractured Crystalline Rock Aquifer from construction of a pipeline in areas where blasting is required for excavation of a trench. Should blasting be required to excavate trenches in areas of shallow bedrock (for example, in the Penokee Hills area), there could be a local increase in the number of fractures and the lateral extent of existing fractures adjacent to an area excavated by blasting. It is anticipated that a local increase in the number of fractures and extent of existing fractures could increase the local capacity of the rock to convey and store water, although this would be anticipated to be a very local effect at shallow depths.

Blasting in rock can result in a temporary release of accumulated sediments in water filled fractures that causes a temporary clouding of local groundwater. These sediments would subsequently resettle within the fractures, returning the groundwater to a non-cloudy condition.

In addition to blasting, the Fractured Crystalline Aquifer could be subject to changes in aquifer recharge. As described above, large tracts of impervious surfaces, which could decrease local levels of aquifer recharge and decrease the available water in the aquifer, are not part of the proposed alignment or the three alternative routes. In areas where the Fractured Crystalline Aquifer has a layer of soils capping the rock the local recharge rates to the aquifer could be temporarily affected by soil compaction resulting from construction practices and tracking of construction equipment increasing runoff and decreasing infiltration. Dewatering of trenches could also have temporary effects to local recharge rates. Enbridge plans to implement best management practices during and following construction to alleviate soil compaction, including low ground pressure equipment or construction mats in soft soils, decompaction methods in agricultural areas to a subsoil depth of 18 inches and decompaction to a subsoil depth of 12 inches in other areas to mitigate this temporary effect.

The cumulative length of the proposed route where shallow bedrock is anticipated was estimated at 0.5 miles based on the mapped area of soils formed over shallow bedrock along the permanent ROW. The estimated length of ROW within RA-01 was estimated at 0.0 miles. Within RA-02, the estimated length was 18 miles and within RA-03, the estimated length was four miles (USGS, 2020).

Neither long term nor cumulative effects on the Fractured Crystalline Aquifer would be anticipated from the construction of Enbridge's proposed Line 5 relocation route or the three alternative routes.

There would be no direct effects to the water carrying or water storage capacity of saturated fractions of the Tyler Formation. As described for the aquifers, local recharge rates to the aquifer could be temporarily affected by soil compaction resulting from construction practices and tracking of construction equipment increasing runoff and decreasing infiltration. Dewatering of trenches could also have temporary effects to local recharge rates. Enbridge would implement BMPs during and following construction to alleviate soil compaction (Section 5.6.3.6).

5.5.2.12 Effects on Artesian Aquifers

As discussed in Section 5.5.2.12, artesian aquifers are present near the proposed route. Given the natural variation of soil conditions between locations, it is possible that artesian aquifers could be encountered during construction, with that possibility increasing with increased depth of construction practices. Figure 5.5-7 shows potential confined aquifer locations using information from multiple sources, including Enbridge-commissioned studies (Appendix G), geotechnical data (Appendix O), and well reports mapped by the DNR.

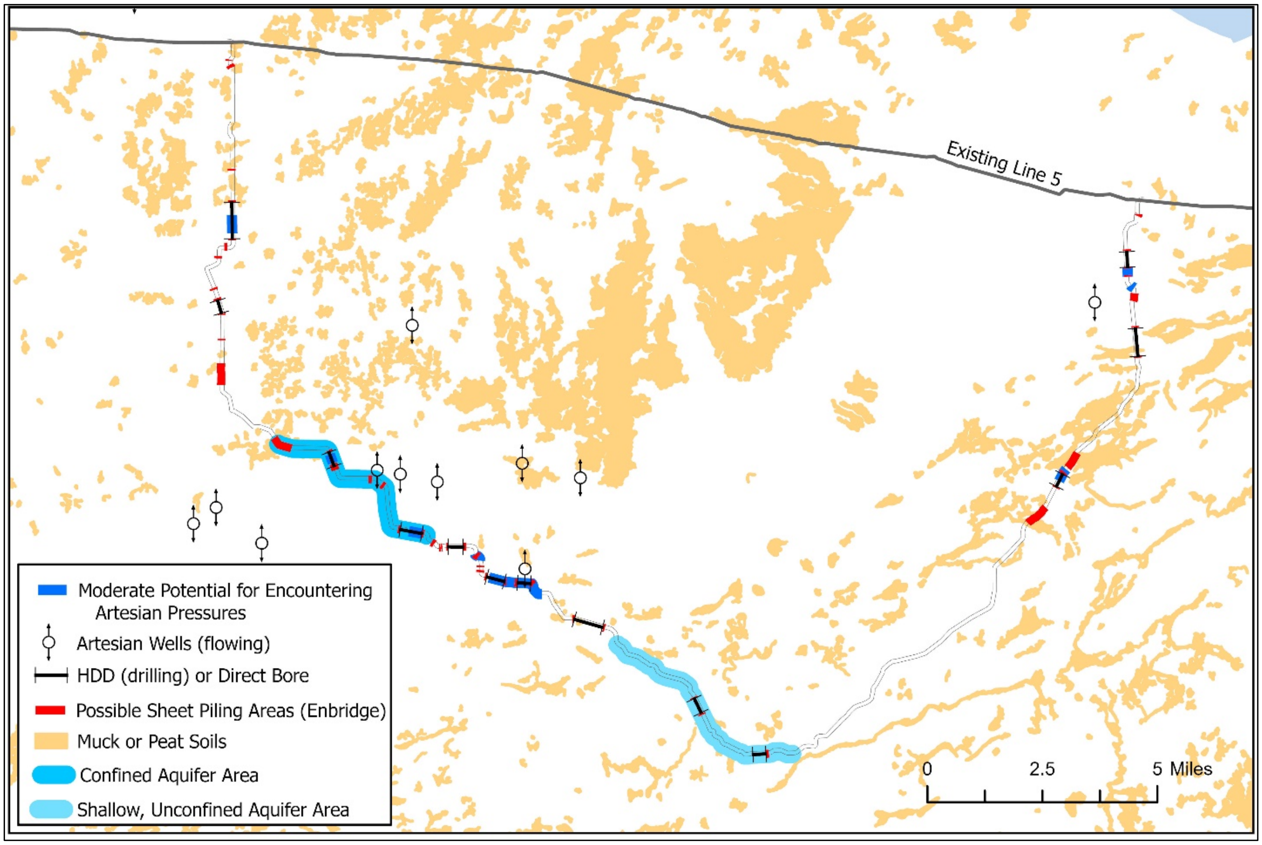


Figure 5.5-7 Potential Confined Aquifer Locations.
Source: Lake Superior Consulting, 2024; Barr, 2024a; Both in Appendix G

The two deepest construction methods expected to be used to install pipe are sheet piling and HDD. Sheet piling is used to support the sides of the trench in areas where soils tend to slump into the trench excavation. The depth of sheet piling is dependent on the proposed depth of pipe installation, and local soil conditions. Enbridge has identified areas of possible and probable sheet piling use in the following areas:

- At the begin and end of HDD drill paths
- Within selected stream and ravine crossings
- Within selected wetland areas
- On either side of major road or railroad crossings
- In areas where soils tended to slump into hand auger holes

The locations of highest risk of aquifer breach would be crossings of streams, ravines, and wetland areas as these are often topographically low in comparison to where the aquifer is recharged, where water pressure is more likely to be higher than ground surface.

Due to the depth of HDD drilling, there would be potential to drill through a confining layer of an artesian aquifer. The potential for this to occur is lower than sheet piling because geotechnical conditions are investigated as part of design; the entry and exit points are typically at higher elevations; and there are techniques that can be implemented to increase the effectiveness of the standard drilling mud at sealing the formations through which the borehole is drilled. These techniques include increasing the ratio of drilling clays to water and using loss reduction additives such as ground cotton seed hulls. During HDD operations, the quality of the drilling fluid is continually monitored, so dilution caused by an aquifer breach would likely be observed quickly. If there is a sudden and sizable increase in drilling fluid, DNR Technical Standard 1072, Horizontal Directional Drilling, calls for contractors to notify the DNR spills hotline to expedite appropriate response to an aquifer breach. For these reasons, the likelihood of effects from an aquifer breach due to HDD would be expected to be low.

As discussed in Section 5.5.1.4, there are two areas along the proposed corridor where the potential for artesian aquifers is the highest. These areas are located between MP 10 to MP 18 and MP 37 and MP 40. For an impact to occur, the aquifer must be shallow enough where it crosses the corridor to be intersected by proposed construction and construction activities would need to extend through the confining layer.

The MP 10 to MP 18 segment of concern begins where an old railroad grade crosses the corridor north of River Road near the Marengo River and ends southeast of the Billy Creek crossing. Static water levels in nearby wells for which the DNR has records range from 12 feet below ground to three feet above ground. These water levels are lower than the static water levels at three of the four major aquifer breaches that occurred during Enbridge's Line 3/93 construction in Minnesota. Should a breach of the confining layer occur, the resulting flows are not expected to be as high as aquifer breaches with higher static water levels. At the Marengo River Crossing, soil borings show the bottom of the clay layer, which is likely to serve as a confining layer, at 80-90 feet below the surface. The direct bore under the Marengo River would have an entry point south of the river, and an exit point north of the river. As currently proposed, the HDD would not extend below the confining clay layer. There would be excavations at the beginning and end to launch the machinery, which would be designed by the contractor. Sheet piling for the entry excavation is probable and is possible for the exit excavation. No depth information was provided for these two excavations; however, it is not expected that the sheet piling would extend through the clay confining layer due to the extent of the clay layer observed in the soil borings. There are two more possible sheet piling locations where the corridor crosses unnamed tributaries of the Marengo River. Near the first location, a soil boring shows the bottom of the uppermost clay layer at 38 feet below grade. During Enbridge Line 3 construction, the piles that breached the aquifer were no more than 30 feet deep.

The MP 37 to MP 40 segment of concern begins in the hardwood swamps of the Blueberry Marsh south of the Potato River and extends north of Vaughn Creek. Static water levels vary greatly in the area, from 60 feet below ground to three feet above ground. South of the Potato River Crossings, Soil boring 75-C shows four feet of peat soils over 2.5 feet of clay, with silty sand below that. Bedrock is highly fractured and only about 20 feet below the ground surface. No artesian conditions were encountered at this location. There is a 930-foot stretch of probable sheet pile trench starting near MP 38.6 and extending through a hardwood swamp. The nearest soil boring to this location revealed silty sand and sandy silt to 25 feet below ground with no water observed during drilling.

5.5.2.13 Soil Property Comparison to Aquifer Breach Locations along Enbridge Line 3/93 in Minnesota

During the construction of Enbridge Line 3/93 in Minnesota, four confirmed major breaches of artesian aquifers occurred. The locations of these major breaches were at Clearbrook Terminal, La Salle Creek, Moose Lake, and MP 1102.5. These breaches occurred in low areas where soil types with different abilities to transmit water come together, such as clay and sand, creating conditions needed for an artesian aquifer. The other common feature of these locations was the presence of soils, such as peat and muck, that tend to slump into the trench excavation. In these areas, sheet piles were used to support the sides of the trench to protect people working in the trench. These sheet piles and associated tiebacks extended through the confining layer, creating a path for pressurized water to exit the aquifer. The major aquifer breaches did not occur at locations where HDD was used. This is not surprising given that the HDD entry and exit points are typically on either side of a river valley at higher elevations.

Table 5.5-3 shows soil characteristics in the vicinity of reported aquifer breaches in Minnesota. Figure

5.5-8 shows the prevalence of muck and peat soils along Enbridge's proposed relocation and route alternatives.

Table 5.5-3 Soil properties at reported aquifer breaches in Minnesota.

	Clearbrook	LaSalle Creek	MP 1102.5	Moose Lake
County	Clearwater	Hubbard	St. Louis	Aitkin
NRCS Soil Survey Mapped Soils	Mooselake & Lupton Soils 0-1% slope, Smiley Loam	Rockwood-Two Inlets morainic complex, 15-20% slopes, stony	Greenwood soils, dense substratum, 0-1% slopes; Hermantown-Canosia-Giese, Depressional complex, 0-3% slopes	Borosaprists and Fluvaquents soils, frequently flooded
Surficial soils from Soil Survey	Muck, loam	Loamy sand	Peat, silt loam, loam	Muck, silt loam
Site-specific data source	(Barr Engineering Co., 2021a)	(Barr Engineering Co., 2021b)	(Barr Engineering Co., 2022)	(Enbridge, 2023e)
Depth of Sheet Pile below ground (feet)	28	28-30	22-27	25-30
No. of Seeps	2	4	>12	11
Land position	Wide valley near ephemeral stream and wetlands including calcareous fen	Valley slope, 20 ft below plain, 20 ft above stream	Valley	Valley with stream
Surface layer-from soil borings	Fill/Topsoil	silty sand, peat	clay, silt, sand, and organics	peat, clay
Confining Layer-from soil borings	Clay	Clay	Silt, clayey sand	Clay
Bottom of confining layer (feet)	15-38	27-41	26.5-35	15.5-18.5
Maximum head above ground surface of the confined aquifer (feet)	8.9	19	18	1.2
Maximum Monitored Flow Rate (gpm)	90	90	270 (multiple seeps)	20
Water bearing layer-from soil borings	Sand and Gravel	Silty sand and sand	Gravel with sand	Poorly graded sand

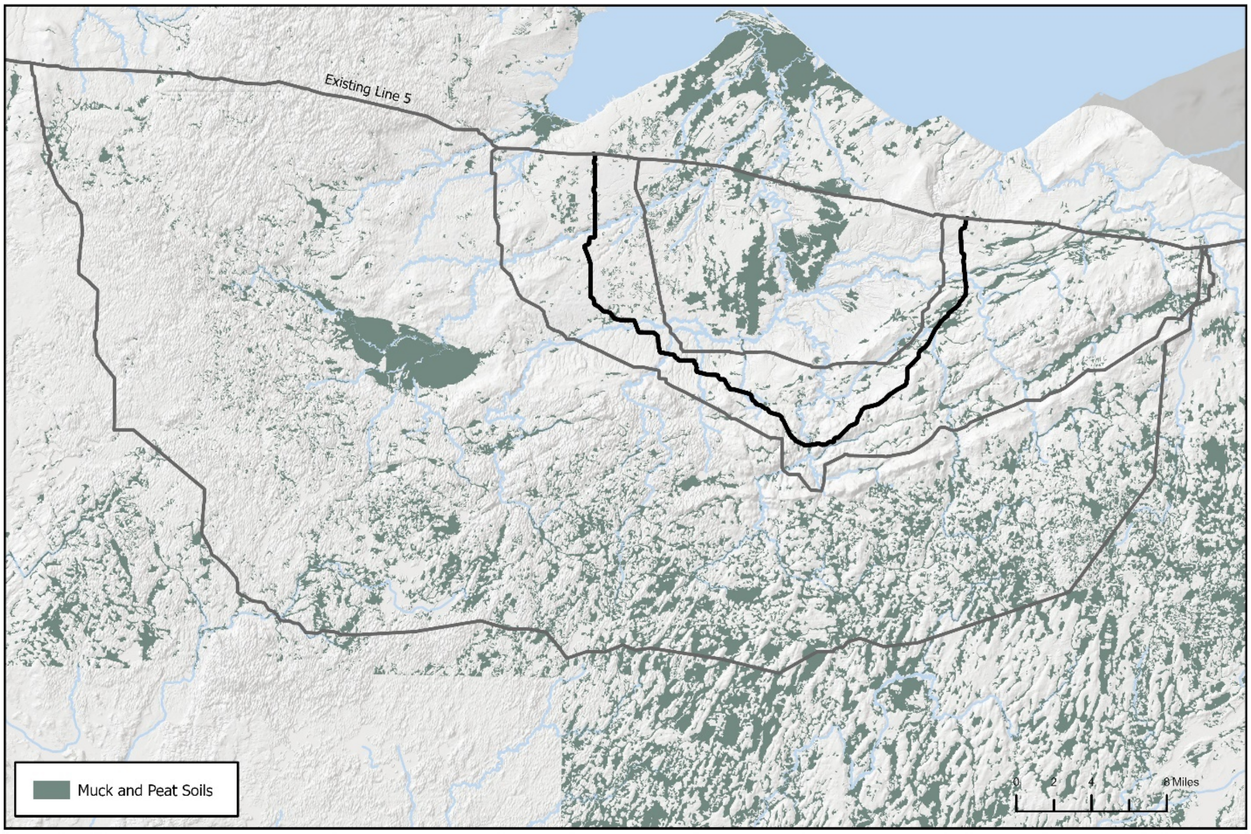


Figure 5.5-8 Muck and peat soils near Enbridge's proposed relocation and route alternatives.
Source: NRCS SSURGO

DNR reviewed soil survey mapping within 25 feet of the proposed alignment and compared it to the mapped soils at the four major breach locations. The Lupton soil series is mapped as present at the Clearbrook Terminal site in Minnesota and appears in combination with other soil series in about three acres of the proposed route near MP 10, MP 18, MP 23, and MP 35-36. The Lupton series generally occurs in flat, forested areas and includes more than five feet of muck on the surface (NRCS, n.d.-a).

The area where soils and topography are most likely to align to create conditions comparable to the four Minnesota sites is along and north of the transition zone within the clay plain. The mapped transition zone appears to cross the proposed route around MP 18 near Billy Creek and MP 37 near the Potato River. Valleys near the transition zone could have characteristics similar to those at Clearbrook Terminal, La Salle Creek, Moose Lake, and MP 1102.5 in Minnesota. South of the transition zone, the bedrock is shallower and there is less likely to be a confining layer. North of the transition zone there are more extensive clay layers that can serve as confining layers.

5.5.2.14 Effects on Water Supply Wells

During construction operations, Enbridge could contract with a municipal well owner to supply potable water for HDD drilling mud or other construction needs. The municipal well owner is likely to specify the rate of water gathered and the total volume of water such that it does not affect the viability of the well or the municipal water supply system in a way that would inconvenience its customers.

No other direct, indirect, or cumulative effects on municipal wells are expected due to the construction of the proposed project from any of the alternatives due to the distance from the proposed work to the closest municipal well.

During construction, private wells may be affected by the following activities:

- Equipment contact with water supply wells or associated equipment could cause damage to above ground section of supply well casings, well caps, damage to well casing welds and damage to well connection appurtenances, water lines or power lines. These effects can generally be prevented through clear marking of well locations. Enbridge proposes working with landowners to determine the locations of water wells within 100 feet of the project workspace.

- Blasting in proximity to a well could liberate corrosion or scale within wells resulting in temporary cloudy well water soon after blasting. The cloudy water would typically clear either after settling of the liberated corrosion or scale or pumping purges the material from a well. In the extreme case, corrosion scale from the well casing could spall into a well during pumping, could clog a pump intake and as a result could cause pump burnout. Enbridge would work with the affected landowner to repair or replace the damaged well pump.

- Trench dewatering could temporarily reduce recharge and lower the water table. Most private wells are deep enough that short-term dewatering activities within 10 feet of the surface are unlikely to cause impacts to water levels in the well. Within the unconfined aquifer area identified by Lake Superior Consultants, effects are more likely. Mitigative measures include limiting pumping rates or supplying those using an affected well with bottled water until water levels recover.

- HDD routes are typically planned to avoid proximity to wells to avoid risk of drilling fluid entering the well. Drilling mud is required to use water from a safe source, such as a municipal water supply, to avoid introducing bacteria into the ground water. Enbridge has stated in its Construction Site General Permit application that the company will only use additives that are considered pre-approved for use in potable well drilling (§ NR 812.091, Wis. Adm. Code) or are listed on the DNR's Approved Horizontal Directional Drilling Products List (DNR, 2022c). These measures are expected to avoid impacts to nearby wells due to HDD installation methods.

- Breaches of artesian aquifers, as discussed in Section 5.5.2.12, are not expected to occur. If a breach occurs, it could affect water supply in wells that rely on that aquifer. The effect would be proportionate to the severity of the breach and the volume of water lost from the aquifer.

Neither Enbridge's proposed route nor any of the three route alternatives would include permanently paving large areas of ground that would reduce groundwater recharge and result in diminished groundwater levels. If the pipeline is constructed as described in Chapter 2, the pipeline would not be expected to permanently alter the aquifer recharge areas to the degree that it would change the groundwater elevations and the groundwater flow patterns that result in supply of water to wells.

5.5.2.15 Effects of Blasting

The most common blasting agent used is a mixture of ammonium nitrate and fuel oil, which is referred to as ANFO. The ammonium nitrate fraction of ANFO is, according to the Defense Research and Development, Canada (DRDC), a highly soluble compound and has the potential to release nitrate, nitrite and ammonia into soil and groundwater. Detonation of ANFO in a wet environment can lead be incomplete chemical reactions and result in release of nitrate, nitrite, and ammonia. The release of nitrates to groundwater would be controlled by using only enough blasting agent to create the trench.

The greatest health risk from nitrates in groundwater is generally considered to be the risk of Methemoglobinemia (colloquially *blue baby syndrome*) to infants, which results from a reduced capacity to carry oxygen if the iron in the hemoglobin of red blood cells forms methemoglobin, which lacks the oxygen-carrying ability of normal hemoglobin (EPA, 2023a; DNR, 2021b). Other factors can contribute to elevated levels of nitrates in groundwater, including failing septic systems, agricultural fertilizers, land spreading of treated septage, and land spreading of manure. Nitrates could also release to surface waters and increase nutrient pollution.

5.6 Erosion & Sedimentation

Erosion is the process by which soil and other earthen materials are removed from a site by water or wind. Sedimentation is the process by which such materials are deposited and settled in waterbodies, wetlands, and lowlands. Both erosion and sedimentation would result from Enbridge's proposed Line 5 pipeline relocation–during active construction, post-construction restoration, and potentially further in the future. The magnitude of erosion and sedimentation would be influenced by several factors. These include slope and terrain, the physical properties of the soils within the permanent ROW and temporary workspaces, the condition of stream channels (banks and beds) where the pipeline would be installed across them via trenching, and the vulnerability of surrounding areas to fluvial erosion (e.g., gullying and valley landslides), as well as the frequency and intensity of rainfall and snowmelt events. Pipeline installations, erosion- and sediment-control measures, geohazard mitigation, and post-construction restoration practices must account for these factors to limit the risk and magnitude of erosion and sedimentation, both in the short- and long-term.

5.6.1 Steep Slopes

The area through which Enbridge's proposed Line 5 relocation route and route alternatives would be constructed has a diverse topography, including steep slopes. Depending on the context, the definition of steep slope ranges from a grade of 10 percent to 40 percent. The Construction Site General Permit application asks applicants to identify slopes that are longer than 50 feet with a grade above 20 percent. Enbridge identified slopes meeting these criteria and included them in their erosion and sediment control plan (Appendix E, Part 7). The DNR also mapped steep slopes using Light Detection and Ranging (LiDAR) data. Table 5.6-1 lists the length, in miles, of two categories of steep slopes along Enbridge's proposed relocation route and route alternatives. The two categories are slopes of 20 percent and greater, and slopes between 15 percent and 20 percent. The specific locations where these slopes occur along Enbridge's proposed relocation route are shown in Figure 5.6-11, which is a set of eight sectional maps showing the locations of the Enbridge-identified "geohazards" listed and described in Section 5.6.6.

Table 5.6-1 Miles of steep slope along Enbridge's existing route, proposed relocation, and route alternatives.

	Proposed	RA-01	RA-02	RA-03	Existing [1]
Length of Pipeline	41.1	31.4	58.0.	101.5	20.4
Slope					
Greater than 20%	7.6	8.7	3.9	8.2	0.9
15 to 20%	1.5	3.2	9.3	20.9	0.5

[1] 'Existing' is that portion of the current Line 5 that would be replaced by Enbridge's proposed relocation.

For additional comparison, Table 5.6-1 includes the length of steep slopes intersected by the span of existing pipeline that would be replaced by Enbridge's proposed relocation. Less than one mile of the existing pipeline passes over slopes of 20 percent or greater; however, one such location, known as "Slope 18," experienced a landslide event in 2019 that exposed a segment of pipeline in a ravine on the Bad River Reservation (Section 5.6.7.1). Not all steep slopes are geohazards (and not all geohazards are steep slopes). The stability of steep slopes depends on a combination of the physical properties of the soil, land cover, smaller scale topography and drainage patterns, and ongoing, long-term erosion processes. Steep slopes occurring in ravines and gullies, such as Slope 18, are subject to episodic landslides and channel erosion, especially when the underlying soils and parent materials are rich in clay (DeLong et al., 2022). These and other types of fluvial erosion risks are discussed in Section 5.6.7.

5.6.2 Soil Properties

Different soil types have different physical properties that would influence the risk of erosion and sedimentation during and after pipeline construction. Enbridge conducted soil investigations along its proposed Line 5 relocation route to gather site-specific data for project design and engineering purposes. Table 5.6-2 summarizes the different types of soil investigations conducted. Soil bores were collected near proposed crossings of streams and other features that were considered for crossing via HDD or direct bore. The results of soil borings are available as both stand-alone boring logs and narrative geotechnical reports. Both formats are available in Appendix O. Hand-augured samples were collected at regular intervals to characterize soil conditions near the proposed trenching line. Enbridge also conducted probing, hammer probing, test digging, and hydrovac excavations in areas of possible shallow bedrock.

Table 5.6-2 Enbridge soil investigations by watershed.

Watershed (HUC 12)	MP Range	Method and number of investigations					
		Soil borings	Hand auger	Probing	Hydrovac	Test dig	Hammer probing
Fish Creek	0.0 - 1.2	2	3	0	22	0	0
Beartrap Creek	1.20 - 3.35	3	19	3	0	0	0
Deer Creek	3.35 - 7.37	12	7	0	0	0	0
Troutmere Creek	7.37 - 13.77	7	26	0	0	0	0
Lower Brunsweiler River	13.77 - 16.70	15	9	1	0	0	0
Marengo River	16.70 - 21.94	16	17	2	0	0	10
Hardscrable Creek	21.94 - 24.93	10	7	2	3	2	10
Devils Creek	24.93 - 26.33	0	2	0	1	0	13
Tyler Forks	26.33 - 35.00	9	32	13	0	3	32
Potato River	35.00 - 38.07	6	7	3	2	0	0
Vaughn Creek	38.07 - 40.64	10	5	0	0	0	0
Graveyard Creek	40.64 - End	2	0	0	16	0	0
Total		**92**	**134**	**24**	**44**	**5**	**65**

The DNR evaluated soil properties along all of Enbridge's proposed relocation route and route alternatives using data from the Natural Resources Conservation Service's (NRCS) Soil Survey Geographic Database (SSURGO). SSURGO data are digitized from the results of county soil surveys conducted by the National Cooperative Soil Survey dating back to 1899. Enbridge's proposed Line 5 relocation route crosses approximately 60 different soil series; together, the proposed route and route alternatives cross over 140 soil series. In addition to soil classifications, SSURGO houses information on a variety of soil physical properties, ratings, and limitations related to various natural resource management and planning activities. This information is available for all soil survey map units in Ashland, Bayfield, and Iron counties, including vertical soil horizons to a depth of five to six feet. Information is also available for smaller (unmapped) soil components. These data are aggregated to soil map units based on their reported percent coverage for each unique soil type. SSURGO data are not intended for site-specific design and engineering purposes; however, they are useful for evaluating soils over large areas, such as the overall ROWs of Enbridge's proposed relocation route and route alternatives.

5.6.2.1 Topsoil

Topsoil, the uppermost layer of soil, is typically a mix of mineral and organic matter. As described in Section 2.6.4, topsoil within the construction ROW (permanent ROW plus temporary workspace) would be disturbed by clearing and grubbing (the removal of stumps, roots, buried logs, and other debris). Topsoil would then be separated from subsoil to maintain its productivity. This would be done by stripping the topsoil to a depth of up to 12 inches or more, depending on the depth of the topsoil, and stockpiling it along the route within temporary workspace. The topsoil would be restored after active construction is completed, prior to reseeding. Topsoil would not be segregated in wetlands with standing water or forested areas where topsoil is very thin.

Table 5.6-3 Surficial soil textures within Enbridge's proposed Line 5 relocation route and route alternatives.

Surficial soil texture	Mapped area within 25 feet of alternative routes (acres)			
	Proposed	RA-01	RA-02	RA-03
Mineral Soils	102.0	122.8	140.2	337.9
Fine sandy loam	4.6	8.7	15.1	60.3
Loam	0.6	2.2	1.1	0.0
Loamy fine sand	2.2	1.0	0.0	0.0
Loamy sand	0.3	0.9	1.8	74.8
Loamy very fine sand	1.7	1.1	6.8	0.0
Sand	7.9	8.7	2.8	64.1
Sandy loam	7.6	5.0	31.3	118.1
Silt loam	77.1	95.2	81.3	20.6
Organic Soils	139.3	67.3	207.4	274.3
Muck	9.9	8.2	19.6	121.7
Peat	0.0	0.0	0.0	14.1
Mucky silt loam	1.2	1.2	0.0	0.0
Highly decomposed plant material	17.1	8.8	26.8	41.0
Moderately decomposed plant material	77.4	24.1	113.3	41.1
Slightly decomposed plant material	33.7	16.3	47.7	56.4
No surface texture identified	7.6	8.7	3.9	3.2
Total area	249.0	190.2	351.5	615.3

At the surface, soils along Enbridge's proposed Line 5 relocation route and route alternatives are characterized by a full range of soil textures: from sandy (coarse-grained material), to loamy (mixtures of coarse-, medium- and fine-grained materials), to clayey (very fine-grained material), plus organic (mucks and peats). A summary of the surface texture of soils within the permanent ROW of Enbridge's proposed relocation route and route alternatives is presented in Table 5.6-3. The DNR used the permanent ROW as a means of consistently comparing soils across all route alternatives. Figure 5.6-1 shows the distribution of these surface textures in relation to the existing, proposed, and alternative routes.

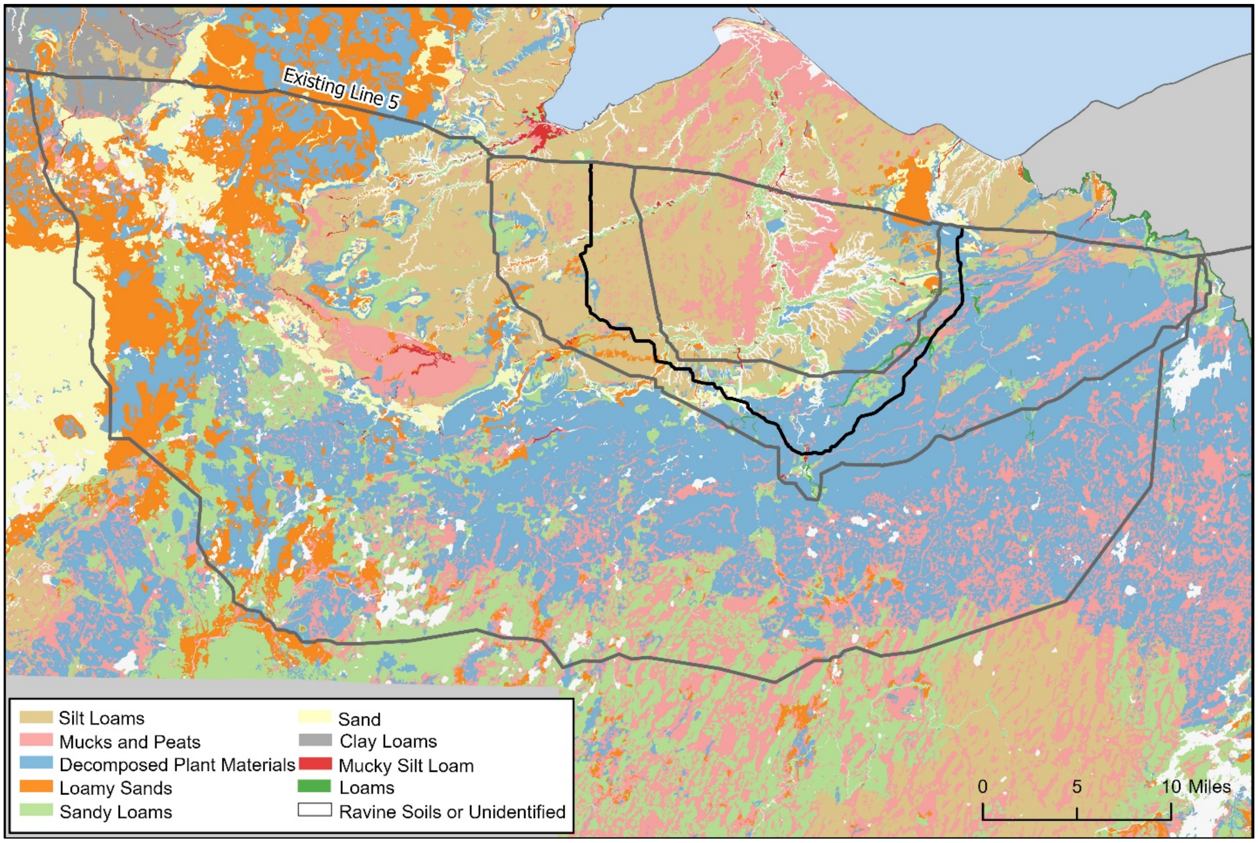


Figure 5.6-1 Soil texture at surface in relation to Enbridge's proposed Line 5 relocation route and route alternatives.
Source: (NRCS, n.d.-b)

5.6.2.2 Subsoils & Parent Materials

Subsoils can differ considerably from topsoil. Subsoils would be exposed during construction and would largely determine the structural, erosional, and hydrologic properties of the overall soil. Most of the subsoils in the project area derive from glacial, glaciolacustrine, outwash, and paleo-shoreline, or terrace deposits, with some coming from river and stream deposition (alluvial deposits) and wind deposition (Figure Figure 5.6-2). Near the Penokee Range (Section 5.5.1.3), bedrock occasionally occurs as outcrops but more generally lies near the surface under a veneer of unconsolidated deposits. These areas would require blasting for pipeline installation (Section 2.5.1.3).

Parent material refers to the sediments and other materials from which soils form. As described in Section 5.5.1, the parent materials of soils in the area of Enbridge's proposed relocation route are mostly glacial deposits and sediments comprising two geologic formations: the Copper Falls Formation and the Miller Creek Formation. Soils developed from the Copper Falls Formation are generally sandier, while soils developed in the Miller Creek Formation are more clayey. Figure 5.6-2 depicts the general location of the underlying soil materials (clay, peat, sand, and gravel) that comprise most of the parent materials in the area. As indicated in Figure Figure 5.6-2, the elevation of approximately 1,050 to 1,070 feet above sea level corresponds to the paleo-shoreline of Lake Superior 11,000 years ago. This line is effectively the boundary and upper elevation of the Lake Superior Clay Plain (Section 5.9.1.1). Soils developed in post-glacial river valleys cutting through the clay plain vary widely because of the active processes of erosion and deposition mixing and remixing soils of various textures.

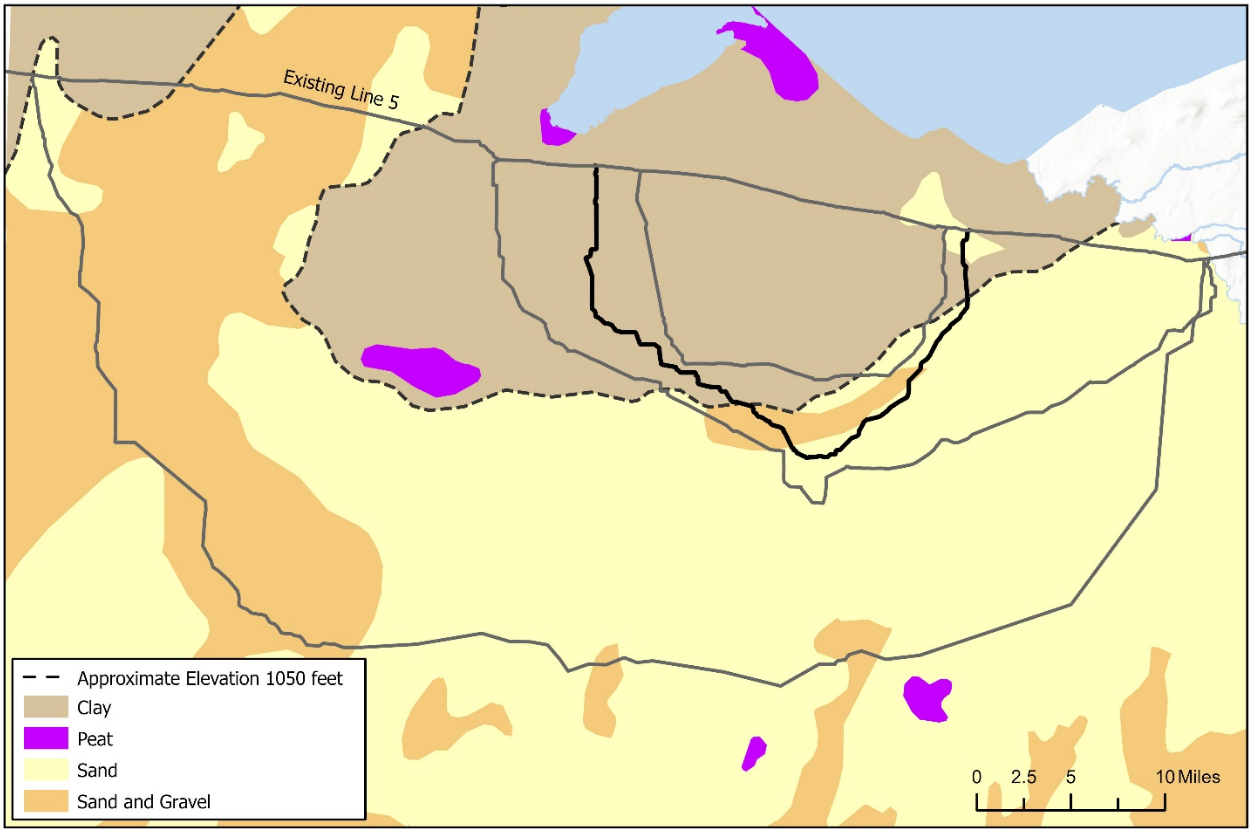


Figure 5.6-2 Underlying deposits/generalized soil parent materials in relation to Enbridge's proposed Line 5 relocation route and route alternatives.
Source: (Schmidt, 1987).

Soils formed from sand and gravel tend to be droughty, whereas clay soils have slower water infiltration and less available water storage. As a result, watersheds with clayey soils tend to have greater proportions of surface runoff and more flash flooding than watersheds with other soil types. In watersheds with a combination of steep slopes and clay soils the drainage systems tend to be closely spaced and entrenched. In general, streams in the Superior Coastal Plane have more flash floods (termed *flashy* streams) due to their high proportion of clay soils. Greater surface runoff increases the likelihood of channel erosion and headwater drainage and can lead to high sediment loads to downstream areas.

Clay soils layered over sand and silt are common across the higher elevations of the Superior Coastal Plane and the sand/gravel transition zone around the paleo-shoreline of Lake Superior (approximately 1,070 feet above sea level) where the Miller Creek Formation covers the sandy interglacial deposits of the Copper Falls Formation. Along steep slopes adjacent to ravines and streams, sandy layers can become saturated during and after intense rainfall events or from water flowing through joints, fissures, or other disturbances in the clay layer above. This introduces an additional structural weakness compared to slopes with uniform clay deposits. Sand units are discontinuous and difficult to map with precision, but they can lead to unexpected slope failures and landslides along stream sides, ravines, and channel headcutting (Section 5.6.7.2).

5.6.2.3 Soils Classified as Limited or Vulnerable

The DNR quantified the acreage of soils within the ROW of Enbridge's proposed Line 5 relocation route and route alternatives that are listed in SSURGO as limited or vulnerable with respect to erosion hazard, drought, compaction, “rocky” or “stony,” shallow bedrock, and drainage. These acreages are listed in Table 5.6-4. Figure 5.6-3 shows the extent of soils classified as “D” soils when not actively drained by tiles or other means. Compared to A, B, and C soils, D soils have the slowest infiltration rates and are most prone to high rates of surface runoff during rain events, which can exacerbate soil erosion and flooding.

Table 5.6-4 Comparison of vulnerable soils within the permanent ROW of Enbridge’s proposed relocation route and route alternatives.

	Proposed	RA-01	RA-02	RA-03
Total acres within ROW	249	190	352	615
Moderate, severe, or very severe erosion hazard (off-road and off-trail)	8.6	9.7	13.4	18.2
Drought vulnerable soils	87	20	171	211
Map unit contains “rocky” or “stony”	97	24	195	273
Shallow bedrock (within 5 feet)	59	4	124	21
Medium or high compaction prone	198	150	316	340
D Soils	142	207	293	251

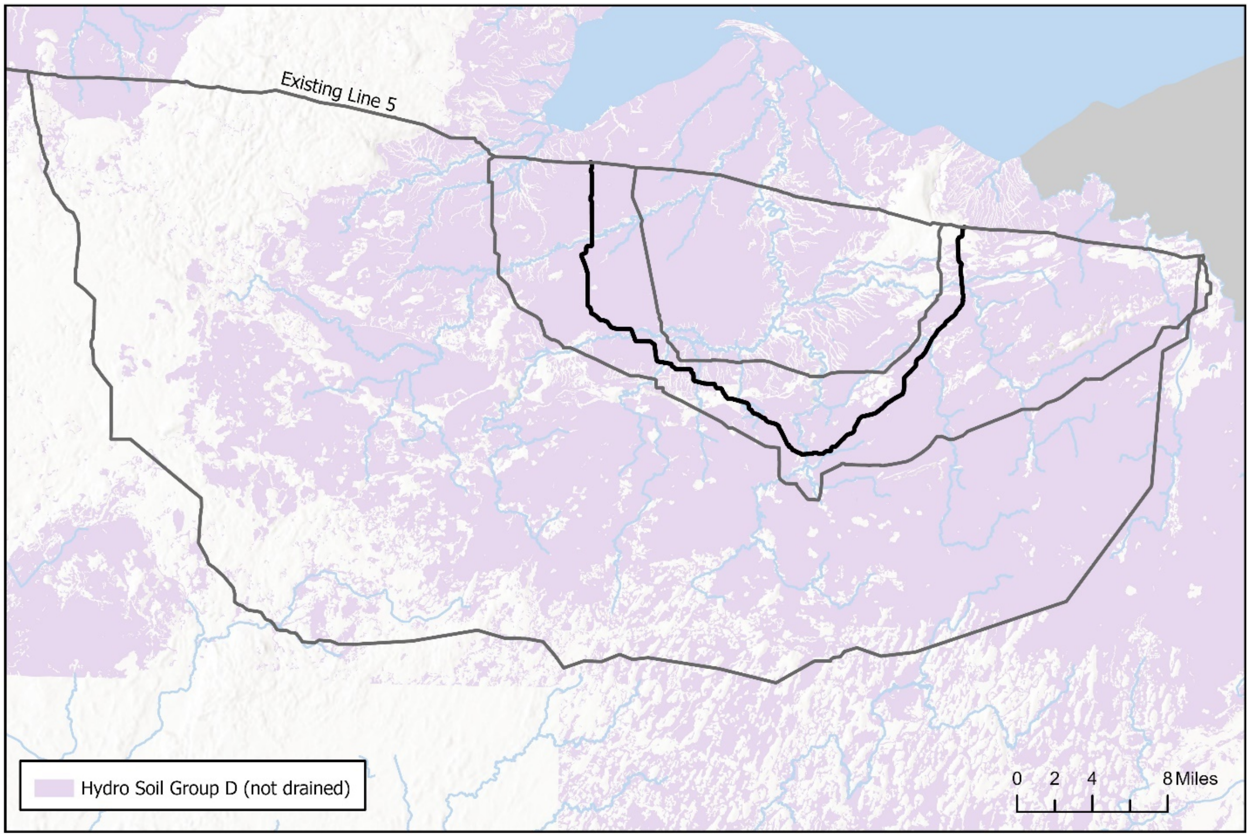


Figure 5.6-3 Group D hydrologic soils in relation to Enbridge's proposed Line 5 relocation route and route alternatives.

5.6.3 Erosion & Sedimentation during Construction

Erosion and sedimentation would be greatest during active construction since this is the phase of the project with the greatest soil disturbance. Soil erosion and sedimentation divide along several categories and lead to a multitude of effects. Further effects of construction (after the main disturbance phase) are discussed in subsequent sections.

5.6.3.1 Soil Compaction

Soil compaction occurs both intentionally and unintentionally during construction. Compaction is often done intentionally to stabilize roadbeds and steep slopes. Compaction also occurs during grading or in high-traffic areas, which harms stability and could cause rutting if soils are wet when they experience compaction stress. The result of soil compaction is generally lower soil moisture and decreased pore space, which limits the ability of the soil to recover after construction and establish successful plant communities. Some soils are more prone to compaction than others; Table 5.6-4 compares the acreages of medium and high compaction-prone soils within 25 feet of Enbridge's proposed Line 5 relocation route and route alternatives.

Soil compaction would increase runoff, limit infiltration, and slow vegetation reestablishment during the restoration phase. It could also cause localized ponding and change local drainage patterns. Soil compaction on the crests of slopes can lead to altered drainage patterns that result in less stable slopes that are more easily erodible. Indirect effects of soil compaction could include increased cumulative runoff resulting in increased soil erosion, increased instream sediment erosion, and sediment deposition in wetlands and other waterbodies. Increased soil erosion reduces soil productivity via nutrient and soil carbon loss. Increased waterway erosion and deposition harms instream habitat quality. Changing erosional or depositional patterns in wetlands can decrease habitat quality. In the long term, decreased soil productivity increases the energy consumption and cost of crops. Increasing runoff and decreasing infiltration also reduces groundwater recharge, which could lower local water tables and reduce baseflow to local wetlands, streams, and supply wells. Compaction is especially risky near the tops of slopes, where it could alter flows to increase erosion and retreat of the slope crest backwards towards flatter upland areas.

Strategies to limit soil compaction include:

- Use of low ground pressure equipment.
- Use of timber construction mats to spread equipment weight (Section 5.8.5.8).
- Temporary suspension of construction on vulnerable soils during wet conditions (Enbridge has not committed to this practice under any specific conditions but does note the option in its EPP; Appendix D).
- Deep tillage of compacted soils after construction concludes (noted as part of restoration for equipment travel areas in section 16 of Enbridge's EPP; Appendix D).

The Construction Site General Permit (Permit No. WI-S067831-6) requires permanent vegetation to reach 70 percent density at restoration sites, which is difficult to achieve in heavily compacted soils. Actions such as those described in Section 2.8.12.1 can improve the recovery time of compacted soils. Roots from vegetation also help break up compacted soils, as do freeze-thaw cycles. Implementing strategies to limit soil compaction would limit the anticipated long-term effects from compaction; most areas of construction would be likely to only incur temporary compaction effects. If these strategies are not appropriately undertaken, soil compaction could cause longer-term effects due to the knock-on problems from failing to establish sufficient planting density during restoration.

5.6.3.2 Sources of Erosion during Construction

Erosion and the discharge of sediment from the construction area to waterways and wetlands can occur at several steps along the construction sequence and can come from a variety of sources:

1. Erosion from initial clearing and grubbing, due to tire rutting and vegetation removal.
2. Erosion between clearing and topsoil removal.
3. Erosion from subsoil exposure after removing and stockpiling topsoil.
4. Erosion from the wind, especially when conducting construction during dry conditions.
5. Erosion from soil stockpiles during active trenching and construction.
6. Erosion from rutting on haul roads and other construction access points.
7. Sediment discharge from tracking onto public ROWs.
8. Erosion during pipe installation, testing, and backfilling activities.
9. Discharge from trench dewatering.
10. Erosion between backfilling and stabilization.
11. Inadvertent releases of drilling fluid during HDD or directional boring.
12. Benthic disturbance from in-stream construction.

Erosion and sediment loading risk is typically greatest and most predictable for items 1 to 10 in the above list. Inadvertent releases (item 11) are less predictable and are discussed separately (Section 5.6.5). Item 12 is also treated separately and informed by modeling performed by RPS (Section 5.6.3.6).

Erosion and sediment discharge would both be likely to be elevated above natural levels during construction. Sediment discharges would be limited, but not completely eliminated, by sediment control and erosion practices required by the Construction Site General Permit (Sections 1.4.3.11 and 2.8.10). Several areas of Enbridge's proposed relocation route cross dense tributary systems of receiving waters, which increases the potential of simultaneous sediment discharges combining downstream. Risks from sediment discharges are divided into the following subcategories:

- Amount of contributing surface area disturbed at each stream crossing point.
- Amount of projected erosion from sheet flow to streams.
- Proportion of fine and coarse sediment in the vicinity of each crossing.
- Geomorphic sensitivity.
- Potential for sediment from trenched crossings to reach sensitive waters.
- Risk of and anticipated consequences of an inadvertent release during HDD operations.

5.6.3.3 Sediment Discharge from Upland Construction Areas

As discussed in Section 5.6.3.6, RPS's modeling of sediment discharge to streams is focused on sediment from stream crossings. The modeling does not address potential sources of sediment to streams from upland soil erosion. To address this information gap, the DNR adapted its Soil Loss and Sediment Discharge Tool (SLSD) for use with GIS software to model the relative risk of sediment discharge from these areas. The SLSD is based on the NRCS Universal Soil Loss Equation (USLE), which is designed to estimate sheet and rill erosion across all types of soils on slopes of up to 20 percent grade (Renard et al., 2011).

The tool then uses information from the Revised USLE (Renard et al., 2011) program to estimate the sediment discharge likely to result from the soil loss calculated by the USLE after deposition and use of one sediment control BMP. The tool is part of standard stormwater regulatory practice for the DNR and is used to assess the potential for sediment discharges to exceed a performance standard of five tons/acre/year (Sections 1.4.3.11 and 2.8.10), and thus the need for additional storm water control measures at construction sites. The tool estimates erosion based on the duration of construction, slope, slope length, surface condition (including erosion control BMPs), rainfall, and implementation of standard erosion control practices. Due to the limitations of the method and associated input assumptions, the results of this tool should be interpreted as a relative erosion risk which can be used to compare risks between route alternatives. Modeling of Enbridge's proposed route could also be used to identify areas where greater attention to bare soil duration, erosion control practices, and sediment control practices would be warranted. Additional technical details on the modeling implementation are in Appendix Q.

The DNR modeled two scenarios with its SLSD tool: a short scenario and a long scenario. The short scenario uses Enbridge's stated construction timing for each construction phase as detailed in the company's EPP (Appendix D) and other documentation along with one row of silt fence. The long scenario is similar but meant to characterize a worst-case scenario for erosion and sediment loss. The long scenario assumes that areas of the construction site would be continuously disturbed for five months (the approximate length of a construction season) before restoration begins. Details of the modeled timeline for each plan can be found in Table 5.6-5.

Table 5.6-5 Sediment discharge assumptions used in DNR's modeling.

Construction activity phase	Assumed cover condition	Duration for short scenario	Duration for long scenario
Clearing & Grubbing	Bare Soil	March 31-April 20 (20 days)	March 31-August 28 (150 days)
Trenching	Bare Soil	April 21-April 27 (6 days)	August 29-September 4 (6 days)
Temporary Restoration	Mulch or Erosion Control Mat	April 28-May 18 (20 days)	September 5-September 25 (20 days)
Final Restoration	Seeding	May 18-July 18 (60 days)	September 26-December 31 (96 days)

The DNR summarized model outputs by contributing area and by 1/10-mile (528-foot) subsections of the proposed alignment. The contributing-area summary describes areas within 165 horizontal feet (50 meters) of each trenched stream crossing point, combining results where multiple streams are crossed in close proximity. The DNR omitted contributing areas crossed using trenchless techniques. The 0.1-mile segment results provide a more generalized look at relative sheet and rill erosion risk within Enbridge's proposed ROW.

The shorter erosion scenario showed almost no waterbody crossings exceeding five tons per acre. The one crossing in excess (i.e., sasv002e) is affected by a high proportion of steep slopes which make it an especially high-risk area. Several additional areas are close to the five tons per acre per year performance standard but do not exceed it. The long scenario showed 47 contributing areas exceeding the five tons per acre threshold on the main line of the ROW.

Figure 5.6-4 shows areas of Enbridge's proposed relocation route and route alternatives where sediment load is modeled as greater than or equal to five tons per acre per year for the first year of construction based on the results of the long and short erosion scenarios described above. Table 5.6-6 describes acreages of Enbridge's proposed relocation route and route alternatives modeled greater than five tons per acre in tabular form. Figure 5.6-5 provides more detailed views of the proposed ROW including areas with greater than 5 tons per acre of predicted erosion in both modeled scenarios, and references to site-specific erosion control plans in Appendix E. Table 5.6-7shows the five largest yield-contributing areas to streams in both scenarios.

Contributing areas greater than five tons per acre exhibit some clustering. One cluster is on the clay plain surrounding the White River on the northwestern boundary of Enbridge's proposed ROW. The second (and largest) cluster is on the southern part of the proposed ROW, which traverses the transition zone and borders the Penokee Hills to the east. The first cluster is localized to steeper river crossings, with somewhat large gaps between high-risk areas. The second group's high-risk zones are more generalized. For example, 10 crossings in this scenario between MP 27.1 and MP 28.7 exceed the five tons per acre standard for sediment discharge. Appendix Q contains a table summarizing results for each stream crossing for both short and long scenarios.

Figure 5.6-6 shows a line plot of the long and short model results for tons of sediment per acre per year by $\frac{1}{10}$ mile marker. The highest risk areas in both scenarios are between MP 19 and MP 30, with spikes in estimated erosion throughout at particularly steep crossing points. Some high-erosion locations are inaccurate because these locations will be crossed by HDD instead of by trenched methods. HDD locations are detailed in Table 2.5-2.

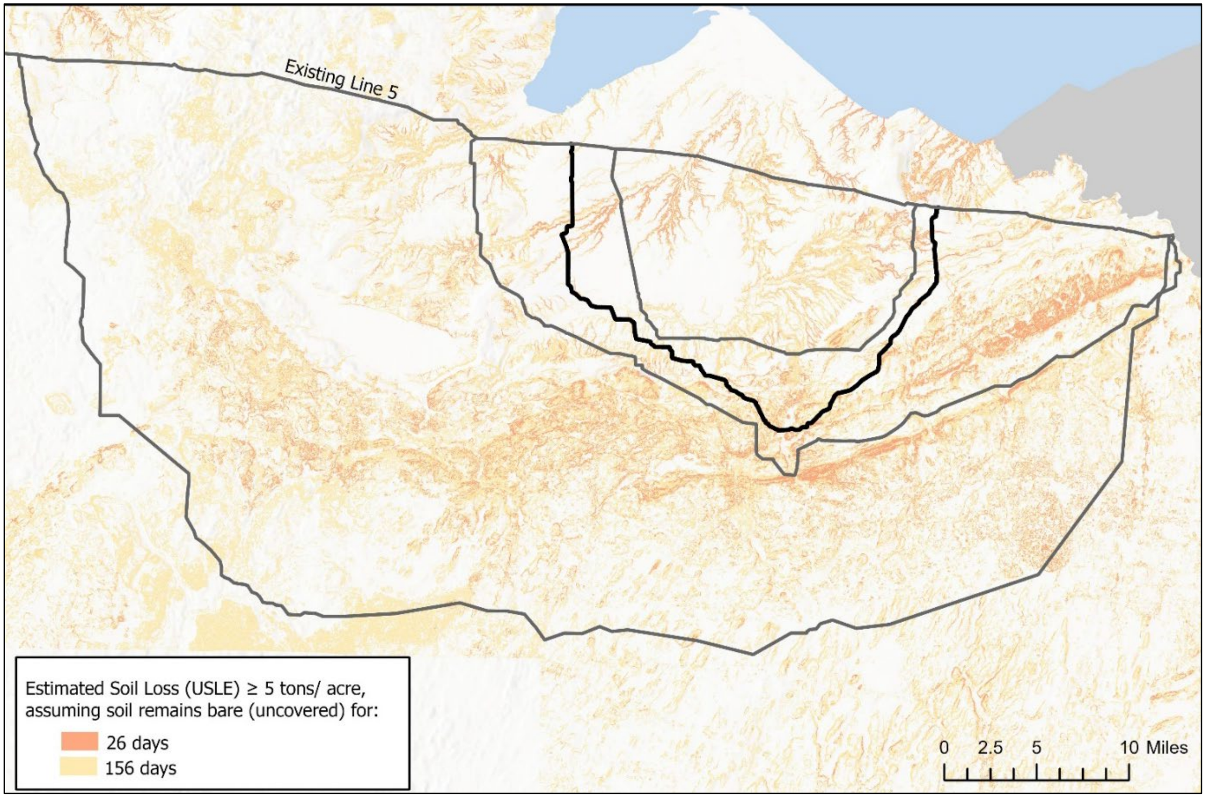


Figure 5.6-4 Areas with estimated soil loss of five tons or more per acre per year around Enbridge's proposed relocation route and route alternatives.

Table 5.6-6 Acres of construction ROW around Enbridge's proposed relocation route and route alternatives with estimated soil loss of five tons or more per acre, per year.

	Proposed	RA-01	RA-02	RA-03
Length of Pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Estimated soil loss (USLE) ≥ 5 tons per acre				
Assumes 26 days of bare soil[1]	33	20	45	348
Assumes 156 days of bare soil[1]	198	97	305	348

[1] Scenarios detailed in Table 5.6-5.

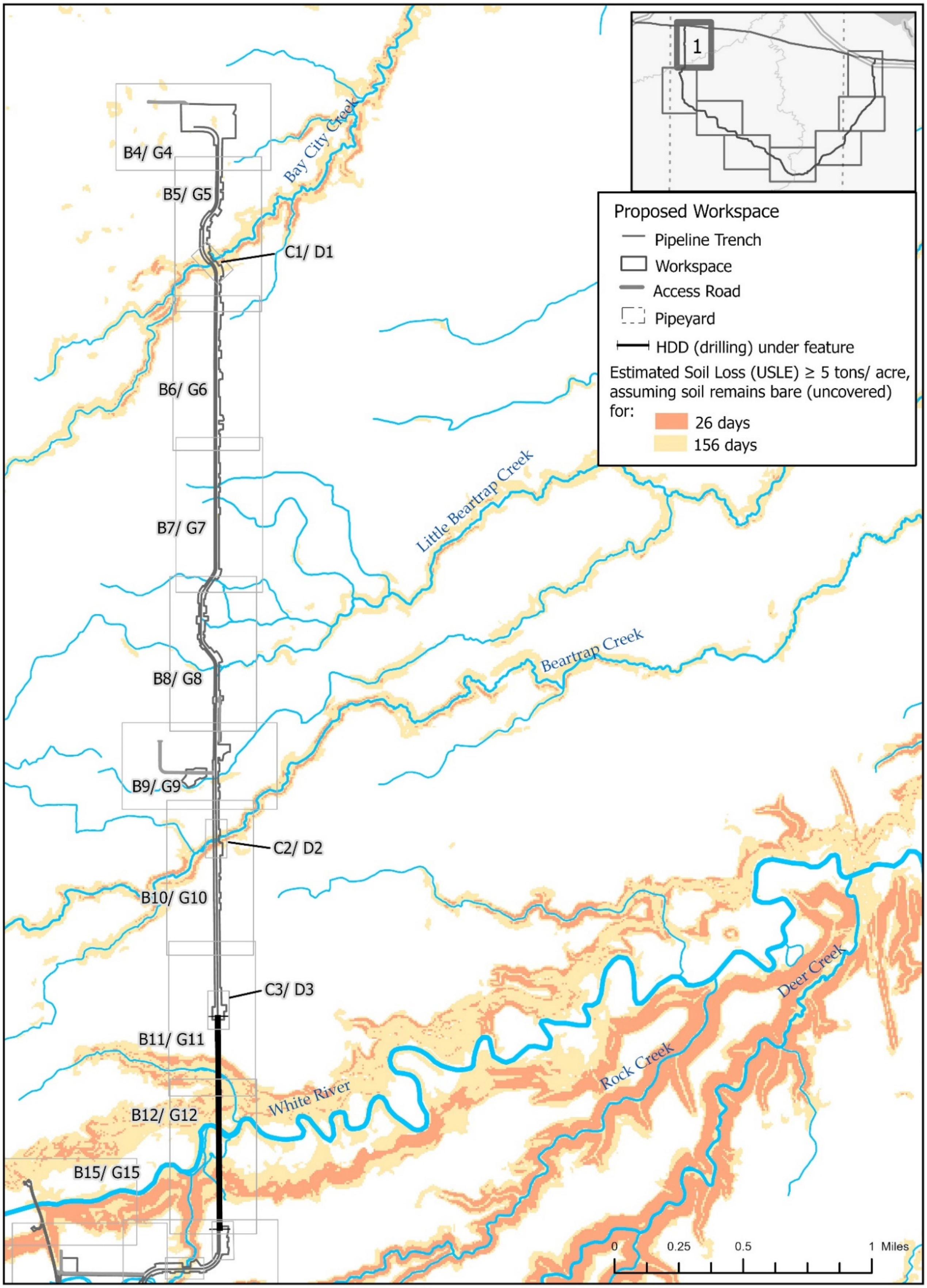


Figure 5.6-5 Estimated soil loss along Enbridge's proposed Line 5 relocation route (map 1 of 8).
Note: Outlines refer to Enbridge erosion & sediment control plan 'sheets' (B, C, D, G) in Appendix E.

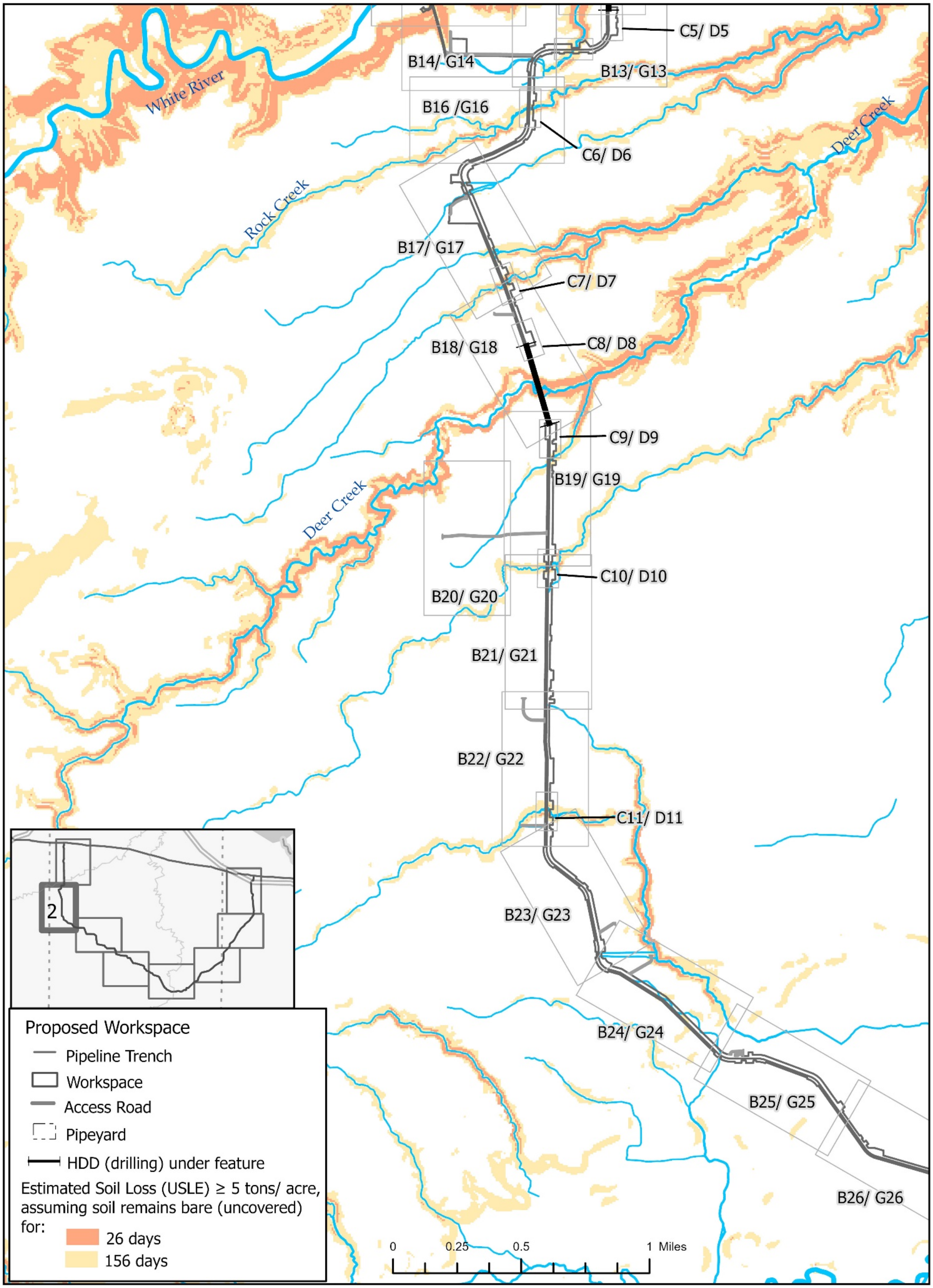


Figure 5.6-5 Estimated soil loss along Enbridge's proposed Line 5 relocation route (map 2 of 8).
Note: Outlines refer to Enbridge erosion & sediment control plan 'sheets' (B, C, D, G) in Appendix E.

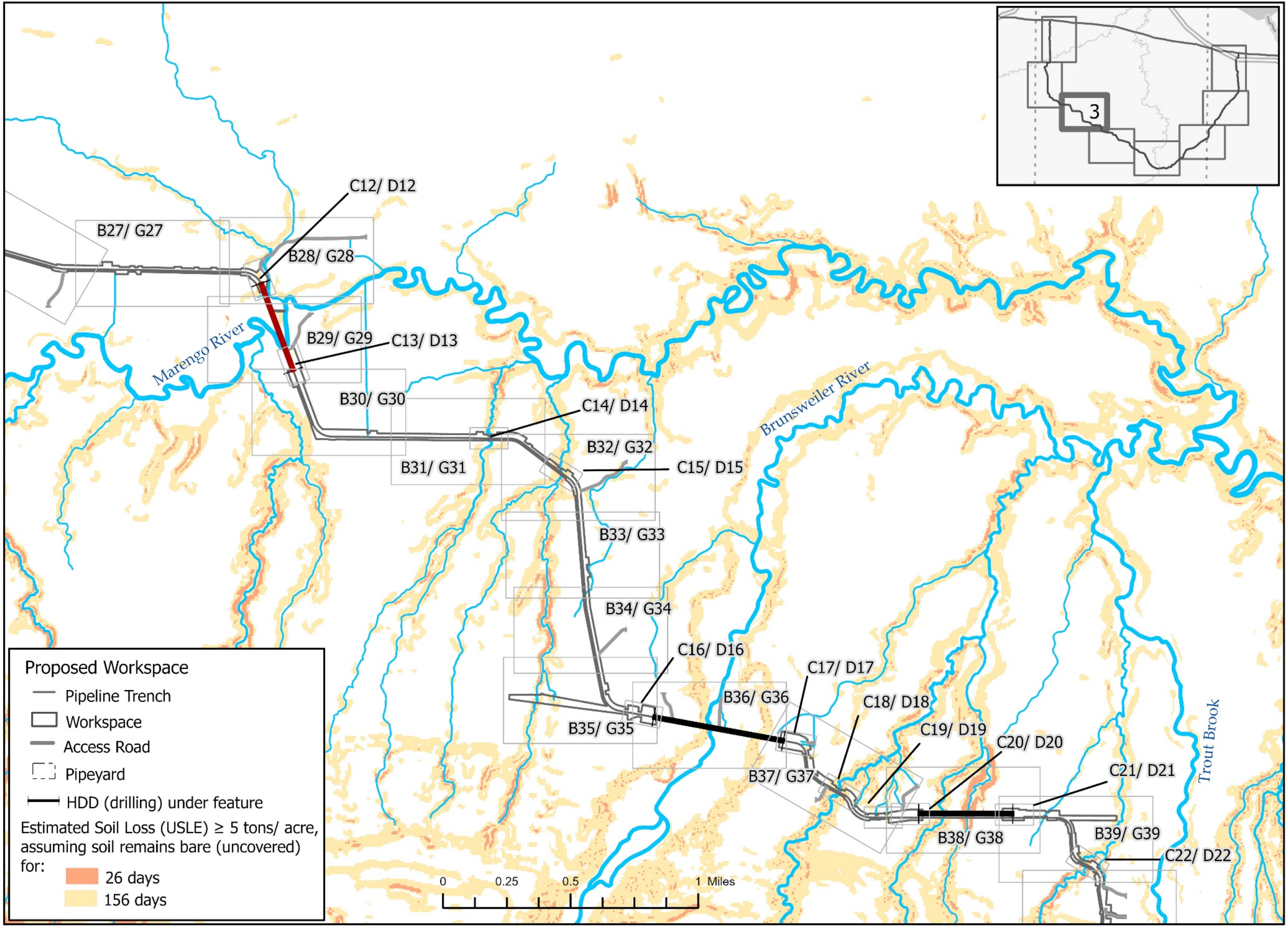


Figure 5.6-5 Estimated soil loss along Enbridge's proposed Line 5 relocation route (map 3 of 8).
Note: Outlines refer to Enbridge erosion & sediment control plan 'sheets' (B, C, D, G) in Appendix E

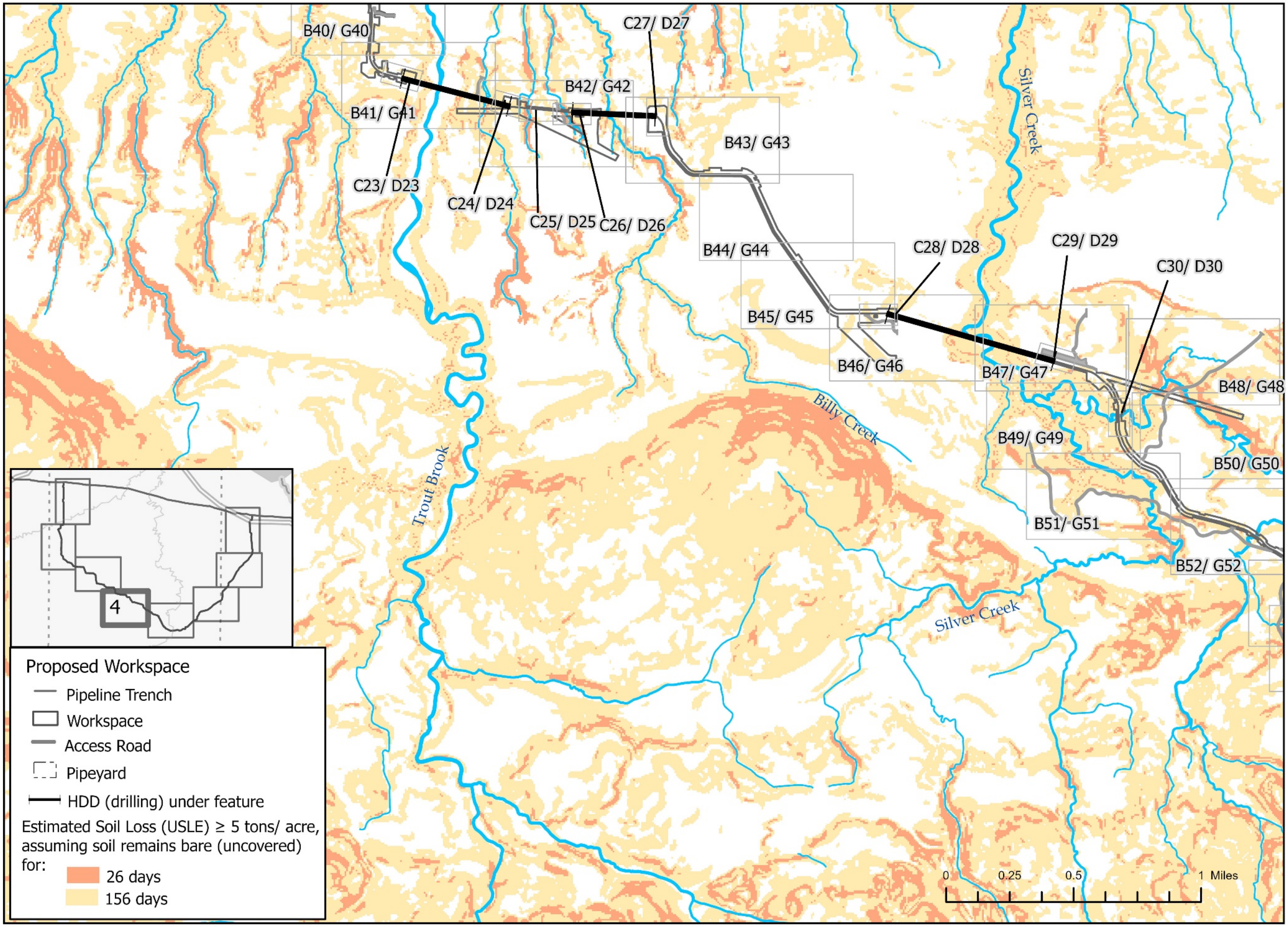


Figure 5.6-5 Estimated soil loss along Enbridge's proposed Line 5 relocation route (map 4 of 8).
Note: Outlines refer to Enbridge erosion & sediment control plan 'sheets' (B, C, D, G) in Appendix E.

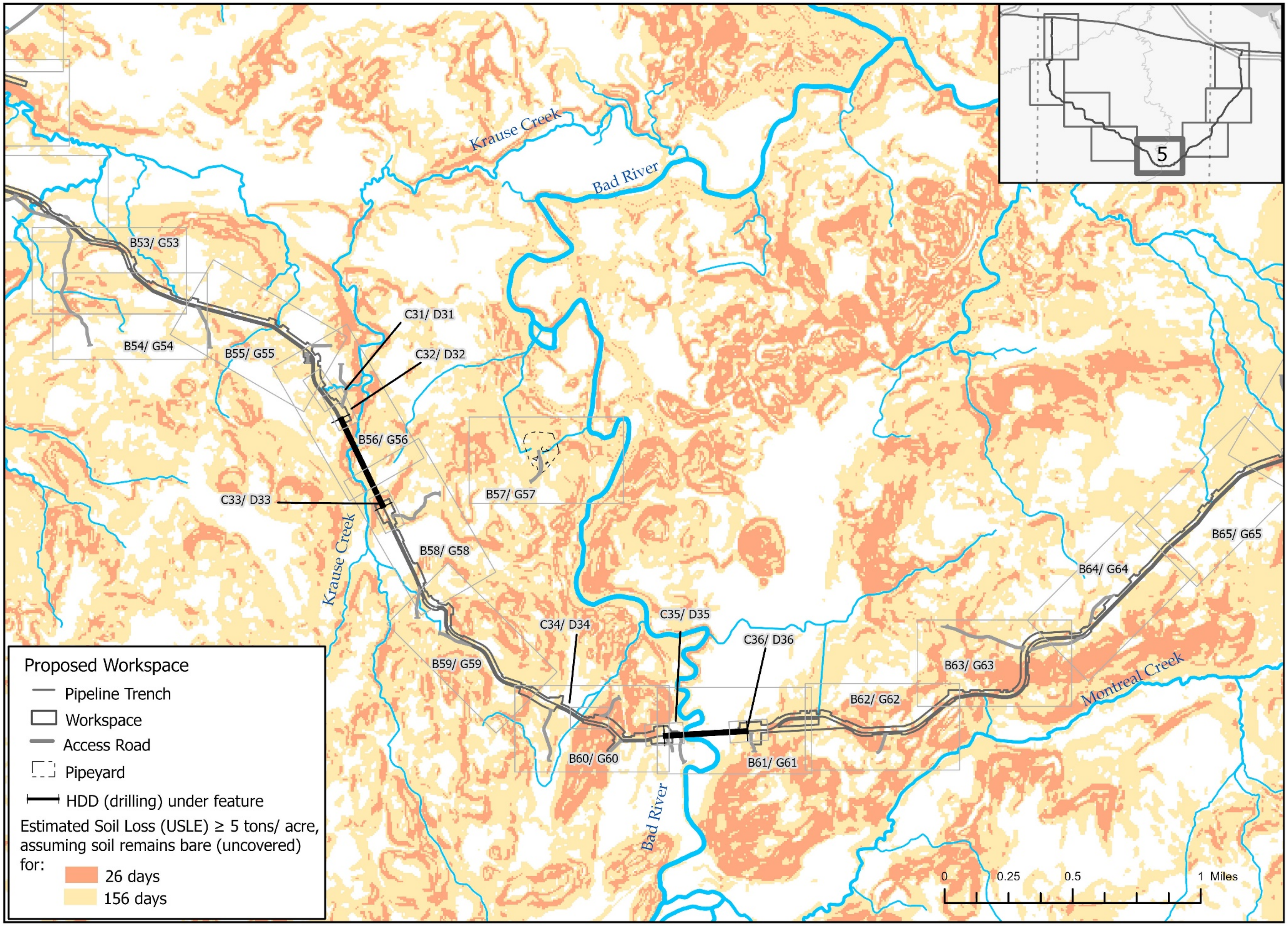


Figure 5.6-5 Estimated soil loss along Enbridge's proposed Line 5 relocation route (map 5 of 8).
Note: Outlines refer to Enbridge erosion & sediment control plan 'sheets' (B, C, D, G) in Appendix E.

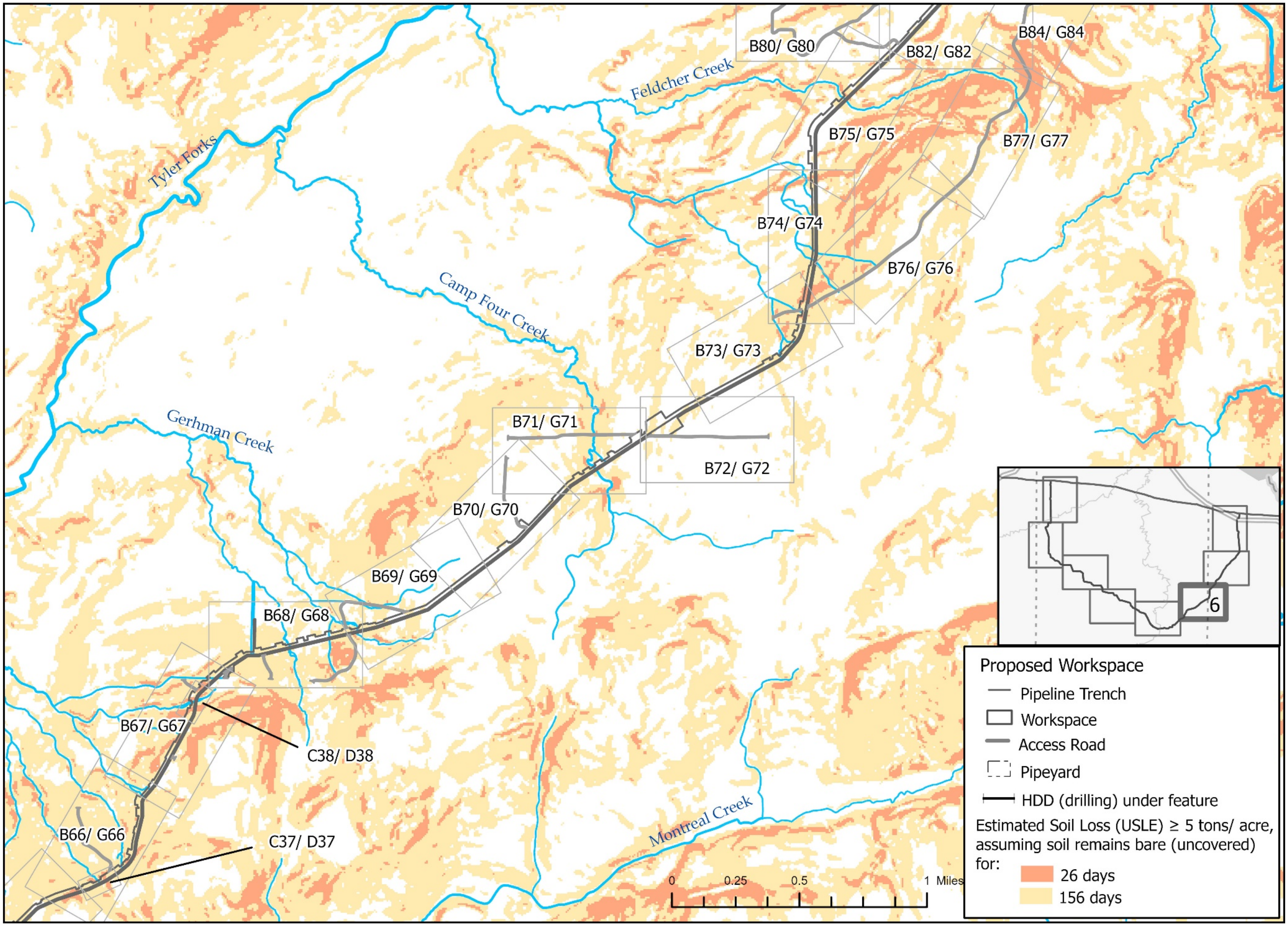


Figure 5.6-5 Estimated soil loss along Enbridge's proposed Line 5 relocation route (map 6 of 8).
Note: Outlines refer to Enbridge erosion & sediment control plan 'sheets' (B, C, D, G) in Appendix E.

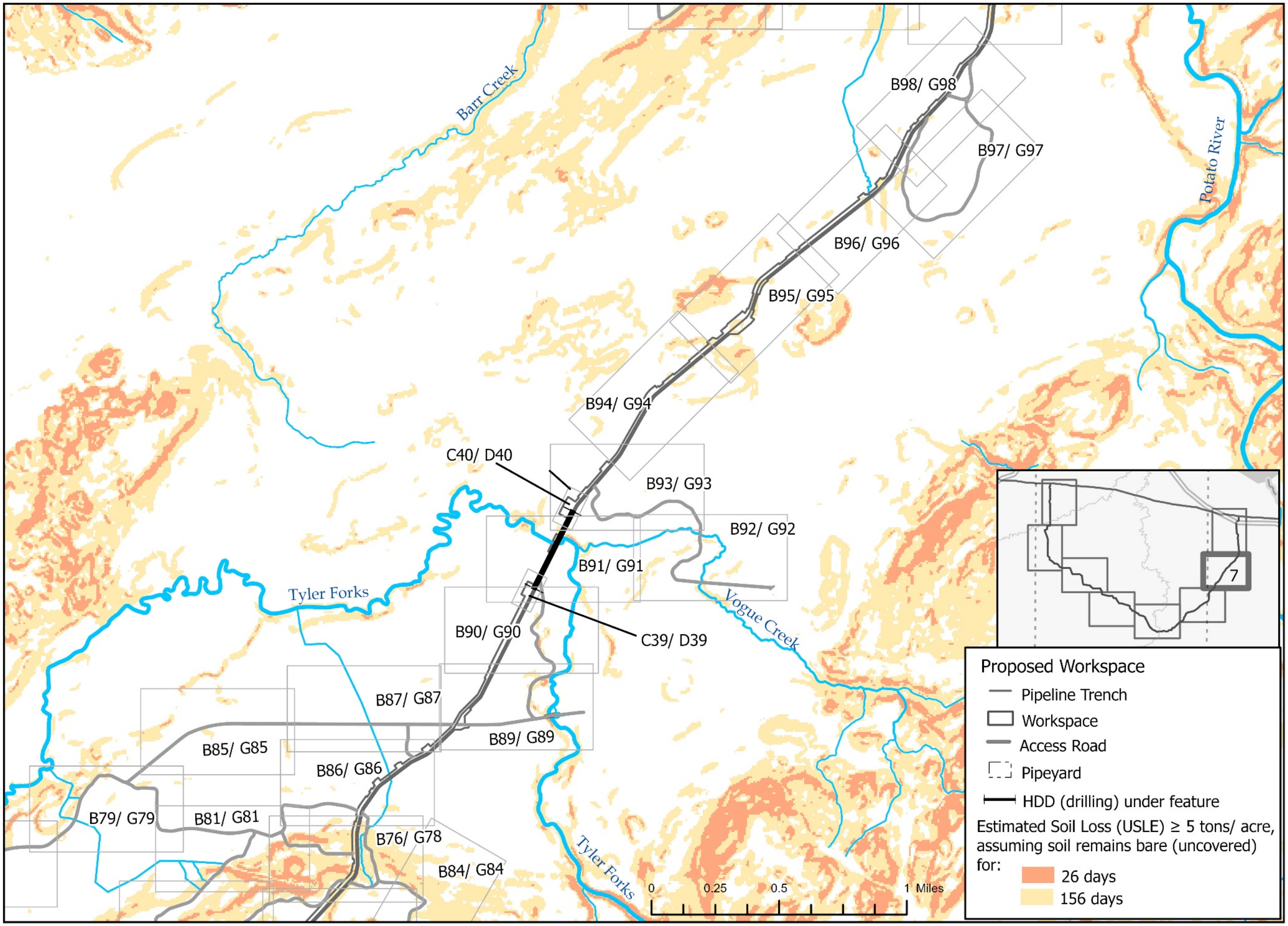


Figure 5.6-5 Estimated soil loss along Enbridge's proposed Line 5 relocation route (map 7 of 8).
Note: Outlines refer to Enbridge erosion & sediment control plan 'sheets' (B, C, D, G) in Appendix E.

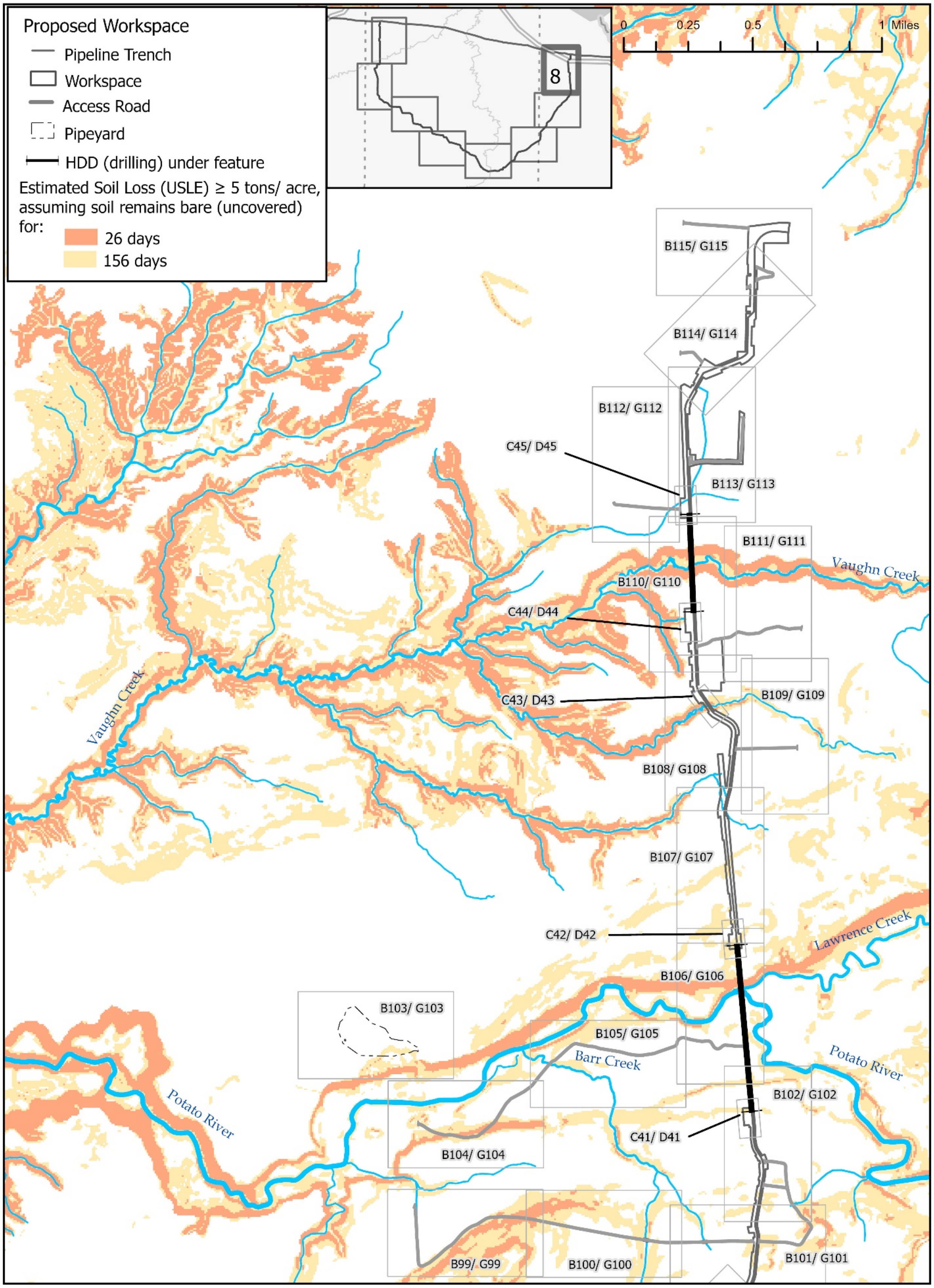


Figure 5.6-5 Estimated soil loss along Enbridge's proposed Line 5 relocation route (map 8 of 8).
Note: Outlines refer to Enbridge erosion & sediment control plan 'sheets' (B, C, D, G) in Appendix E.

Table 5.6-7 Highest total sediment yield regions along Enbridge's proposed Line 5 relocation route.

Contributing area ID	Stream crossings	Waterbody	Sediment loss long (tons)	Sediment loss short (tons)
126	sasc025i, sasc025i_x, sasb1004e, sasb1002i	UNT Billy Creek	68.9	17.3
125	sasc028e, sasc026e	UNT Billy Creek	38.5	9.68
169	sasv018i	UNT Scott Taylor Creek	22.1	5.56
149	sasa071p_x1, sasa071p_x2	UNT Silver Creek	21.3	5.36
76	sase1015i	UNT Marengo River	17.8	4.47

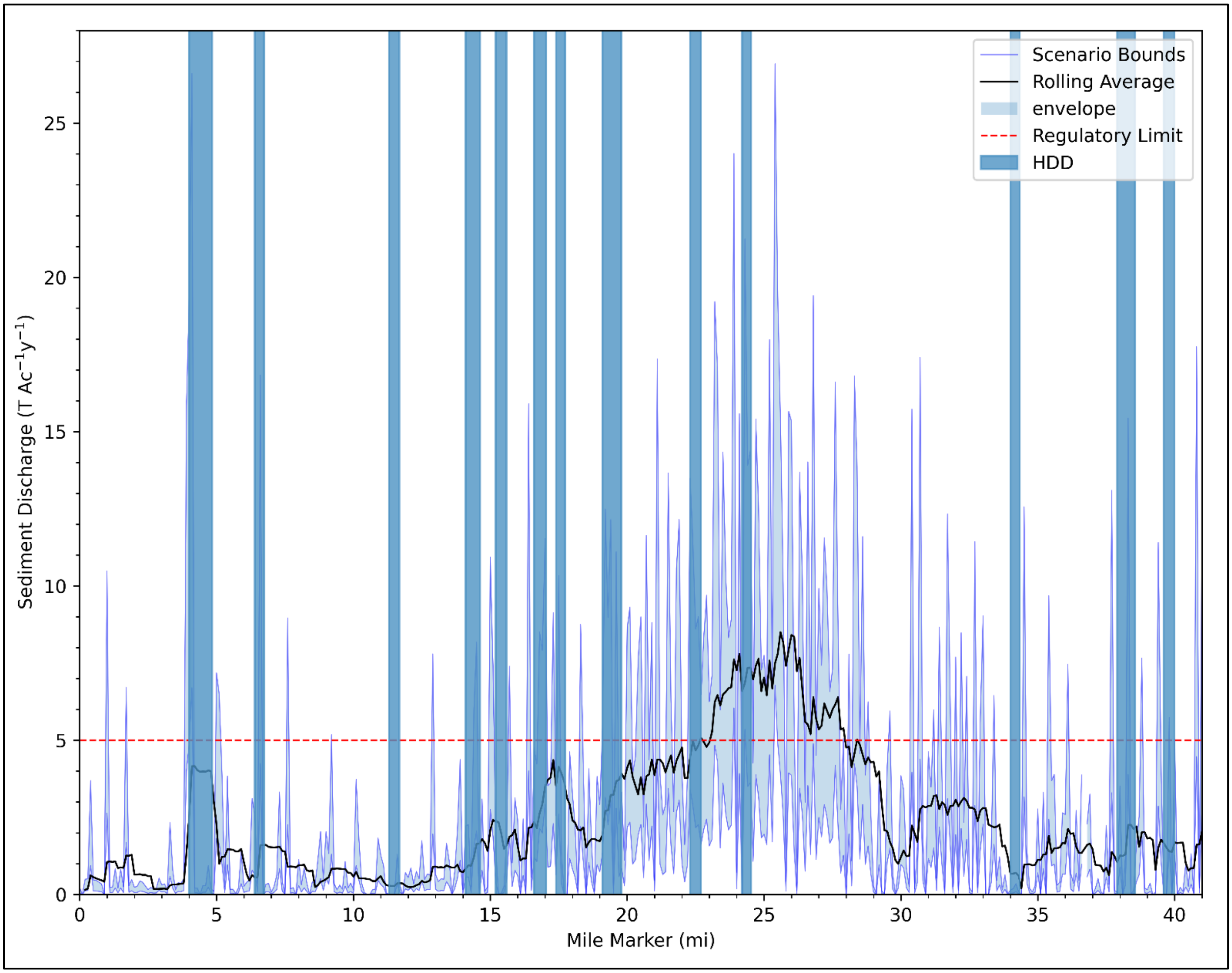


Figure 5.6-6 Modeled sheet flow sediment input by milepost.
Dark blue bars represent HDD locations. Red dotted line represents five tons per acre. Light blue is the area between estimates from the long and short scenarios, which are light blue lines. Black line represents rolling average (window: 0.5 mi) of modeled sediment output.

When considered by milepost marker, 118 mileposts are in excess of the five tons per acre per year regulatory limit in the long scenario, or roughly 25 percent of all milepost markers at a one-tenth-mile resolution. In the short scenario, four mileposts (one percent of all mile markers) exceeded five tons per acre, with five more within one-half of a ton per acre of the limit. The most at-risk milepost markers are clustered between MP 23.9 and MP 25.4, and the additional high values cluster around this milepost range as well (Table 5.6-8). Disturbance areas that are likely to exceed five tons per acre per year of sediment discharge would be required to reduce the potential discharge through the implementation of additional erosion and sediment control measures and limitations on bare ground durations to the maximum extent practicable.

Table 5.6-8 Highest-risk MPs based on modeled long and short scenarios.

Milepost (MP)	Total sediment discharge – short (tons)	Total sediment discharge – long (tons)	Sediment discharge rate – short (t/ac/yr)	Sediment Discharge rate – long (t/ac/yr)
25.4	11.9	47.2	6.78	26.9
23.9	15.8	62.9	6.04	24.0
26.8	7.97	31.6	4.88	19.4
25.5	8.44	33.5	4.88	19.4
23.2	14.3	57.0	4.84	19.2
25.2	7.38	29.3	4.53	18.0
40.8	1.55	6.14	4.47	17.8

5.6.3.4 Trench Dewatering

Construction operations are expected to include dewatering, as described in Section 2.6.7, where needed to provide safe working conditions within the trench. The need for dewatering would depend on site conditions at the time of construction, which would be affected by rain events and seasonal groundwater fluctuations. If the trench requires dewatering, the outlet of the dewatering pump could cause erosion outside of the trench if improperly placed by concentrating a high volume of flow on a single ground point. Any discharges not placed in vegetated or armored areas have the potential to contribute to additional sheet flow erosion and sediment discharge to receiving waterways.

Trench dewatering would most likely occur during the spring months when snowmelt and precipitation both contribute to elevated groundwater levels. Trench dewatering would also most likely be necessary near stream crossings, where groundwater is naturally near the land surface. Dewatering typically runs water through a filtering apparatus before it runs to the local land surface, removing coarse particles but leaving finer particles in suspension.

Construction site dewatering activities are covered under the Construction Site General Permit if the flow is under 70 gallons per minute (gpm). Where dewatering activities exceed 70 gpm of water pumped from the site, both a temporary high capacity well permit and coverage under the Dewatering Operations WPDES Permit WI-0049344-5 would be required. Enbridge is currently covered under this permit for statewide maintenance operations. Dewatering discharges are typically treated through seepage, settling, or filtration. As part of their application for coverage under the Dewatering Operations permit, Enbridge would have been required to submit information on typical dewatering practices. Enbridge included details for typical dewatering operations in the erosion control plan details in Appendix E.

5.6.3.5 Proportion of Fine & Coarse Sediment

Eroded soil could behave differently upon entering waterways due to its grain size. The Natural Resources Conservation Service (NRCS) maps fractions of each sediment class (clay, silt, and sand) during its soil survey operations. Soils with a higher proportion of sand are more likely to affect local stream areas and settle out relatively quickly, while soils with higher proportions of silt and clay will generally affect the total suspended sediment load farther downstream of the crossing in question. All soil proportion data are from the SSURGO dataset, which describes soil parameters in terms of map units (see full discussion in section 5.6.1). Soil data are from nine to 15 inches of depth, which is the typical depth excavated by ground clearing operations in advance of construction.

Soil composition also allows estimation of bulk density and potential volume input to streams from sheet flow erosion. For example, contributing areas 125 and 126 (draining to Billy Creek through crossings sasc025i, sasc025i_x, sasb1004e, and sasb1002i) are modeled to lose a total of 27 tons of soil in the first year after construction under the short scenario. Using standard estimates of soil bulk density from NRCS, this corresponds to 30 cubic yards of soil loss (23 cubic meters) into the stream. Under the long scenario, this becomes 127 cubic yards (97 cubic meters) of sediment in the first year.

Table 5.6-9 Proportion of sediment type at high-risk crossings.

Contributing area ID	Stream crossings	Waterbody	% Clay	% Silt	% Sand
126	sasc025i, sasc025i_x, sasb1004e, sasb1002i	UNT Billy Creek	18.5	54.4	27.1
125	sasc028e, sasc026e	UNT Billy Creek	18.5	54.4	27.1
169	sasv018i	UNT Scott Taylor Creek	5.0	90.0	5.0
149	sasa071p_x1, sasa071p_x2	UNT Silver Creek	10.0	60.0	30.0
76	sase1015i	UNT Marengo River	20.0	51.30	28.7

Based on the proportions in Table 5.6-9, the dominant substrate in high-risk stream crossings is silt, and secondarily sand. This means that most affected streams would have intermediate transport of sediment downstream when sheet flow occurs.

5.6.3.6 Sediment Transport in Waterways

Sediment from proposed trenched crossings could reach sensitive waters depending on the distance from each crossing point to a receiving water's confluence with these waterways. Trenched crossings have the most potential for direct sediment effects at the immediate time of construction because these crossings would directly disturb stream and riparian sediment around the trench line and adjoining riparian zones. Enbridge hired RPS Consulting to model the potential for sediment discharge from trenched crossing construction to affect total suspended solid loads downstream of construction areas. Summaries of RPS's model outputs were shared with the DNR.

In lieu of using real stream geomorphological data to inform sediment transport calculations (due in part to complexity and in part to the diversity of stream morphologies encountered along the ROW), RPS designed generic stream morphologies to represent sediment transport behavior in trenched crossings. Table

5.6-10 describes the dimensions of each hypothetical channel. RPS's defined morphology was a flat-bottomed stream with vertical sides with a constant slope and flow rate. This set of variables will tend to overestimate sediment transport in slow areas and underestimate it in turbulent ones (like riffles or rapids). It will also neglect sediment deposition in areas with slow flow or meanders. RPS considered two stream sizes, one five-feet wide and one 25-feet wide, to capture how small and medium sized crossings would each respond to sediment inputs.

RPS also ran their models for a matrix of other parameters (specifically flow/velocity - Table 5.6-11, sediment type, and sediment loading), creating an envelope of different sediment transport scenarios. RPS provided summarized behavior from the model every 32.8ft (10m) for 3280ft (1000m). Appendix AH includes additional details about RPS's sediment transport modeling.

Table 5.6-10 RPS model dimensions for medium and small water crossings.

Crossing size	Watercourse width (feet)	Watercourse depth (feet)
Small	5	1
Medium	25	3

Table 5.6-11 Velocity inputs across different crossing sizes specified by RPS modeling.

Watercourse size	Low velocity input (feet·second^{-1})	Medium velocity input (feet· second^{-1})	High velocity input (feet·second^{-1})
Small (3 feet x 1 foot)	0.52	0.72	1.01
Medium (25 feet x 3 feet)	0.55	0.85	1.28

These models can be interpreted as informed guesses about the average behavior of sediment plumes in small and medium streams which are crossed via trench; they will encompass some aspects of the sediment transport behavior but fail to capture others, especially spots downstream of the crossings where sediment could accumulate disproportionately. They also do not capture the proportion of sediment which would remain suspended in a stream over longer distances (especially clays) since sediment type remaining by distance was not provided and longer distances were not captured.

Figure 5.6-7 shows the sediment concentration predicted downstream for the full matrix of medium crossing scenarios modeled, and Figure 5.6-8 shows the same matrix for small crossings.

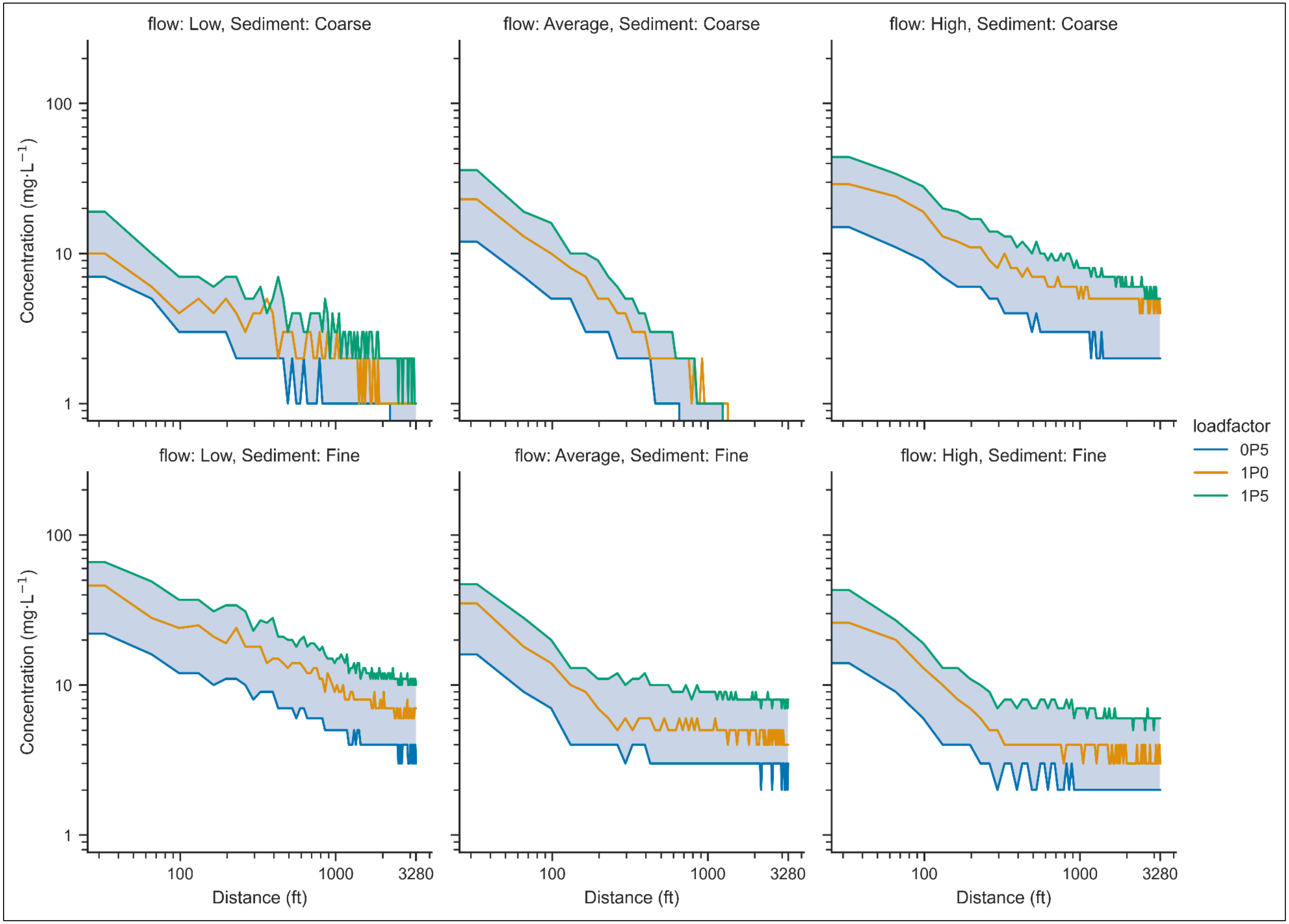


Figure 5.6-7 Envelope of medium stream sediment transport scenarios from RPS sediment transport modeling.
Blue lines indicate behavior at 50% loading, orange lines represent 100% loading, and green lines represent 150% loading scenarios.

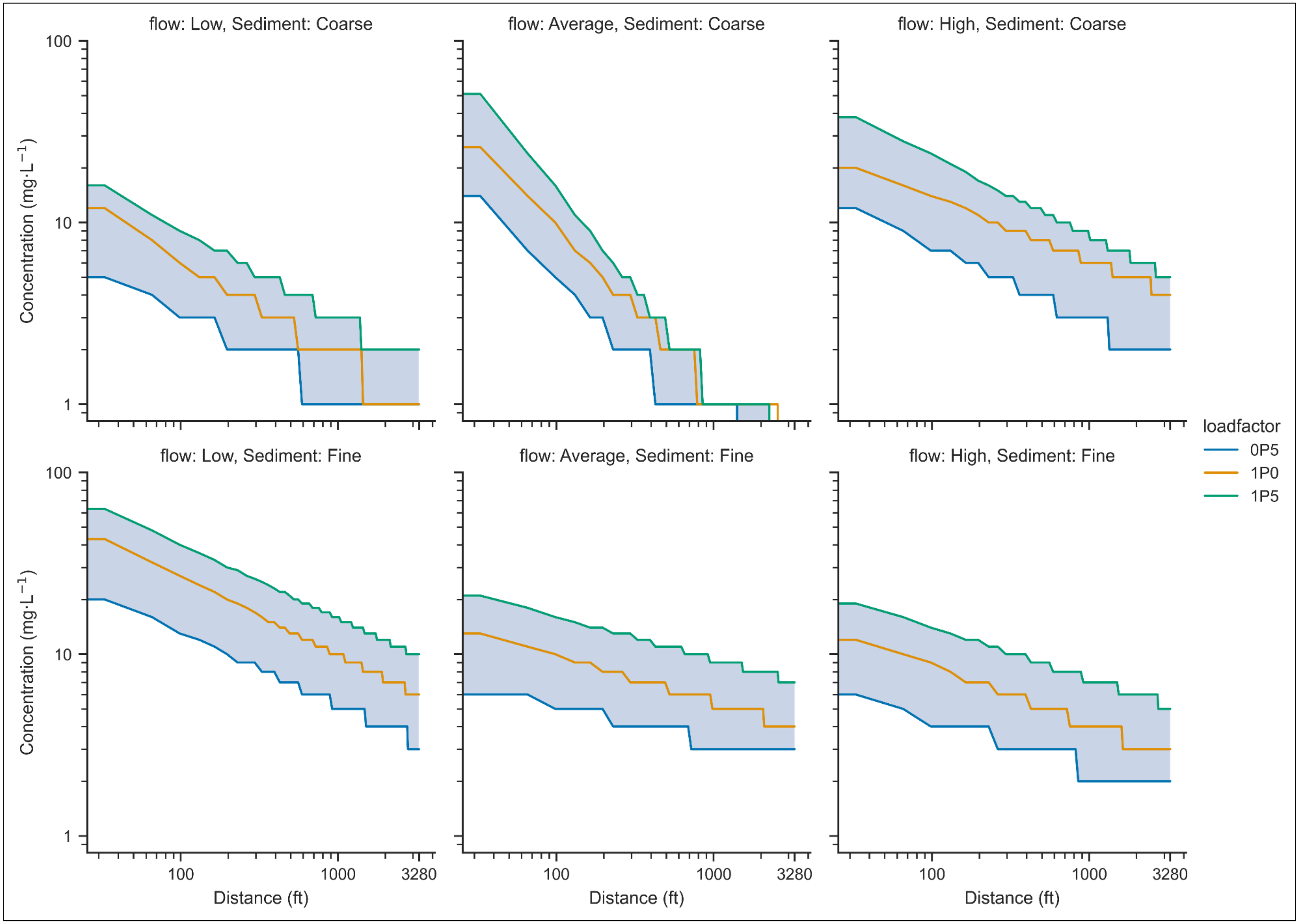


Figure 5.6-8 Envelope of small stream sediment transport scenarios from RPS sediment transport modeling.
Blue lines represent behavior at 50% loading, orange lines represent 100% loading, and green lines represent 150% loading scenarios.

RPS assumed that waterbody crossings would only discharge sediment from dam installation and removal, without sediment loading during the trenching itself. This neglects any sediment transported from pumping operations, which are necessary to prevent a buildup of water during a dry crossing event. Further sediment loading after completion of crossings is neglected despite backfilling damaging the natural sorting and armoring of streambed sediments, which typically limit erosion during periods of low flow.

The DNR took RPS's model outputs for both stream types, under average flow conditions, and applied them to all streams crossed by Enbridge's proposed relocation route according to the actual streams' widths and substrates as reported in Enbridge's waterbody crossing table (Appendix B). Regression lines were fit to the sediment decay functions shown in Figure 5.6-7 and Figure 5.6-8 and used to predict the concentration of sediment at different distances along each stream. Regression lines for each model scenario can be viewed in Appendix S.

As illustrated in in Figure 5.6-7 and Figure 5.6-8, across both stream types and all scenarios, RPS's models predicted the setting out of the vast majority of sediment within 3,280 feet (1,000 meters) downstream of the proposed waterbody crossings, with the steepest decline in total suspended solids occurring within the first 328 feet (100 meters) where the heavier particles would fall out of suspension. Nearby streambed substrate (and consequently, macroinvertebrate and fish communities) would be greatest affected in most situations by the added total suspended solids load. In some cases, total suspended solids load has the potential to be additive if crossings are undertaken near-simultaneously (for example, in places where crossings are within 600 feet or fewer of one another). Models run for fine sediment also predicted that most of the clay sediments would settle out by 3,280 feet (1,000 meters); however, clay is often suspended for much longer in real scenarios, even in very slow-moving water. Clay particles would in most cases be diluted by greater volumes of water over time, reducing their concentrations. In low flow conditions, however, high concentrations of clay particles could persist farther downstream than the modeling domain suggests.

5.6.4 Control Strategies

The main mitigatory action taken by Enbridge would be development of a comprehensive storm water erosion and sediment control plan in accordance with regulatory requirements. As discussed in Sections 1.4.3.11 and 2.8.10, Enbridge would be required to obtain coverage under the Construction Site General Permit (Permit No. WI-S067831-6) because the proposed project would disturb more than an acre of land due to construction activity. If covered by the Construction Site General Permit, Enbridge may discharge runoff on the condition that it follows the site-specific erosion and sediment control plan submitted with its permit application and revised based on DNR comments. That plan must, by design, meet performance standards in s. NR 151.11, Wis. Adm. Code. The code requires erosion and sediment control practices to prevent or reduce sediment discharge related to specific activities or receiving waters (s. NR 151.11 (6m), Wis. Adm. Code). The erosion control practices may need to be augmented if the plan fails to reduce sediment discharge below five tons per acre per year (s. NR 151.11 (6m) (b), Wis. Adm. Code). The DNR provides guidance on how to comply with this performance standard. Typically, underground utility construction would follow the prescriptive compliance option from DNR's Construction Site Soil Loss and Sediment Discharge Calculation Guidance. Prescriptive compliance is provided for small areas of steep slopes, utility trenching, slopes greater than 20 percent, and areas of concentrated flow. Prescriptive compliance measures include limitations on the duration of bare soil conditions, implementation of soil stabilization practices, and immediate temporary or final stabilization upon reaching an interim or final grade, respectively.

Enbridge's erosion and sediment control plan (Appendix E), which was submitted with the company's Construction Site General Permit application and revised in response to DNR comments, identifies several specific erosion control strategies including slope breakers, sediment barriers (silt fences, straw bales, and bio-logs), storm water diversions, trench breakers/plugs, sediment traps, sediment basins, mulching, and revegetation. These measures would reduce the potential for erosion and sediment discharge during construction. Each one is described in more detail in sections 2.6.3 and 2.8.10. Figure 5.6-9 provides visual examples of some of these erosion control strategies.

Figure 5.6-9 Examples of erosion control strategies used at a pipeline waterbody crossing mid-restoration.

The figure shows erosion matting, slope breakers (near bottom), silt fences, and riprap near the streambed, as well as the establishment of vegetation during the erosion phase.

Multiple erosion control measures may be required near steep slopes and erodible soils. Enbridge's Erosion and Sediment Control Plan (Appendix E) states that slopes steeper than five percent grade with bases greater than or equal to 50 feet from a waterbody, artificial drainage, or wetland are required to be fully covered by erosion control matting until revegetation is complete and there is no potential for scouring or sediment transport to surface waters. The plan calls for implementation of earthen berm slope breakers wherever possible on highly erodible slopes. Enbridge's plan also calls for tile inlet protection in the ROW, but does not specify a strategy for doing so, instead stating that protection would be based on the site-specific conditions of the tile inlet. Permanent erosion control measures outlined in Enbridge's EPP (Appendix D) include vegetation and slope breakers for typical areas, and installation of turf reinforcement mats or permanent ditch checks for sensitive or steeply sloped areas.

Work is anticipated to begin or extend into winter (Appendix D, Part 2). Winter conditions could either reduce or increase effects depending on temperatures and precipitation types. In general, frozen or snow-covered conditions could reduce soil movement. Snow melt, or rain on frozen ground, could result in increased sediment discharges. As discussed in Section 2.8.10, erosion and sediment control practices would need to be in good condition prior to a thaw or rain event. Figure 5.6-10 shows construction near a riverbank during winter conditions. According to Enbridge's EPP (Appendix D), "If winter conditions preclude cleanup and topsoil restoration, the area will be stabilized and temporary ECDs will remain in place until installation of permanent erosion control measures is complete. Depending on site and weather conditions, Enbridge will require the use of dormant seeding, mulching, and/or installation of erosion control blanket on stream banks or other sensitive locations."

Figure 5.6-10 Erosion control measures along a riverbank during winter conditions.
Photo: Ben Callan, DNR

If fully implemented, Enbridge's erosion control plan has the potential to reduce erosion losses from construction and restoration and limit construction-related sediment discharges. The DNR would review Enbridge's Erosion and Sediment Control Plan (Appendix E) prior to issuing permits. If after permit issuance a portion of the plan fails to limit sediment losses, or there is a change that has a reasonable potential to induce pollutant discharge not already addressed by the plan, amendments would be required.

During both temporary and final stabilization, vegetation establishment could be challenging in droughty soils (Section 5.9.1.5). Coarse soils drain water more quickly away from the root zone, causing faster-onset drought in these areas. Depending on the weather conditions at the time of restoration, droughty soils could make revegetation much more difficult, causing local soil erosion. Vegetation in sandy soils are especially vulnerable to drought, and sandy areas would likely be difficult to restore due to reduced structural stability and faster drainage. Erosion from droughty soils also removes nutrients and organic matter, which reverts slopes to a more highly disturbed state and further reduces water-holding capacity.

Mitigation strategies for droughty soils include watering, mulching, and re-seeding. Watering would be unlikely due to the progressive restrictions in equipment access post-restoration outlined in Enbridge's EPP and other construction materials. Mulching would improve water retention characteristics during the plant establishment phase but would not help retain water in deeper soils as grasses used for restoration increase their root depth. Restoration of organic matter, which would ultimately improve the stability of these slopes in the long-term, typically takes decades, and accumulations could easily be lost from extreme erosion events; this would increase the long-term risk of erosion after vegetation restoration in these areas.

Because termination of coverage under the Construction Site General Permit requires documentation of uniform perennial vegetation of at least 70 percent density, it would be unlikely that droughty soils would pose a high long-term risk. However, if an area has poor water-retention capacity and remains droughty after closure of the permit, it could be susceptible to later erosion if additional droughts occur. Drought vulnerability effects interact with the cumulative effects of climate change, which are discussed more fully in Chapter 7. Warmer summer temperatures and more intermittent rainfall will both contribute to drought and soil water depletion past the wilting point, the point at which plants begin to wilt due to lack of water. This trend will likely exacerbate drought, especially in sandy soils.

5.6.5 Inadvertent Releases (Frac-outs)

During installation of pipe by HDD and direct bore methods, as described in Section 2.5.2, there is a risk that drilling fluid could reach the surface at an unintended location. This is called an inadvertent release. Inadvertent releases are most common in areas with soft or granular sediments that do not have high resistance to pressurized drilling fluid. They are also most common at the entry and exit point of the HDD alignment, since these areas exert the least confining force. Direct bore has a lower risk of an inadvertent release because the drilling fluid is circulated within hoses in the pipe being installed, so the fluid pressure is only present around the drill head.

Enbridge has proposed 12 HDD road and waterbody crossings, one direct bore waterbody crossing, and 17 direct bore road and railroad crossings (Table 2.5-2; Table 2.5-3). The trenchless waterbody crossings would range from 1,788 feet to 4,485 feet in horizontal length for a total of 32,232 feet (6.1 miles) and cross under multiple smaller tributaries in addition to the waterway the crossing is named for. For details on Enbridge's design methodology for HDD crossings, see Section 2.5.2.2 and Appendix G. Table 5.6-13 summarizes each proposed HDD waterbody crossing and its potential risk points.

Little literature exists on prediction of inadvertent release risk during pipeline construction, and there are not reliable methods to predict inadvertent release locations. During design of HDD profiles, the Delft Method is used to estimate the ability of soil to resist fluid pressures and define locations of elevated risk but the accuracy of that method has been questioned.(Goerz, Boelhouwer, and Taylor, 2020; Staheli, Christopher, and Wetter, 2010). Another challenge to predicting inadvertent release risk is that the 3-D subsurface soil structure varies along the length of an HDD, making it difficult to identify risk areas with any accuracy. It is generally not feasible to fully define those variabilities because soil borings are typically offset from the proposed alignment by 50 feet or more to avoid increasing the risk of inadvertent release at the soil boring locations. There are also access challenges and expenses that limit the number and location of soil borings that can be obtained along a proposed alignment. For these reasons, a factor of safety of two is generally desired, meaning the pressure keeping the fluid in the hole is two or more times the pressure of the fluid pushing on the surrounding soil. The subsurface soil variabilities also limit the accuracy of comparisons between projects as a means of predicting inadvertent releases on a proposed project, but they can provide an example of where and how many inadvertent releases could occur on HDDs of a similar diameter and length.

The DNR used Enbridge's Line 3/93 in Minnesota as an example of inadvertent releases that could occur on a project to install a similar diameter pipeline. During the construction of Enbridge's Line 3/93, HDD was used for 19 crossings totaling 43,145 feet (8.17 miles). The crossings ranged from 1,418 feet to 4,413 feet in horizontal length, distances that are comparable to those of Enbridge's proposed Line 5 relocation (Table 2.5-2). As shown in Table 5.6-12, 12 of the 19 HDD crossings constructed for the Line 3/93 project (nearly two-thirds of that project's HDD crossings) had one or more inadvertent releases. In total, 28 inadvertent releases occurred along Line 3/93.

Of the 28 Line 3/93 inadvertent releases, 18 occurred within the entry or exit workspace and 10 occurred outside the workspace around the HDD entry or exit (Table 5.6-12). Most of the inadvertent releases were estimated to release less than 50 gallons of drilling fluid, with 22 of the 28 inadvertent releases releasing less than 100 gallons (Table 5.6-12). Thirteen inadvertent releases released to wetlands. Only one released directly into a river. The inadvertent releases did not all coincide with areas of predicted elevated risk. The inadvertent releases mostly occurred within the construction workspace, but the largest inadvertent release, estimated to have released 6,000 to 9,000 gallons of drilling fluid, was discovered in a wetland outside of the workspace at 1:30 pm.

Based on what occurred on Line 3/93 in Minnesota, the DNR assumes that inadvertent releases would occur during the construction of Enbridge's proposed Line 5 relocation. The location and severity would likely vary between inadvertent releases, with most inadvertent releases occurring in the entry and exit workspaces. In correspondence related to waterway and wetland permitting, Enbridge committed to following DNR Technical Standard 1072, Horizontal Directional Drilling. This technical standard has requirements for inspections of the drill path and surrounding area during drilling and for staging of inadvertent release response supplies and equipment to minimize potential effects from inadvertent releases. As part of complying with DNR Technical Standard 1072, Enbridge has submitted site-specific inadvertent release plans for each proposed HDD and the Marengo River direct bore (Appendix N). These site-specific plans would be reviewed as part of the Construction Site General Permit review. Additional evaluation of site-specific risks is provided in Appendix G.

Table 5.6-12 Summary of HDDs on Enbridge's Line 3/93 in Minnesota.

Waterbody feature (MP)	Total horizontal length of HDD crossing (feet)	Estimated duration of HDD (days)	Section with elevated risk based on hydrofracture analysis	Total inadvertent release (estimated gallons released)	Number of inadvertent releases located in entry/exit workspaces	Number of inadvertent releases located in elevated risk area
Red River (MP 801.8)	2,110	18	Approximately 1,035 feet from entry point (north bank of river) and 1,540 feet from entry point (200 feet south of south bank) for 1,335 ft total	2 (450)	1	2
Tamarac River (MP 828.6)	1,463	27	Last 40 feet	0	0	0
Middle River (MP 836.0)	1,755	27	Last 70 feet	4 (315)	4	4
Snake River (MP 843.2)	1,574	21	Last 40 feet	1 (20)	1	1
Red Lake River (MP 864.3)	3,182	57	Last 70 feet	2 (1,280)	1	1
Clearwater River (MP 875.4)	2,768	48	Last 75 feet	2 (50)	2	1
Clearwater River (MP 922.2)	2,818	45	Last 90 feet	2 (35)	2	0
Mississippi River (MP 941.0)	2,217	50	Last 70 feet	3 (160)	0	0
Hay Creek (MP 963.7)	2,802	50	Last 60 feet	0	0	0
Straight River (MP 974.2)	3,579	75	Last 300 feet	1 (Flowed to drilling mud pit)	1	0
Shell River (MP 983.7)	2,309	45	Last 140 feet	0	0	0
Shell River – Oxbow (MP 985.3)	4,413	80	Last 140 feet	0	0	0
Shell River (MP 991.2)	1,589	45	Last 60 feet	0	0	0
Crow Wing River (MP 993.3)	1,816	45	Last 40 feet	0	0	0
Pine River (MP 1017.4)	1,433	30	Last 40 feet	1 (100)	1	0
Daggett Brook (MP 1037.4)	2,262	50	Last 80 feet	0	0	0
Willow River (MP 1066.5)	1,418	50	Last 50 feet	3 (170)	2	2
Mississippi River (MP 1069.7)	2,190	50	Last 80 feet	1 (9,000)	0	1
East Savanna River (MP 1085.9)	1,447	40	Last 70 feet	6 (1,480)	3	3
Total:	**43,145**	**853**		**28 (13,060)**	**18**	**15**

Note: Table adapted from Table 7.1.1-2 Line 3 Replacement Project Summary of Hydrofracture Analysis Reports for Proposed HDD Crossings to include information from an August 9, 2021, letter from the MPCA to Minnesota Senators and Representatives.(Minnesota Pollution Control Agency, 2021)

Table 5.6-13 Summary of HDD site characteristics along Enbridge's proposed Line 5 relocation route.

Waterbody/road & MP	Length (feet)	Estimated build time (days)	Elevated inadvertent release risk areas per hydrofracture analysis	DNR additional risk commentary
White River – MP 4	4,485	65	None	Factor of safety close to 2 between 300 & 500 feet.
Deer Creek – MP 6	1,790	21	Final 60 feet, high risk	
Marengo River – MP 11	2,013	45	Final 40 feet	This crossing is proposed to be completed using direct bore because the risk of inadvertent release using HDD is high due to soft soils.
Brunsweiler River – MP 14	2,809	45	Final 20 feet	
Highway 13 – MP 15	2,018	20	Final ~80 feet, high risk	Ditches on both sides of the Highway 13 roadbed exceed Safety factor of 2.
Trout Brook – MP 16	2,356	25	Final 50 feet	
Billy Creek – MP 18	1,788	41	Final 10 feet	
Silver Creek – MP 19	3,674	73	Final 100 feet, high risk	
Krause Creek – MP 22	2,092	92	Final 15 feet, high risk	
Bad River – MP 24	1,788	22	Final 40 feet, high risk	
Tyler Forks – MP 34	1,851	47	Final 80 ft, high risk	
Potato River – MP 38	3,496	98	First 100 feet and final 122 feet, high risk	
Vaughn Creek – MP 39	2,072	22	Final 65 feet, high risk	Factor of Safety may be below 2 at stream.
Total:	**32,232**	**571**		

The consequences of an inadvertent release in or near a stream would vary by the size of the affected stream and the exposure time of the inadvertent release. The highest-risk case is that an inadvertent release would occur on a stream with relatively small dimensions and low flow, which would have relatively little ability to clear accumulated sediment or dilute suspended sediment within the drilling fluid. However, since HDD would primarily be used to cross large watercourses, any small streams would likely flow into the larger stream where dilution could occur within a relatively short distance. Most of the suspended sediment within the drilling fluid would be bentonite, which is a type of clay that settles out best in calm, slow water pools. These cases would cause a very high concentration of persistent suspended sediment, with the potential to violate water quality standards. The risk of causing violations to water quality standards downstream could be greatly reduced by quick detection, containment, and remediation. The response to an inadvertent release in a waterway typically could include the following actions:

- Detection through monitoring of drilling fluid pressures or regular inspections of the drill path and surrounding area.
- Containment of the drilling fluid by surrounding the affected area with haybales or sandbags on

banks or turbidity curtains in water.

- Vacuum truck removal of liquid within the containment area.
- Manual removal of thick bentonite deposits in wetlands and on streambanks.
- Flushing of thin bentonite deposits that cannot be removed without disproportionate effects on vegetation.

Enbridge commissioned RPS to model the sediment transport from an inadvertent release occurring in the middle of the Bad River. The model scenario assumed a one-hour duration prior to detection and mitigation as a worst-case scenario. If Enbridge were to follow their inspection and response procedures, the actual duration would likely be shorter. RPS predicted under their scenarios that the total suspended solids concentrations near the release sites would have more than 20,000 ppm total suspended solids but that the sediments would settle out so that at a point 1.2 miles downstream the concentrations would be below 19 ppm. The model RPS used included assumptions related to the tendency for clay to stick together and form larger particles. The crossing modeled is upstream of an oxbow and several curves in the river alignment.

The consequences of an inadvertent release in or near a wetland would also vary by the size of the affected wetland, the type of vegetation, and the exposure time of the inadvertent release. The highest-risk case is that an inadvertent release would occur in a wooded wetland with standing water hundreds of feet from the nearest vehicle access.

The probability of an inadvertent release is increased in locations where sediments are soft and drilling is shallow, especially where drilling does not proceed through bedrock but rather in overlying sediments. The highest risk area from this perspective is the direct bore crossing of the Marengo River. Borings from Enbridge's construction assessment showed that many sections of soil borings taken from this location only required the weight of a 140-pound hammer to drive soil cores into the ground, often for 20 to 40-foot stretches of vertical profile at a time. This indicates that underlying sediment deposits around the Marengo River crossing are soft and deformable without high pressure. Depending on the 3-dimensional structure of the soil system in this region, it is possible that HDD could cause an inadvertent release through a pocket of soft sediment which extends from the drilling depth to the surface. This location is also shallower in depth than other proposed HDDs, crossing under the Marengo River at a depth of 29 feet below the streambed. The direct bore installation method proposed for this location typically has a lower risk of inadvertent releases compared to HDD because it does not use drilling fluid to keep the hole open, as described in Section 2.5.2.1.

Another high-risk location would be the HDD crossing Highway 13 (MP 15) which also does not traverse bedrock but instead goes through soil for the entirety of its route. This location is also a higher-consequence location because of its proximity to small streams which would have low inadvertent release dilution. RPS did not model the potential for an inadvertent release at this location. The streams draining this region are small and flow through culverts, meaning that the discharge from an inadvertent release would be a very large proportion of the total streamflow for this crossing, especially in low flow conditions. The large discharge scenario assumes a fluid loss of 8,500 cubic feet per hour, or around 2.47 cubic feet per second, around the discharge magnitude of a small stream or creek under baseflow conditions. For smaller crossed streams, this amount of incident sediment could easily cause large accumulations and potentially strongly aggrade the stream under low flow conditions, assuming sediment settles out as easily as reported by RPS's modeling outputs for large streams.

5.6.6 Geohazards

As discussed in Section 2.1.2, Enbridge identified potential geohazards along its proposed relocation route (Table 5.6-14; Figure 5.6-11). Geohazards are a subset of natural hazards that can pose a threat to pipelines, including exposure (loss of soil cover) over and around sections of pipeline. Geohazards are caused by a combination of soil conditions, topography, natural forces, and water movement that can cause rapid landform changes. Geohazards include mudslides, avalanches, rapid erosion, and other land deformations. In Enbridge's Line 5 project area, geohazards are most likely to be influenced by water movement, such as when streams meander or water within a soil layer causes slope subsidence. While geohazards are primarily a natural phenomenon, human changes to the environment can alter features in a way that makes them more stable or less stable. 'Hydrotechnical' geohazards (Table 5.6-15; Figure 5.6-11) are specific to stream channels and include scour, aggradation/degradation, bank erosion, encroachment, avulsion, and meander cutoffs. These terms are defined as follows:

- **Scour** refers to the short-term, local deepening of a channel due to a channel characteristic such as a bend, contraction, event specific flow, or obstruction. Scour is hazardous to the pipeline crossing as it may rapidly decrease the depth of cover between the pipeline and the channel bottom.

- **Aggradation and degradation** refer to non-local, long-term changes in the channel bed elevation resulting from erosion or sedimentation. Degradation is hazardous to a pipeline crossing because it will eventually decrease the depth of cover between the pipeline and the channel bottom. Aggradation is hazardous because it will eventually increase the elevation of the channel bottom, thereby decreasing the capacity of the channel and potentially allowing more frequent overtopping of the channel banks. Considering that the reduction or increase in cover over the pipe may be a long-term consequence of degradation and aggradation, periodic inspections are the most useful asset for monitoring the effects of degradation and aggradation.

- **Bank erosion** refers to the movement of the channel's banks due to erosion. This is hazardous to the pipeline crossing because it decreases the horizontal distance between the channel boundary and the transition between the typical pipeline bury depth and the depth of the pipeline at the channel crossing.

- **Encroachment**, like bank erosion, is a decrease in the horizontal distance between a channel boundary and the pipeline, however, encroachment is unique in that it affects a pipeline that runs parallel to the channel and does not cross it.

- **Avulsion** refers to the sudden establishment of a new channel. This event is hazardous to the pipeline where the new channel may be at a location where the pipeline is not designed with a channel crossing in mind. Avulsion can be temporary in high flows or become permanent because of high sedimentation loads and flows which allow the overtopping of banks and the erosion of new channels.

- **Meander cutoffs** occur when a channel's geometry short circuits through two points along a channel; namely, at meander oxbows. Meander cutoffs become particularly hazardous when the breach is between two points of much differing elevations which may be within a path of a pipeline crossing.

Table 5.6-14 Enbridge-identified geohazards along Enbridge's proposed Line 5 relocation route.
These sites are identified by red box symbols in Figure 2.1-9 and Figure 5.6-11.

ID	Location	Geohazard Risk	Geohazard Description	Mitigation Measures
G0A	Bay City Creek	High	Northern slope has active landslide originating from stream bank undercutting.	Stream bank will be stabilized with riprap, biostabilization, and standard E&S controls. Northern slope stabilized by replacing landslide soil with riprap fill.
G2A	Little Beartrap Creek	Low	Minor stream bank erosion	Stream bank will be stabilized with rootwads, re-grading, and standard E&S controls.
G2B	Beartrap Creek	High	Minor stream bank erosion, possible undercutting.	Stream bank will be stabilized with rootwads, biostabilization, and standard E&S controls.
G5A	Rock Creek	Moderate	Stream bank erosion. Evidence of old shallow slide	Stream bank will be stabilized with biolog, biostabilization, and standard E&S controls. Regrade slope back to 3:1 and installing trench breakers with engineered stabilization.
G5B	Drainage area south of Rock Creek	Low	Water collecting in ditch	Install riprap or similar to prevent channel migration/head cut.
G5C	Unnamed tributary of Deer Creek	Moderate	Stream bank erosion. Pipe alignment passing through eroded meander.	Stream bank will be stabilized with riprap, rootwads, and standard E&S controls.
G7A	Wiberg Road (roadway ends prior to intersect-ing proposed route)	Low	Stream meander migrating west toward alignment. Short side- slope present. Eastside workspace on slope. Travel lane may need to be on westside of pipe.	Pipeline centerline to be field adjusted within permanent easement to increase distance from stream. Pipe designed with additional depth of cover.
G12A	Unnamed tributary of Marengo River	Low	East bank of stream has secondary flood channel and bank erosion between the two channels.	Stream bank will be stabilized with biolog, re-grading, and standard E&S controls to maintain channel (secondary flow channel starting to form). Maintain stream crossing pipe depth to toe of eastern slope.
G14A	Unnamed tributary of Brunsweiler River	Moderate	Eroded toe on West bank. Pipe trench leading to stream has potential to hold water.	Stream bank will be stabilized with biostabilization, re-grading, and standard E&S controls. Existing west bank slope to but regraded to 3:1 slope. Use trench plugs with engineered stabilization.
G14B	Hanninen Road to Highway 13 drainage Area	Low	Potential for pipe trench to hold water. Existing culvert along route shows signs of washout.	Stabilize slope with typical BMPs. Designed with additional depth of cover.
G15A	Unnamed tributary of Trout Brook	Moderate	Minor stream bank erosion, prior slope movement.	Stream bank will be stabilized with rootwads, re-grading, and standard E&S controls. Pipeline

ID	Location	Geohazard Risk	Geohazard Description	Mitigation Measures
				alignment shifted north to avoid cut bank and prior slope movement.
G19A	Unnamed tributary of Silver Creek	High	Mass wasting activities on N and S slopes and bank erosion. Existing slope near 1:1. Off ROW landslides noted up and down the stream.	Stream bank will be stabilized with biolog, biostabilization, and standard E&S controls. North slope to be restored with engineered stabilization. Restore wetland contours.
G20A	Area east of Silver Creek north of County Road C	Low	With the high side slope and rocky terrain requiring blasting, water will likely migrate into the pipe trench and form additional flow paths over the pipeline. Additionally, existing drainage ditch has exposed rock and should be re-established.	Install a high side French drain system to carry water across the ROW. Reconstruct drainage channel where stone is currently exposed. Install trench breakers per typical BMPs.
G21A	Area west of access road 046 north of County Road C	Low	Sheet flowing water on flat area capable of erosion along the ditch line and potential for future pipe exposure	Restore contours and reestablish vegetation.
G22A	North of Krause Creek/South of County Route C	Low	Pipeline parallels stream channel creating pipeline exposure potential	Stabilize streambank with biostabilization, and/or other typical BMPs. Restore wetland contours.
G22B	Area south of Krause Creek with side slope	High	n/a	Mitigated with HDD
G23A	Golf Course Road – east of crossing – pipeline in stream	Moderate	Environmental shows a wetland along pipe centerline. During the geohazard investigation, there was flowing water along the centerline of the pipeline capable of eroding the pipe ditch.	Stabilize wetland with biostabilization and/or other typical BMPs. Restore wetland contours.
G23B	East of Golf Course Road and west of Highway 13	Moderate	Prior alignment was parallel with intermittent stream.	Pipeline was re-routed to minimize environmental features.
G23C	West of Highway 13 – far slope	Moderate	Likelihood of underlying rock shelves on slope with potential for slope to slide after construction.	Slope to be restored with engineered stabilization.
G23D	West of Highway 13 – near slope	Moderate	The permanent ROW is mostly all contained within a bedrock feature. Need to set expectations of how much rock the Contractor is to blast and	Route selected/designed to minimize blasting and disturbance. Slope stabilization to be completed using typical BMPs.

ID	Location	Geohazard Risk	Geohazard Description	Mitigation Measures
			remove. May not be feasible or necessary to remove all the rock within the ROW.	
G24A	East of N. Butler Road	Low	Evidence of old shallow slides on existing 3:1 slope that may reactivate during construction	Slope to be restored with engineered stabilization.
G25A	East of E. Butler Road	High	Existing shallow creep slide with visible toe bulge running parallel to pipeline	Slope to be restored with engineered stabilization. Recontour slope to stable angle.
G25B	East Butler Road to bore site 41E – Area 2	Moderate	Evidence of old shallow creep slides along slope.	Pipeline centerline to be field adjusted within permanent easement. Slope stabilization to be completed using typical BMPs.
G28A	Unnamed tributary of Gehrman Creek	Low	The stream evaluated during the site visit is not noted as the primary flow path on the environmental drawings. The stream banks on this flow channel may be susceptible to slumping post construction	Stream bank will be stabilized with biolog, re-grading, and standard E&S controls. Lay stream bank slope back at 3:1.
G29A	Camp Four Creek	Low	Area east of stream crossing is extremely wet. Geohazard noted is related to the need for buoyancy control	Stream bank will be stabilized with standard E&S controls. Buoyancy controls will be required over a large area.
G31A	Feldcher Creek	Low	Laminar flow across a large area with no distinct channel due to a newer beaver dam across the ROW.	Stream bank will be stabilized with standard E&S controls. Reestablish flow channel within impounded area.
G39A	Beaver dam south of Steinmetz Road	Moderate	Geohazards related to existing beaver dam and bank slopes	Mitigated with adjustment of pipeline alignment

Source: Enbridge. Note: ID = ‘G’ + mile post + ‘A’ or ‘B’ depending on the spatial sequence along the proposed relocation route.

Table 5.6-15 Enbridge-identified hydrotechnical geohazards at stream crossings along Enbridge's proposed Line 5 relocation route.
These sites are identified by blue triangle symbols in Figure 2.1-9 and Figure 5.6-11.

ID[a]	Stream	Likelihood of hydrotechnical geohazard						Stream crossing		
		Scour	Aggradation/ degradation	Bank erosion	Encroach-ment	Avulsion	Meander cutoff	Method[b]	HDD/DB[c] Length	HDD/DB[d] Depth
H0A	Bay City Creek	possible	possible	likely	unlikely	Possible	unlikely	DC	-	-
H2A	Little Beartrap Creek	possible	possible	possible	unlikely	possible	unlikely	OC/DC	-	-
H2B	Beartrap Creek	possible	possible	likely	possible	possible	possible	OC/DC	-	-
H4A	White River	possible	possible	likely	likely	likely	likely	HDD	4,439 ft.	60 ft.
H5A	Rock Creek	possible	possible	likely	unlikely	unlikely	unlikely	DC	-	-
H6A	Deer Creek	likely	likely	likely	likely	likely	likely	DB	1,965 ft.	20 ft.
H11A	Marengo River	possible	likely	likely	likely	likely	likely	HDD	1,777 ft.	40 ft.
H14A	Brunsweiler River	possible	possible	likely	possible	likely	likely	HDD	2,790 ft.	60 ft.
H14B	Unnamed tribary of Brunsweiler River	likely	likely	likely	possible	possible	possible	OC		
H15A	Unnamed tributary of Trout Brook	possible	likely	likely	likely	likely	likely	OC/DC		
H16A	Trout Brook	possible	possible	likely	unlikely	likely	unlikely	HDD	2,337 ft.	71 ft.
H17A	Billy Creek	possible	possible	likely	likely	possible	likely	HDD	1,775 ft.	60 ft.
H19A	Silver Creek	possible	possible	likely	likely	likely	likely	HDD	3,435 ft.	60 ft.
H19B	Unnamed tributary of Silver Creek	possible	likely	likely	unlikely	likely	possible	OC/DC	-	-
H22A	Krause Creek	possible	unlikely	possible	unlikely	unlikely	unlikely	HDD	2,076 ft.	58 ft.
H24A	Bad River	likely	likely	likely	likely	likely	likely	HDD	1,777 ft.	48 ft.
H28A	Unnamed trib. of Gehrman Creek	possible	possible	possible	unlikely	possible	unlikely	DC	-	-

ID[a]	Stream	Likelihood of hydrotechnical geohazard						Stream crossing		
		Scour	Aggradation/ degradation	Bank erosion	Encroach-ment	Avulsion	Meander cutoff	Method[b]	HDD/DB[c] Length	HDD/DB[d] Depth
H29A	Camp Four Creek	possible	possible	unlikely	unlikely	unlikely	unlikely	OC/DC	-	-
H31A	Feldcher Creek	unlikely	possible	unlikely	unlikely	possible	unlikely	DC	-	-
H34A	Tyler Forks	Likely	likely	likely	likely	likely	likely	HDD	1,841 ft.	60 ft.
H37A	Potato River	Likely	possible	likely	likely	likely	likely	HDD	3,472 ft.	60 ft.
H39A	Vaughn Creek	likely	likely	likely	likely	likely	likely	HDD	2,055 ft.	60 ft.

Source: Enbridge.

Notes:

[a] ID = ‘G’ + mile post + ‘A’ or ‘B’ depending on the spatial sequence along the proposed relocation route.

[b] Method of stream crossing (OC = open trench-wet, DC = open trench dry, HDD = Horizontal Directional Drill, DB = Direct Bore).

[c] Length (feet) of the Horizontal Directional Drill (HDD) of Direct Bore (DB).

[d] Depth (feet below the assumed stream bed) of the HDD or DB.

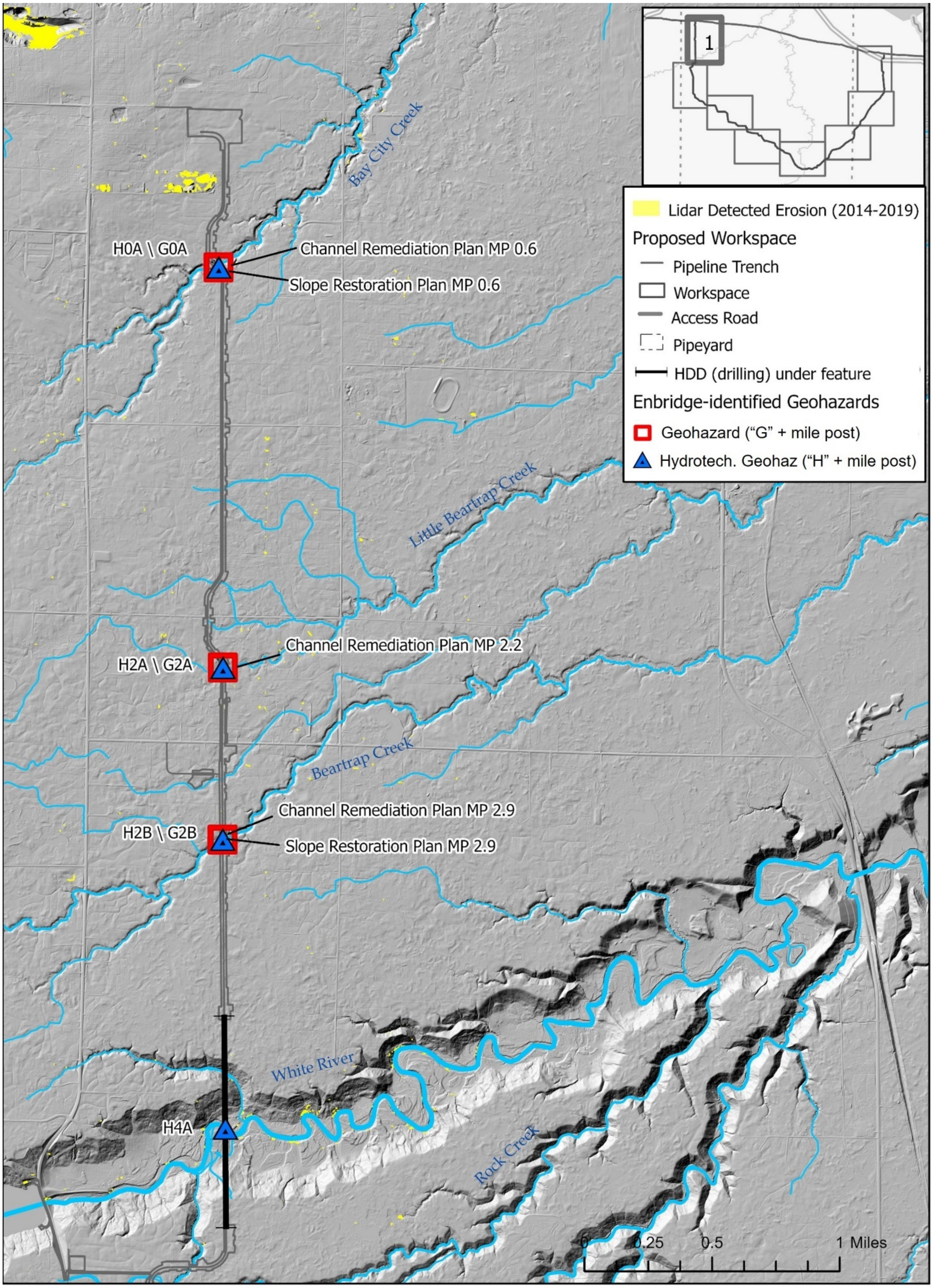


Figure 5.6-11 Potential geohazards along Enbridge's proposed Line 5 relocation route (map 1 of 8).

Note: Enbridge's slope restoration and channel remediation plans are in Appendix E.

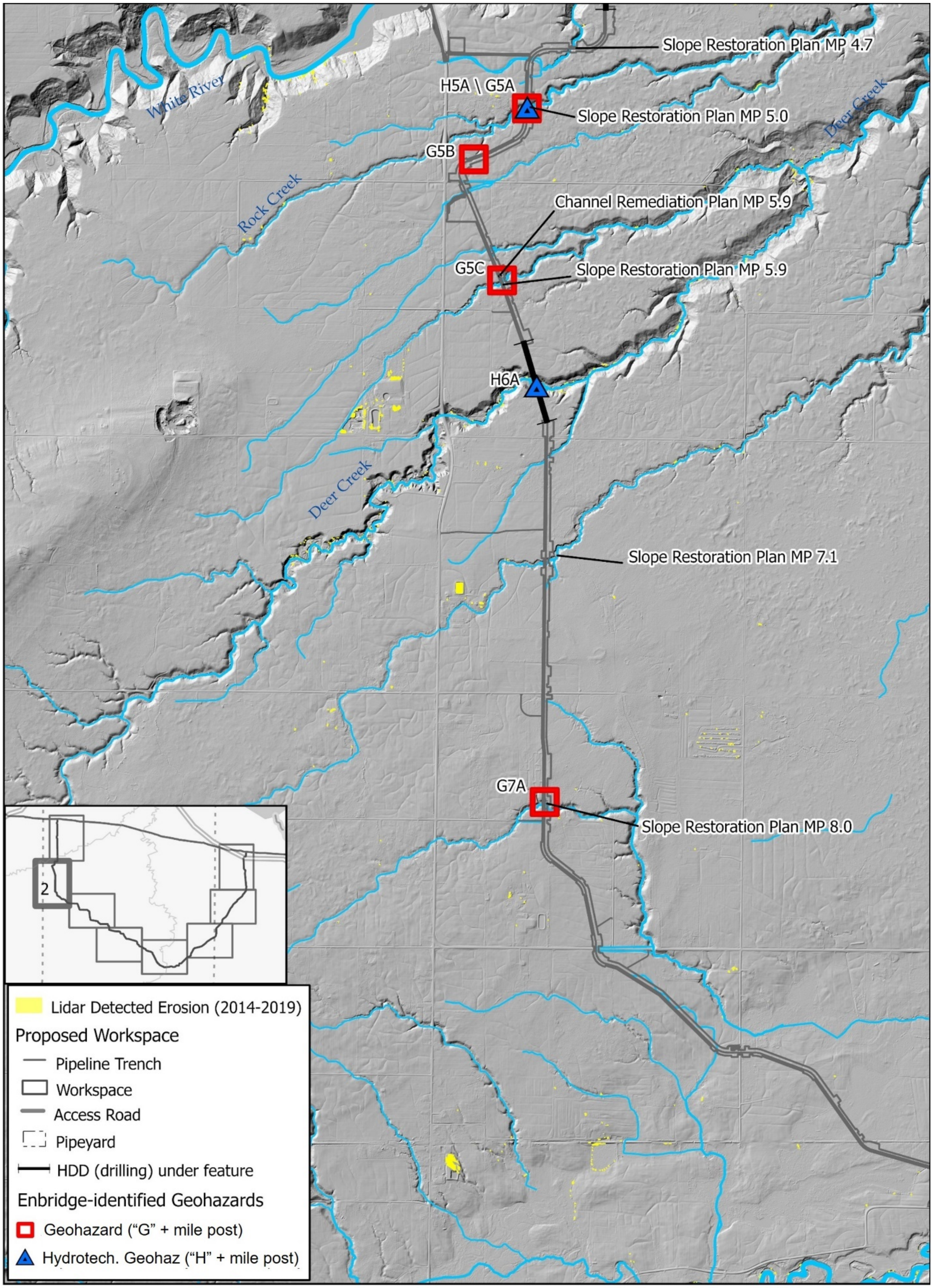


Figure 5.6-11 Potential geohazards along Enbridge's proposed Line 5 relocation route (map 2 of 8).

Note: Enbridge's slope restoration and channel remediation plans are in Appendix E.

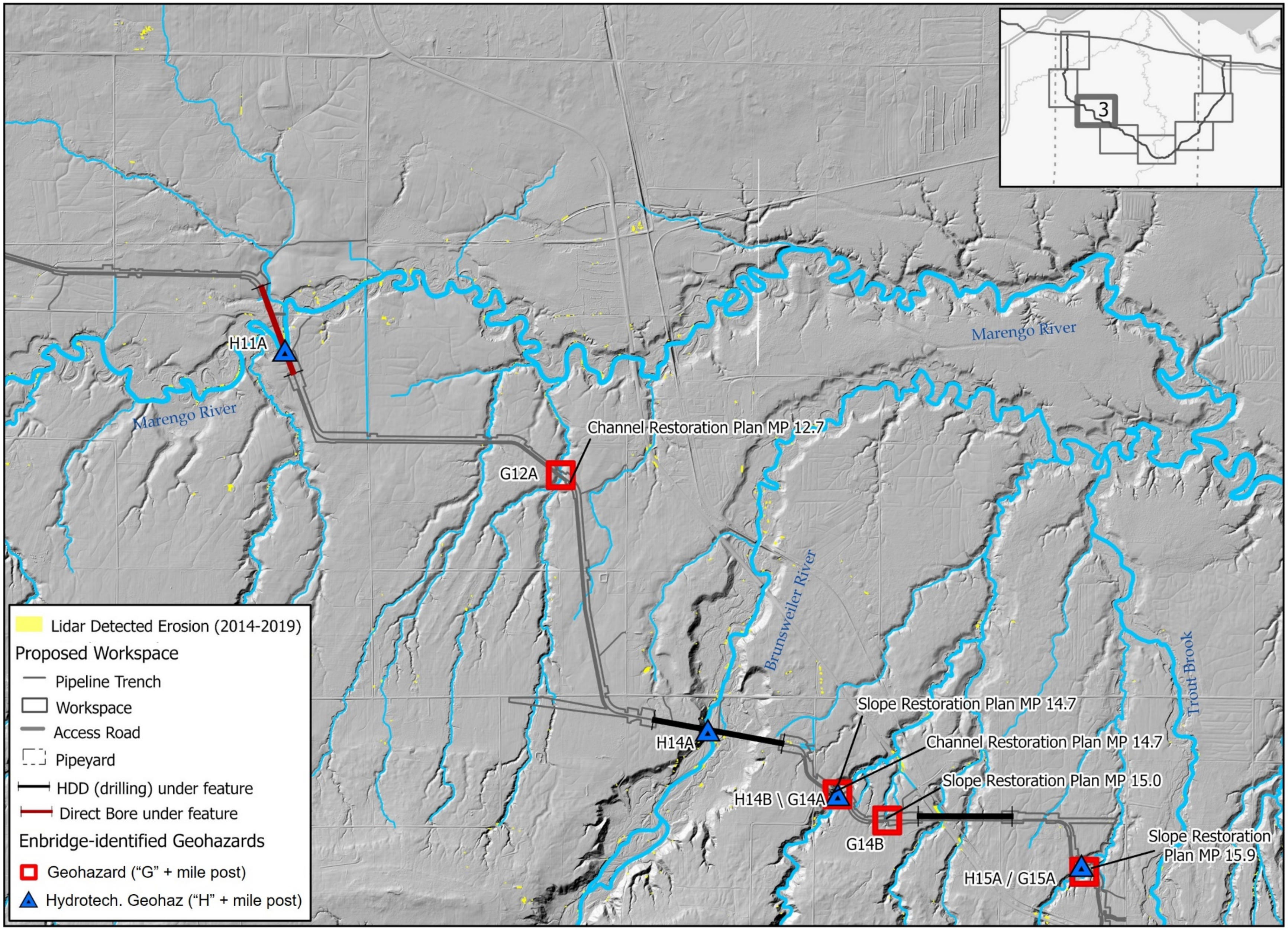


Figure 5.6-11 Potential geohazards along Enbridge's proposed Line 5 relocation route (map 3 of 8).
Note: Enbridge's slope restoration and channel remediation plans are in Appendix E.

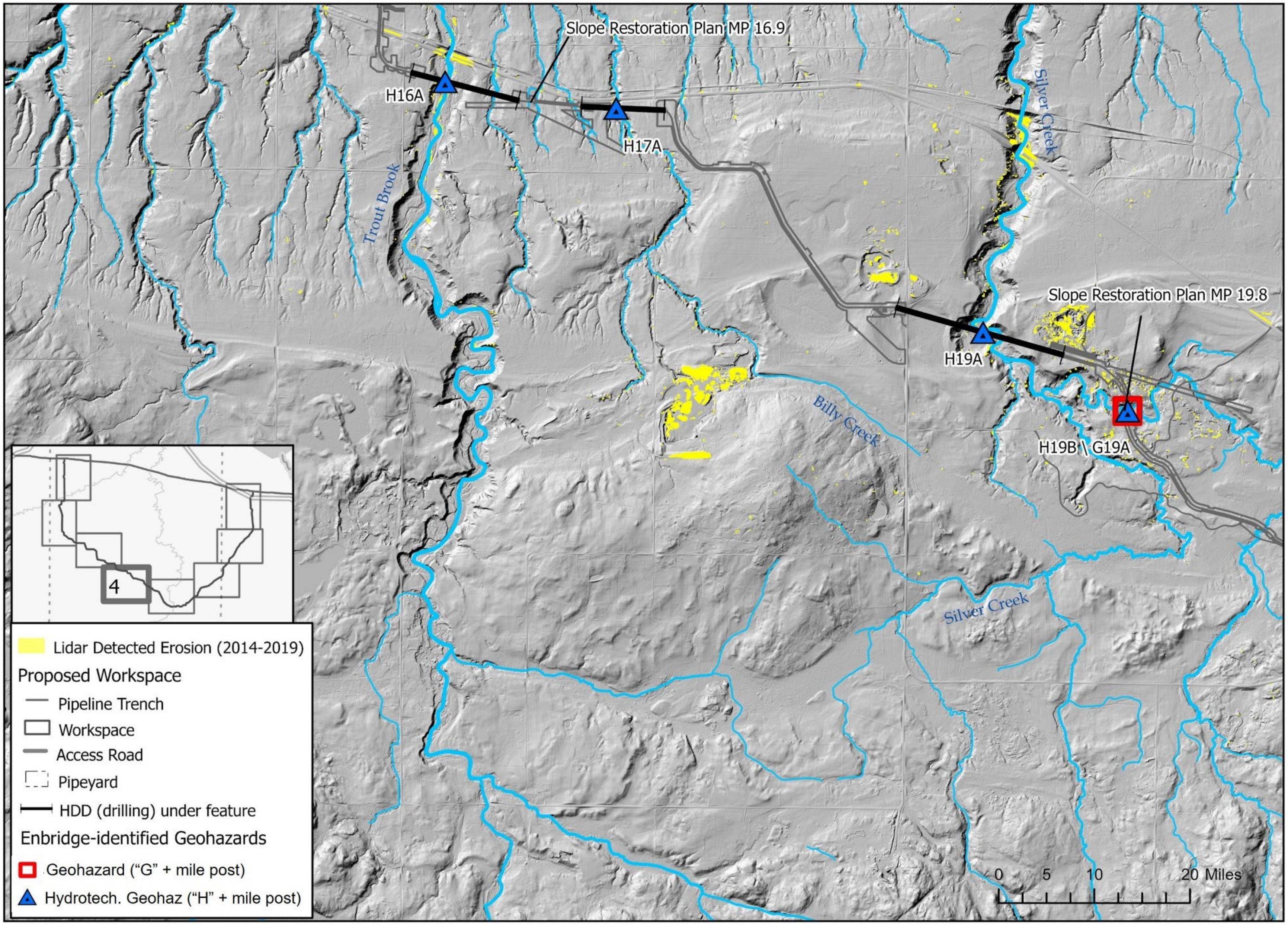


Figure 5.6-11 Potential geohazards along Enbridge's proposed Line 5 relocation route (map 4 of 8).
Enbridge's slope restoration and channel remediation plans are in Appendix E.

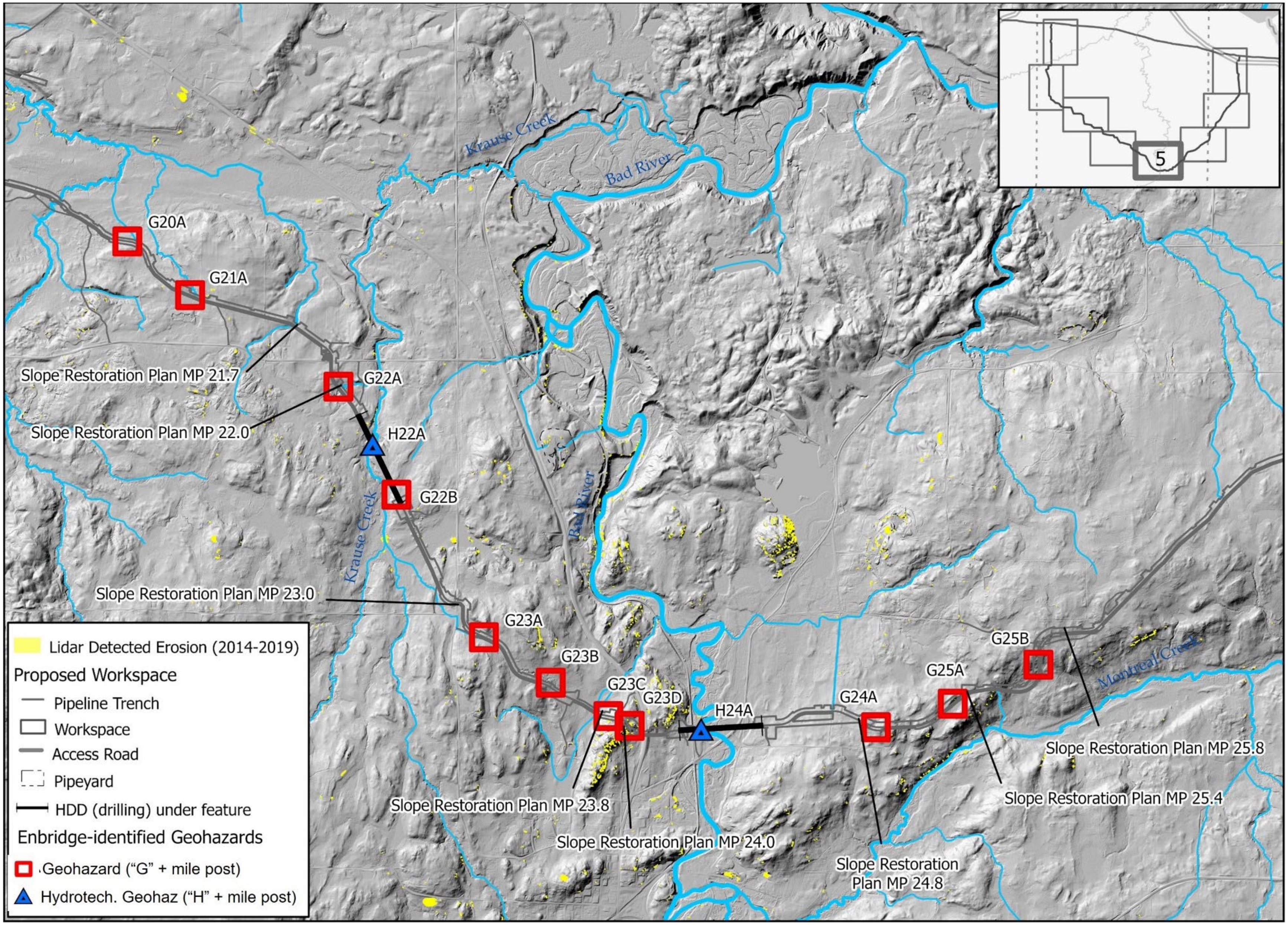


Figure 5.6-11 Potential geohazards along Enbridge's proposed Line 5 relocation route (map 5 of 8).
Enbridge's slope restoration and channel remediation plans are in Appendix E.

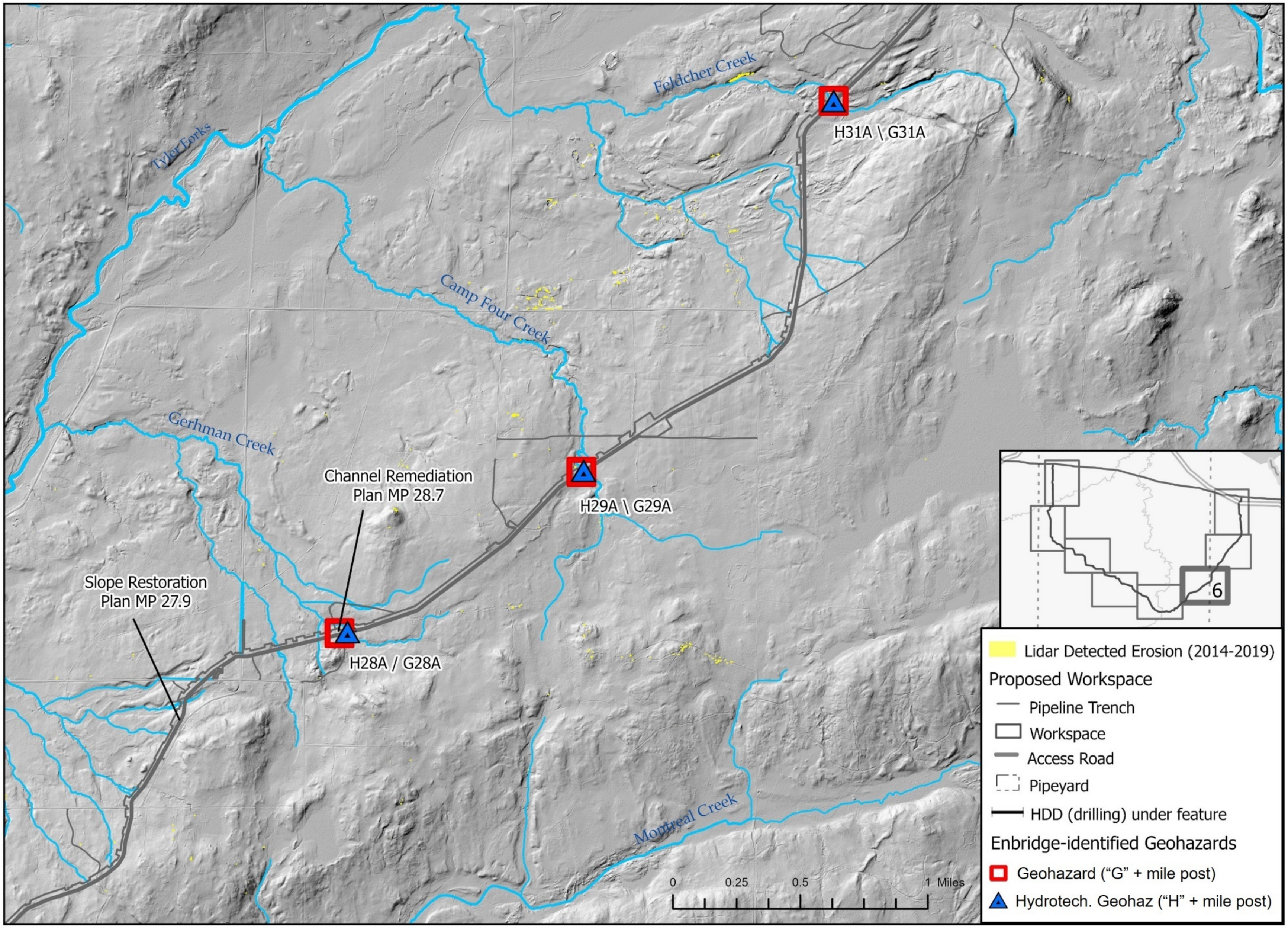


Figure 5.6-11 Potential geohazards along Enbridge’s proposed Line 5 relocation route (map 6 of 8).
Note: Enbridge’s slope restoration and channel remediation plans are in Appendix E.

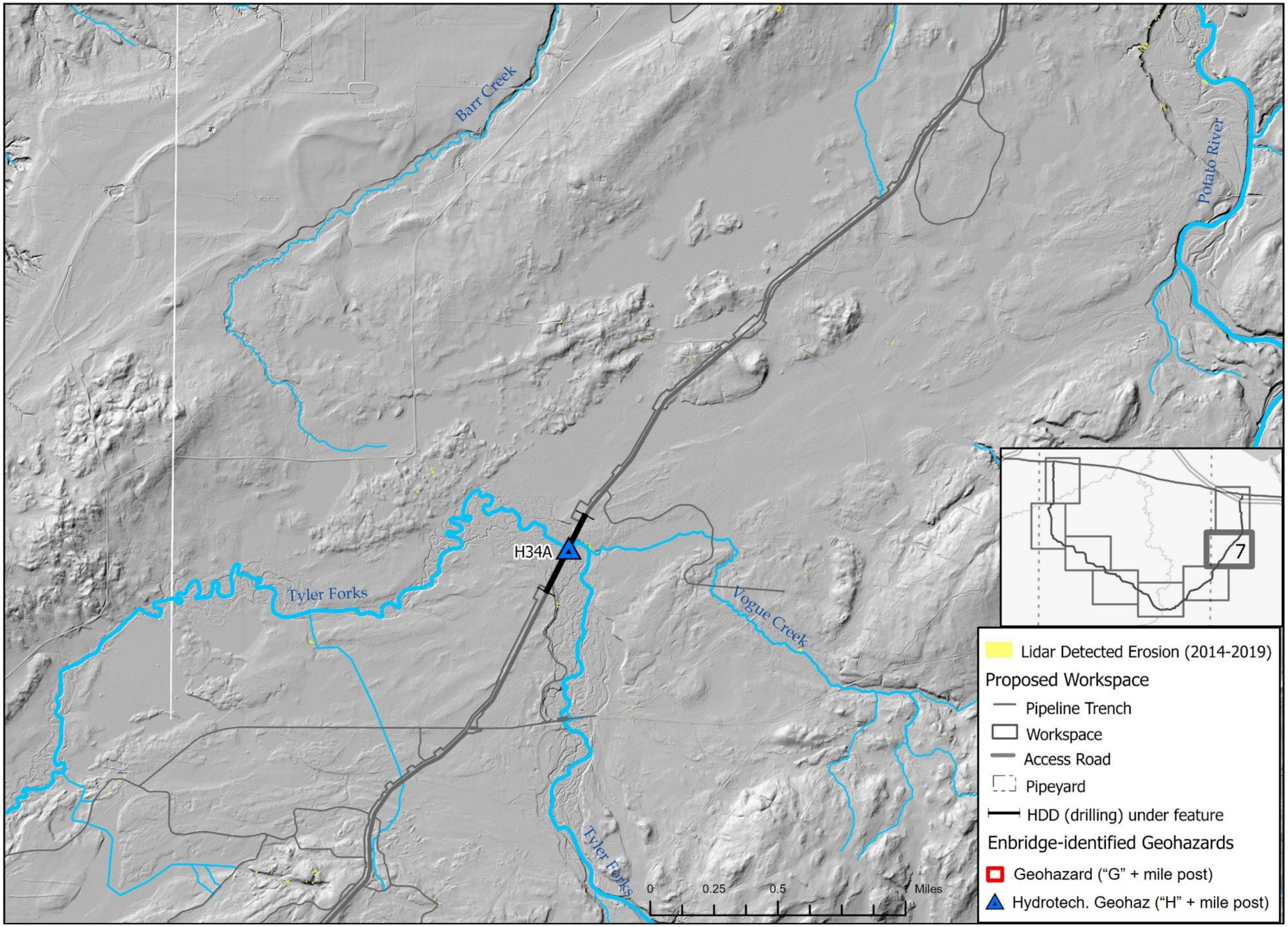


Figure 5.6-11 Potential geohazards along Enbridge's proposed Line 5 relocation route (map 7 of 8).
Note: Enbridge's slope restoration and channel remediation plans are in Appendix E.

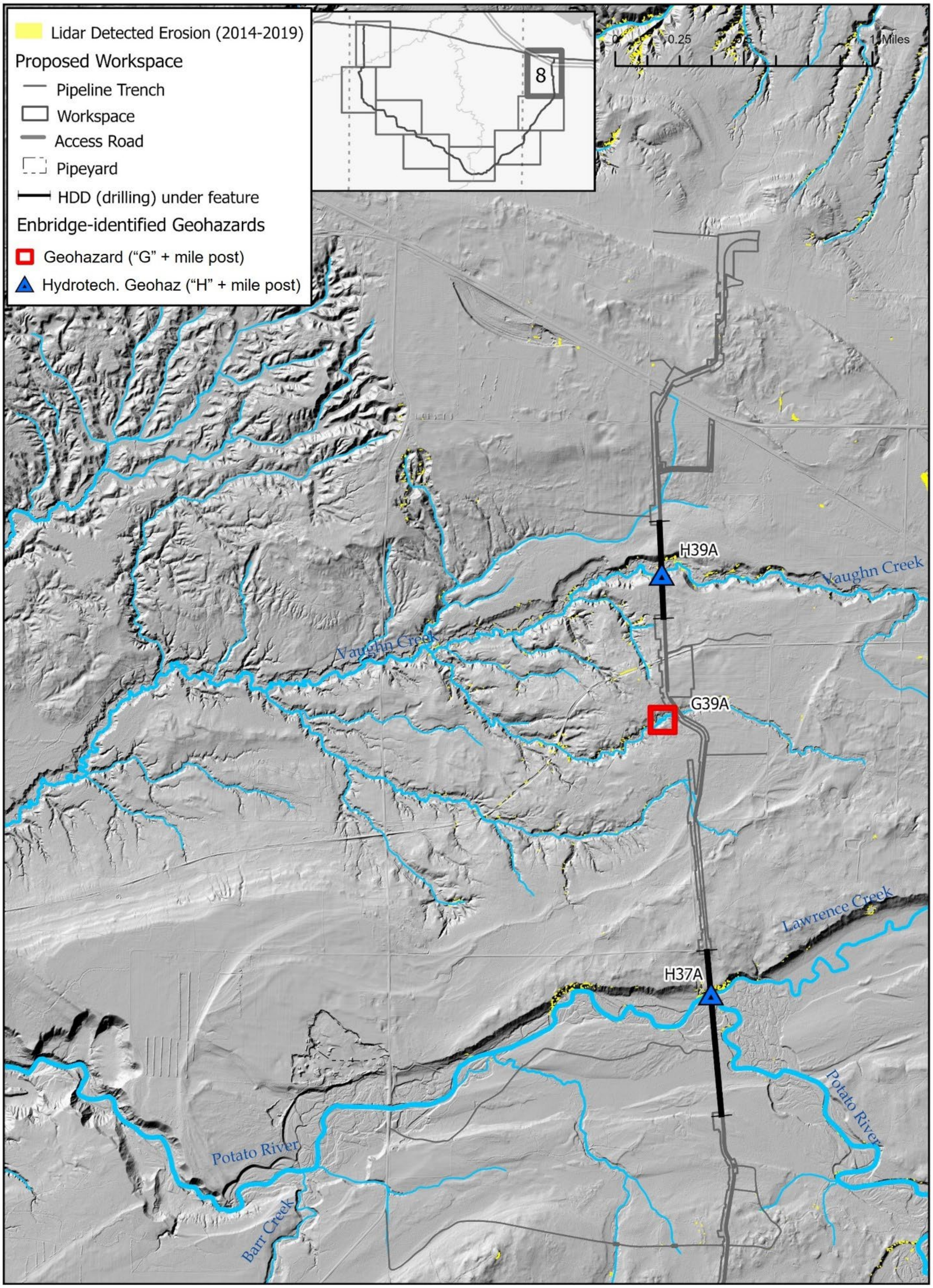


Figure 5.6-11 Potential geohazards along Enbridge's proposed Line 5 relocation route (map 8 of 8).
Note: Enbridge's slope restoration and channel remediation plans are in Appendix E.

Figure 2.1-9 shows an overview of potential geohazard areas throughout the proposed ROW; Figure 5.6-11 provides detailed views of geohazard areas along the proposed ROW. Enbridge evaluated each proposed waterway crossing for the possibility of hydrotechnical geohazards that included scour, aggregation/degradation, bank erosion, encroachment, avulsion, and meander cutoff. The results of the evaluations are presented in Table 5.6-15. According to Enbridge (2021c), the geohazard assessments considered:

- Avoidance of side slopes to cross contour lines perpendicular with the pipeline.
- Avoidance of paralleling meandering watercourses.
- Drainage control including trench plugs, riprap ditches, pipe trench drains, longitudinal drains, transverse drains.
- Surface water controls including waterbars and diversion ditches.
- Depth of cover.
- Backfill and compaction requirements.
- Soil amendments.
- Mechanically stabilized slope options.
- Slope facings.

The unique geohazards of pipeline exposure at waterway crossings along the proposed route were evaluated by Enbridge (2021c) by assessment of:

- Visual observations of proposed channel crossings.
- Topographic measurement and physical sampling of channels.
- Comparison of present and historic aerial imagery.
- Analysis of the channel crossing watersheds.
- Determination of recurrence interval peak flood flows.
- Determination of threshold channels.
- Determination of channel properties related to geometry-flow dynamics specific to various recurrence intervals.
- Determination of scour depths and estimation of the likelihood of meandering based on various recurrence intervals and historic aerial imagery.

Areas of steep slopes within Enbridge's proposed Line 5 relocation route are summarized in Table 5.6-1 and are shown in Figure 5.6-11. Based on topographic data from 2014 and 2019, Enbridge mapped areas of erosion. The DNR also mapped soils prone to erosion (Figure 5.6-4).

Clearing vegetation and grading steep slopes can accelerate erosion. Natural processes like large rainfall events also accelerate erosion on steep slopes, increasing the risk of pipeline exposure. Additionally, losses in vegetation and grade changes in the upland area adjacent to the crest of steep slopes may increase the potential for slope failure through increase piping and rill development. Groundwater seepage may also cause greater erosion risk; perched aquifers can add weight to layers of soil in steep slopes, which make them more prone to slippage and large-scale failure (Chase et al., 2012). Vegetation (especially trees) usually prevents this by increasing evapotranspiration (i.e. removing shallow groundwater) and reinforcing slopes against weakening with root systems (Chase et al., 2012). Clearing the tops of slopes can accelerate steep slope/bluff retreat (Chase et al., 2012).

Figure 5.6-20 illustrates a few of the failure modes from groundwater seepage from bluffs along the Great Lakes, which are applicable to steep slopes in the project area along river valleys and ravines. Natural extreme rainfall events can accelerate erosion and bank failure, leading to exposure of buried pipelines. As discussed in Section 6.2.2.6, pipeline exposure can increase the risk of pipe failure and spills.

Figure 5.6-12 shows an example of pipeline exposure in wetlands, which increases the risk of pipeline damage, especially exterior coating damage.

Figure 5.6-12 Enbridge Line 6A pipeline exposure in a wetland, Rusk County.
Photo: DNR

Figure 5.6-13 and Figure 5.6-14 show pipeline exposures in streams from other projects; these exposures are examples of what geohazards look like when they occur. Figure 5.6-13 shows a 34-inch pipe (Enbridge's Line 6A which traverses the state of Wisconsin north to south). The pipeline exposure occurred in a small stream and was likely the result of downcutting. Corrosion is clearly accelerated where water is flowing over the pipe, which creates greater risk of a breach and spill. In this case the pipeline is also a barrier to traversal of the stream despite it having flowing water.

Figure 5.6-14 shows a Northern Natural Gas pipeline with exposure in a sandy-bottomed stream. There is clear damage to the pipeline's coating in this picture, and gravel below the exposure point suggests increased abrasion due to the exposure. This photograph also depicts the degree of streambank incision.

Figure 5.6-13 Enbridge Line 6A pipeline exposure at stream crossing June 2021.

Figure 5.6-14 Northern Natural Gas Black River Falls pipeline exposure.

Enbridge developed a site-specific mitigation plan for each geohazard, which typically involves some mixture of streambank stabilization and grading of steep slopes, with the intention to minimize the potential for a sudden exposure (Appendix F). A subset of geohazards is also due to beaver inundation; these are areas where the pipeline may become exposed by floating when its trench is fully inundated. Enbridge has identified these areas for removal of beavers and installation of buoyancy control measures on the pipeline before final burial (Appendix Z).

Long-term stability of geohazard locations depends on use of appropriate erosion control during construction and the quality and success of post-construction restoration. Actions taken during construction and restoration can either increase or decrease the probability of additional change, as discussed in Section 5.6.5. Section 2.8 describes the various construction and restoration practices proposed for use on this project. Should additional geohazards be encountered during a construction phase, the hazard would need to be evaluated and appropriate mitigative measures designed and implemented. According to Enbridge, the company could decide to install monitoring devices such as strain gauges, inclinometers, GPS pins, or similar devices, but Enbridge has not committed to any of these technologies at this time.

5.6.6.1 Example Geohazard along Enbridge's Proposed Line 5 Relocation Route

The geohazard at MP 25.2 is an example of a non-stream crossing slope which poses a risk to water resources neighboring the pipeline. The area has a steep slope off-camber to the pipeline alignment, such that slope failure or subsidence would expose the pipeline (Figure 5.6-15). The temporary workspace boundary is directly adjacent (between three and 15 feet) to a forested wetland with high integrity (Figure 5.6-16). Failure of the associated slope could cause an increase in sediment supply to the wetland, and clearing operations not carefully constrained to the temporary workspace would affect the wetland. The area is also a proposed blasting zone, which could lead to additional concern about destabilization of underlying substrate or impervious confining layers which could be maintaining the wetland's integrity.

Furthermore, an exposure and subsequent spill would be high consequence for the adjacent wetland, as would any pinhole leaks due to the pipeline's situation on the slope. Additional maintenance would be risky because of the chance that re-excavation of the pipe would further destabilize the slope and lead to further sediment inputs across the workspace boundary and into the adjacent wetland.

Figure 5.6-15 Geohazard slope at MP 25.2, October 2023.
Photo: Andrew J. Brown, DNR

Figure 5.6-16 Wetland adjoining the geohazard at MP 25.2, October 2023.
Photo: Andrew J. Brown, DNR

While Enbridge has identified the MP 25.2 location as a geohazard, it has not provided a site-specific slope stabilization plan describing actions to limit the risk of slope loss and exposure prevention. The wetland adjacent to this site was not surveyed for functional values or noted on Enbridge's construction sheet because it does not intersect the project ROW.

5.6.7 Long-term Risks & Effects of Fluvial Erosion

Enbridge identified the geohazards listed in Section 5.6.6 in relation to its proposed Line 5 pipeline relocation and the risk of exposure (loss of soil cover) at specific locations. Longer spans of the proposed relocation route, as well as RA-01 and RA-02, traverse parts of the Lake Superior Clay Plain that are also vulnerable to long-term geomorphic (landform) change caused by the movement of water and sediment during rainfall and snowmelt. Collectively referred to as "fluvial erosion," these geomorphic changes include valley landslides and slumping, gully formation, headwater incision, knickpoint erosion, channel movement and widening, streambed scour, and channel degradation.

Portions of the Lake Superior Clay Plain are particularly prone to fluvial erosion (Wheeler and Bodette, 2011). This was evidenced by widespread, rapid, and in some cases catastrophic fluvial erosion events–including numerous road and bridge 'washouts'–that occurred in the area during the historic floods of July 2016 (GLIFWC Climate Change Team, 2023). Long-term increases in the frequency and intensity of storm events in northern Wisconsin, both observed and projected (Sections 7.3 and 7.4), will continue to increase the risk of fluvial erosion in the area. The same is true of past and future changes in land cover and soil conditions, including changes associated with linear infrastructure such as roads, and to a lesser degree pipelines. These changes include:

- Loss of forest cover.
- Increased soil compaction and imperviousness.
- Altered microtopography and drainage patterns.
- Altered streambanks and streambeds.
- Loss and conversion of wetlands, including ditching.

In recent years, researchers from the USGS and collaborating agencies have evaluated fluvial erosion hazards associated with gullying, streamside landslides, and the loss of wetland storage from hydrologic changes in the headwaters in the Marengo River watershed, a sub-watershed of the Bad River watershed (F. A. Fitzpatrick et al., 2023). A combination of field-based, rapid geomorphic assessments and GIS analyses of the stream network resulted in a map of stream segments' vulnerability to stream- and valley-side landslides, headwater incision, coarse sediment deposition and channel change, and hydrologic alteration (associated with ditching). Figure 5.6-17 shows an overall vulnerability to geomorphic change (ranging from "minimal" to "likely") across the Marengo River watershed, as composited from the four individual fluvial erosion hazard vulnerabilities. As illustrated, most of the stream segments where one or more type of fluvial erosion is considered "likely" are north of the Lake Superior paleo-shoreline (the upper boundary of the Lake Superior Clay Plain) and in nearby transitional areas.

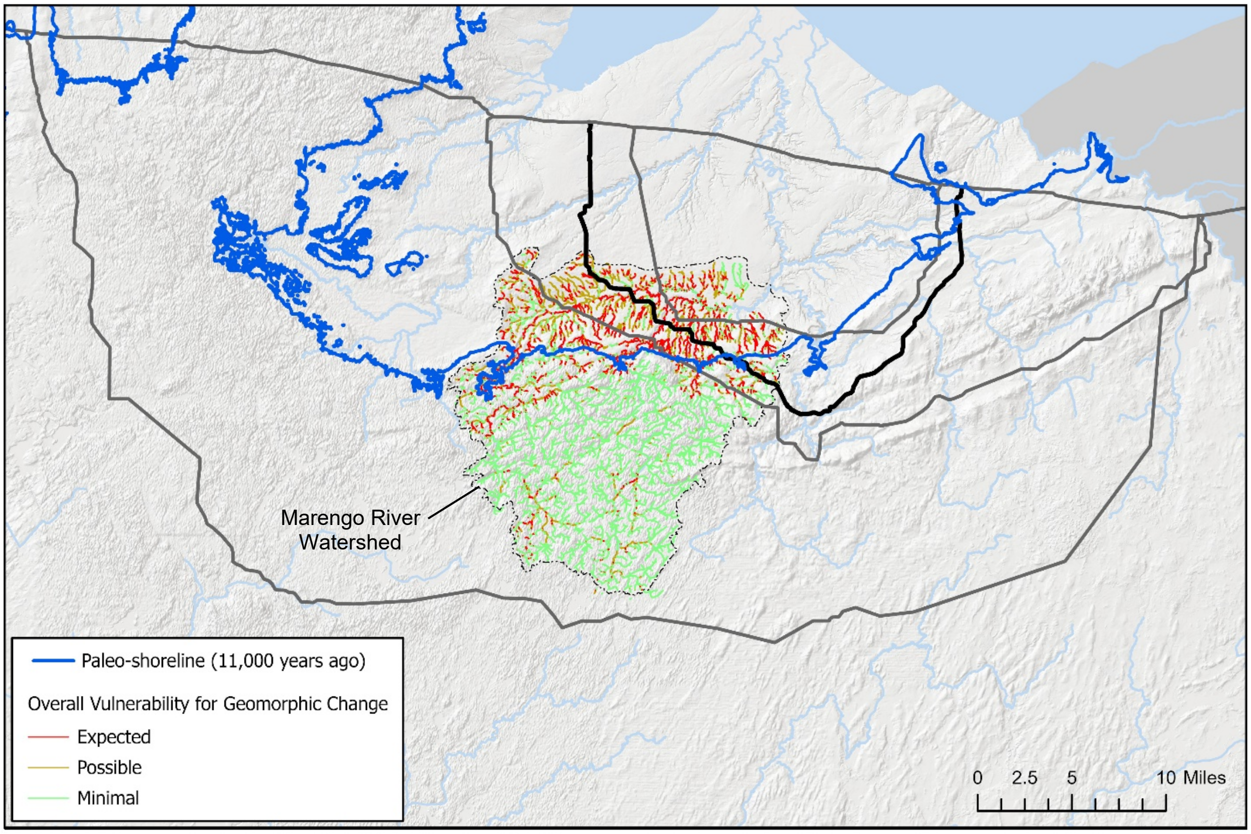


Figure 5.6-17 Overall vulnerability for geomorphic change in the Marengo River watershed.
Source: USGS, DNR

In collaboration with USGS, the DNR queried the SSURGO soil database to identify areas of heightened fluvial erosion risk across the entirety of Lake Superior Clay Plain, defined here as the area between the current Lake Superior shoreline to the north and the paleo-shoreline (an elevation of approximately 1,070 feet above sea level) to the south. The areas of heightened vulnerability include river valleys and ravines, soils with steep slope gradients, and areas where soils are vertically stratified into layers of clay, sand, and other surficial deposits. To map these areas, the DNR queried all SSURGO map units in Ashland, Bayfield, and Iron counties, at or below an elevation 1,070 feet, to identify all units that have *any* of the following properties:

- Slope Gradient (averaged across the map unit) > 14 percent
- *or* Local Phase (narrative description) includes “ravine”
- *or* Parent Material (narrative description) includes “alluvium” (i.e., river valley deposits of clay, silt, sand, and gravel)
- *or* Parent Material (narrative description) indicates vertical stratification of clay, sand, and other deposits (e.g., “clayey till over underlying stratified loamy and sandy lacustrine deposits”)

Figure 5.6-18shows the results of this query, representing soils that are vulnerable to fluvial erosion. Table 5.6-16 compares the number of acres of soils vulnerable to fluvial erosion within the construction ROWs of Enbridge’s proposed Line 5 relocation route and route alternatives.

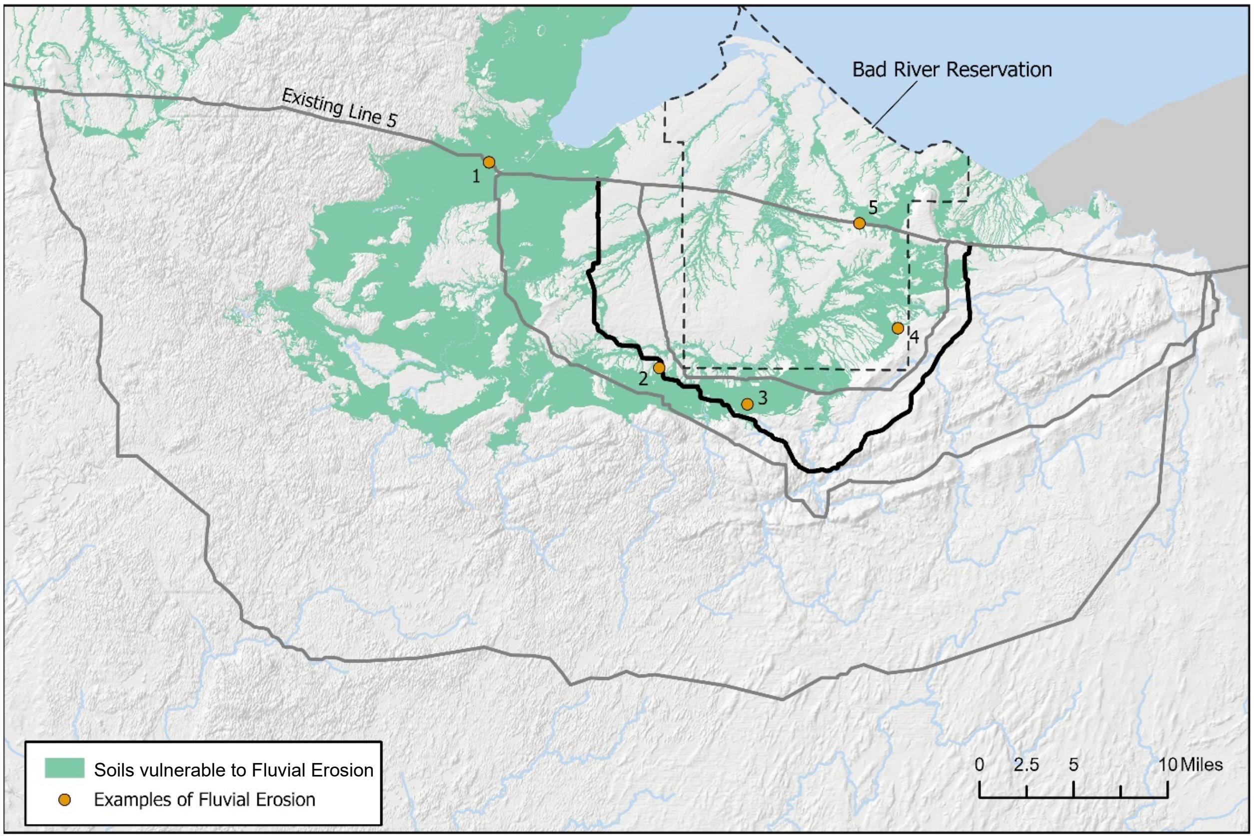


Figure 5.6-18 Soils vulnerable to fluvial erosion, and the location of select examples, along Enbridge's proposed Line 5 relocation route and route alternatives.
Examples of fluvial erosion (1-5) are listed below.

Figure 5.6-18 shows the locations of five examples of fluvial erosion. These are listed below with the sections where each is described in more detail.

1. Slope 20 (Section 5.6.7.6)
2. Long Road culvert knickpoint (Section 5.6.7.3)
3. Highawy13 at Silver Creek (Section 5.6.7.1)
4. Potato River Road gully (Section 5.6.7.2)
5. Slope 18 (Section 5.6.7.2)

Table 5.6-16 Acres of soils vulnerable to fluvial erosion within the construction ROWs of Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed	RA-01	RA-02	RA-03
Length of pipeline	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Acres of vulnerable soils within the construction ROW[1]	123 acres	194 acres	207 acres	6 acres

Data Source: NRCS SSURGO.

[1] Acreages do not include HDD sites associated with the proposed pipeline relocation route. No temporary workspace included in the route alternatives.

5.6.7.1 Valley Landslides & Slumping

Landslides along river valleys are possible in landscapes with steep slopes. Along Great Lakes tributaries, a large proportion of steep slopes are in the vicinity of river valleys, along steep and confined stream channels, or in headwater ravines. The transition zone and Lake Superior Clay Plain provide the combination of steep slopes in the landscape and along geologically young river valleys. Landslides and slumping along river valleys occur because of large, destabilizing rainstorms and channel downcutting. Large rainstorms weaken the slope structure from the top of the channel. Downcutting weakens the toe at the bottom of the slope and causes the slope to become steeper and less stable. Streambanks can also be destabilized from changes in hydrology, runoff, vegetation, and slope disturbance. Soil characteristics and structural stability are also important determinants of the location and timing of landslides near streams. The project area is especially prone to landslides, particularly in the transition zone, because of continuous and discontinuous layers of sand of varying thickness below a clayey surficial layer. An example of catastrophic valley landslide occurred during the historic flood of July 2016 at the Highway 13 bridge over Silver Creek (Site #3 in Figure 5.6-18). Valley landslides and slumping upstream of the bridge and highway contributed to their being ‘washed-out’ during the extreme flood (Figure 5.6-19).

Figure 5.6-19 Valley Landslide and Washout of Highway 13 at Silver Creek, July 2016.
Photo: Ashland County Land and Water Conservation Department

Slumping occurs when a mass of soil moves a short distance down a slope. Slumping frequently occurs when the base of a slope is removed by erosion or other means (Figure 5.6-20). Slumping occurs in rivers, streams, valleys, and ravines when large rainfall events create flooding conditions. Flooding in these locations generates high water velocities which undermine the base of surrounding slopes. Once the base of a slope is eroded, uphill banks fall into the bottom of the ravine, replacing the lost material (Figure 5.6-21). The process continues any time flow velocities are great enough to cause erosion to the base of the slope. Slumping is more common in the transition zone due to the prevalence of high slopes and is generally common in the project area due to the highly variable and sudden changes in streamflow which occur in response to precipitation events.

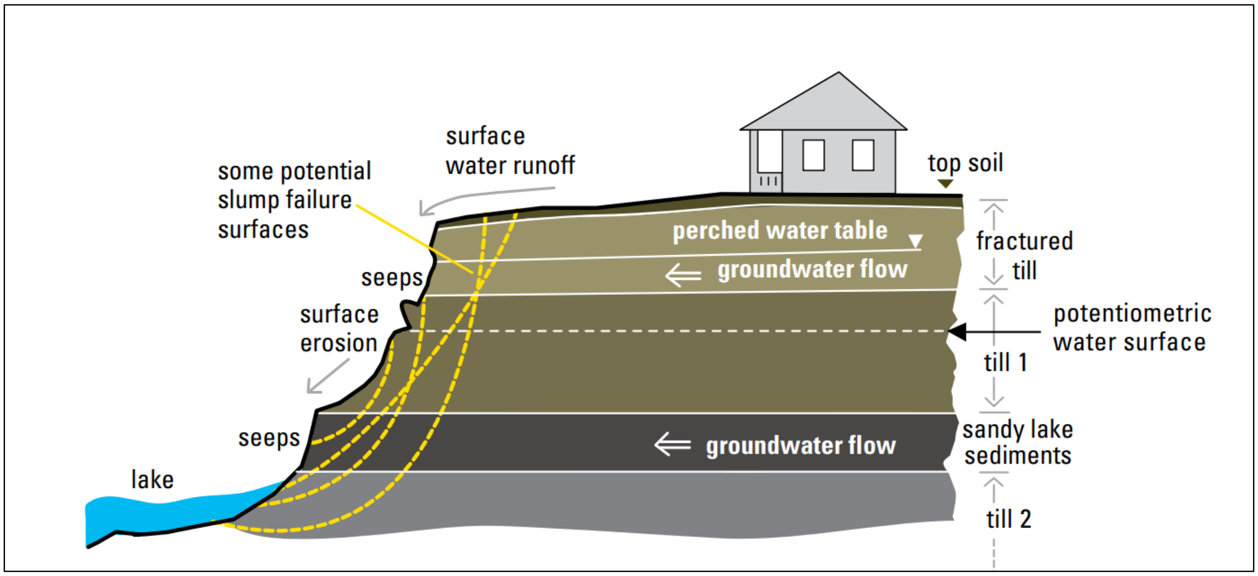


Figure 5.6-20 Illustration of potential bluff failure due to shallow and deep groundwater flow through exposed layers of soil.
Source: Sea Grant, 2012

Figure 5.6-21 Mass wasting along the Brunsweiler River.
Photo: Kyle Magyera, Wisconsin Wetland Association

Areas where the pipeline crosses a stream or ravine are at higher risk of slumping. The destabilized area would be less resistant to erosion during rain events and would be at elevated risk of slumping until the site is fully revegetated and stabilized. Final stabilization typically takes two months but could take between 12 to 24 months if site conditions are unfavorable. A site-specific erosion and sediment control plan (Appendix E) approved by the DNR as part of coverage under the Construction Site General Permit would require Enbridge to perform weekly inspections from construction to completion of restoration, and additional inspections after every rainfall event of 0.5 inches or greater. Slumping is typically a gradual, continuous process which has reduced acute effects on aquatic habitats and species but does contribute to sediment load in the watercourse and could contribute to sedimentation depending on the particle composition of the slope in question.

Landslides associated with ravines and valley side failures can be sudden and can cause acute changes to channel geomorphology and can be a large source of disturbance for aquatic habitats. The quick large loading of sediment, trees, and brush in what is usually a river bend can cause a temporary dam that backs up water and can reroute a stream which is not powerful enough to erode the newly imported sediment bank, causing channel movement in the medium- to long-term until additional flooding clears the blockage. Channel movement affects the presence of aquatic habitat in the region as well by physically covering former habitat zones. The backup of water and downstream floods that happen when the sediment dams break results in a thick blanket of sediment in overbank areas smothering riparian wetland vegetation and reducing floodplain storage in subsequent flood events.

Areas where the pipeline would cross a stream or ravine would be at a higher risk of slumping during restoration. While stream banks and valley slopes are restabilizing, they would be more prone to slumping and sediment loss at the streambed interface. Final stabilization typically takes two months if conducted during the growing season, but could take between 12 to 24 months if site conditions are unfavorable. Two important aspects to consider are the top vegetation and the movement trajectory of the channel. Vegetation at the top of slopes affects runoff, rill formation, stormwater infiltration, and potential groundwater seepage. If the channel is downcutting, the toe would become unstable and add to slumping potential of the entire bank, regardless of the vegetation or armoring.

Due to soil disturbance and reduced slope stability, landslides are more likely to occur during the restoration phase. Landslides are typically precipitated by a rainfall event larger than is covered by the Construction Site General Permit and Enbridge’s restoration plans would not include designs for such events. The highest-risk landslide areas would either be crossed by HDD or have site-specific plans for erosion control and stabilization. Landslide potential was evaluated in the Marengo River erosion study (F. A. Fitzpatrick et al., 2023), which found that channels vulnerable to landslides were concentrated in the transition zone and clay plain (Figure 5.6-17).

Slumping is part of the natural process of streambed movement, especially in Enbridge’s prosed project area. Slumping will naturally shift steep slopes away from a stream over time as erosion progresses. Slumping can begin to occur from a single destabilizing event or as a natural consequence of seasonal streamflow. Slumping causes bank retreat over time. One transition zone watershed, North Fish Creek, with high bluffs near stream areas, had a bluff retreat rate of 1.6 feet per year due to slumping and landslide processes between 1950 and 1999 (F. A. Fitzpatrick, Knox, and Whitman, 1999). This area is naturally highly dynamic, and it is likely that similar bluff retreat rates occur in other areas of steep relief in and around the transition zone. Bluff retreat is a long-term risk for HDD sites. If HDD entry and exit points are placed too close to bluff edges in the project area, bank retreat could eventually cause a pipeline exposure from retreat backwards. The only potential HDD entry/exit point close enough for this to be a relative risk would be the Bad River HDD exit point, but the bluff which causes the risk is not currently connected to the river and would be unlikely to become a continual erosion point in the near term due to the morphology of the surrounding area.

Landslides would most likely occur in response to frequent moderate floods or more infrequent large floods. Short but intense precipitation events could cause excessive saturation on the top of bluffs and ravines which can lead to unexpected failures, especially in areas with cleared vegetation. High flow and precipitation events, and thus landslides and slumping, are more likely to occur moving forward due to climate change (Section 5.7.9.1).

From initiation of construction to permit termination, permit-required inspections would facilitate identification of soil movement within Enbridge's proposed project boundaries. If soil movement would result in disturbance of vegetative cover, repair and replacement of seeding would be required. The site-specific erosion and sediment control plan (Appendix E) if permitted by the DNR under the Construction Site General Permit would require Enbridge to perform weekly inspections from construction to completion of restoration, and additional inspections after every rainfall event of 0.5 inches or greater due to the risk of slumping.

5.6.7.2 Gully Formation, Headwater Incision

Gully erosion is common in the Lake Superior basin. Gullies form when stormwater runoff concentrates enough that its velocity becomes erosive, exceeding the stabilizing capacity of vegetative cover. Gully erosion is common at the edge of agricultural fields or in areas downstream of developments with poor peak flow attenuation. Concentrated road drainage into ravines and valleys can also form gullies. Newly formed gullies erode at irregular intervals upgradient into surrounding areas, usually due to rainfall events or snowmelt. Gullies occur naturally but their development can accelerate due to land use and climate change. Gullies can also form from trench dewatering if improperly conducted.

Headwater incision (or headcutting) is related to gully erosion. Incision is the process by which a stream erodes a channel deeper than would normally allow the stream to regularly overflow into its floodplain. Headcutting is the process by which the stream channel migrates or propagates uphill, typically into ephemeral or intermittent headwater streams. Possible consequences include higher volume flows resulting in stream degradation and hydrologic disconnection from the floodplain.

Headcutting typically occurs during smaller erosion events but can be accelerated by larger flow events which also form gullies further uphill. Headwaters are at higher risk if they are in erodible soils at relatively steep slopes (F. A. Fitzpatrick et al., 2023). Headwaters whose channels and upland areas are cleared for permanent ROWs are at greater risk since construction would increase the erodibility of soils in these locations through compaction and the loss of woody cover. In particular, removing vegetation from the crests of slopes could introduce instability and loss of crest materials, which would accelerate the process of flow concentration (Wohl, 2018).

A secondary effect of headcutting and gullying is the drainage of wetlands. Headcuts which advance far enough upstream to connect with adjacent wetlands can cause those wetlands to drain, reducing water storage capacity in the landscape and reducing the amount of wetland habitat in the area. Figure 5.6-22 shows active headcutting in an ephemeral stream, where the headcut has migrated into a wetland area, resulting in the loss of wetland habitat and flood storage. If pipleline construction sufficiently destabilizes a headwater channel, it could induce headcutting that drains adjacent wetlands. This in turn can lead to lowering the water table, additional runoff volumes, and increased magnitude of downstream flooding with potential for more landslides downstream.

Figure 5.6-22 Headcutting in an ephemeral stream, Marengo River watershed.
Photo: Kyle Magyera, Wisconsin Wetland Association

Gully formation could be expected in areas where there are more easily erodible soils, near steep slopes, and in areas of unbroken, unvegetated slope. Steep slopes are shown in the geohazard identification maps (Figure 5.6-11). Recently disturbed soil has a greater risk of gully formation due to a lack of stabilizing root mass. Careful erosion control and vegetation reestablishment are necessary to prevent new gully formation. Once a gully forms, it is typically necessary to regrade it, import additional topsoil, reseed, and re-mulch to stabilize the area. The proposed project would be required to implement construction erosion and sediment control measures and post-construction stormwater measures which would be expected to reduce the potential for gully formation. Enbridge would also be required to repair any gullies formed due to the proposed project. After headward channels form, they increase the risk of landslides, slumping, and channel downcutting. Restoring headward-cutting channels requires lifting and stabilizing their vertical grade, among other interventions.

Gully formation after restoration is possible when slopes on ROW are exposed to concentrated flow, either through continuous exposure or via sudden formation in a large storm event. Clearing would naturally make soils more susceptible to erosion on the ROW by limiting the amount of root structure and roughness at the land surface, which would allow lower-velocity flows to form rills and eventually gullies in the landscape. Gully and headcut development would be an inherent part of the project area's landscape, and it is common, especially in the transition zone, for large storms to cause greatly accelerated headcutting and gully formation, destabilizing large areas during sudden events.

One example of sudden destabilization is a site in the transition zone within the Bad River Reservation called Potato River Road (Site #4 in Figure 5.6-18). This road failed during the July 2016 flood due to rapid gulley formation and headcutting over the course of the storm, where it received between six and 10 inches of rainfall over the course of 24 hours (NOAA, 2024a). The road, positioned far uphill to a headwater channel, failed when the channel rapidly migrated uphill and into the roadbed, traveling several hundred feet uphill in under a day and forming a large, amphitheater-shaped ravine. Figure 5.6-23 and Figure 5.6-24 are both images taken by DNR staff during an October 2023 site visit.

Figure 5.6-23 Newly formed gully along Potato River Road with riprap stabilization, October 2023.
Photo: Samuel Hermanstorfer, DNR

Figure 5.6-24 Newly formed gully along Potato River Road, October 2023.
Photo: Samuel Hermanstorfer, DNR

The failure was primarily caused by a process called groundwater sapping (*sapping* in the sense of *undermining*) in conjunction with extreme surface flow. Groundwater sapping is a geomorphic process where sand units in steeply sloping areas become saturated with shallow groundwater and flow towards the nearest drainage. Groundwater sapping is possible because of the characteristic soil profile of the transition zone. The transition zone's soils are often interleaved clay and sand layers. Clay is more stable on slopes than sand, so when clay constitutes the surface material it allows steeper slopes to persist in the landscape for longer. By contrast, sand will not hold steep slopes, regrading itself more quickly because of its lower structural cohesion. Sand is also especially structurally vulnerable when saturated, which can make it behave as a fluid or slurry. Sand conducts groundwater much more quickly (thousands of times faster) than clay, creating preferential channels of groundwater flow through the sand layers.

When intense rainfall caused infiltration through the landscape, water preferentially traveled through sand layers at the site, saturating and liquefying them. Their presence near the (potentially clay-capped) slope destabilized the slope face and caused sudden failure of the entire structure, leading to uphill channel migration of hundreds of feet. The area is likely less stable at present due to the prevalence of surficial sand and lack of slope vegetation 8 years after recovery.

Sudden headcutting of this type would be dangerous for a pipeline because it can cause a sudden exposure uphill of where geohazards are presently identified due to the soil's layering. An example of gully formation effecting the existing Line 5 pipeline is the area known as "Slope 18" within the Bad River Reservation (Site #5 in Figure 5.6-18). At this site, the current Line 5 pipeline traverses a steep ravine along an unnamed tributary of Denomie Creek (Mashkiiziibii Natural Resources Department, 2020). In the uplands to the east of the ravine, the filling-in of low areas within the ROW, at some point or points over time, resulted in alteration of the overland flow path during rainfall and snowmelt, such that water runs west down the ROW toward the ravine, instead of its natural course parallel to ravine. This led to concentrated runoff and gullying during large rainfall events like those that occurred in 2016 and 2018. Once the gully formed, the failure of the slope self-propagated, leading ultimately to pipeline exposure (Figure 5.6-25). This has necessitated repair and permanent stabilization (riprap) along the ravine side slope.

Figure 5.6-25 Gullying and pipeline exposure at Slope 18 failure.
View looking west downslope towards the existing ravine along unnamed tributary of Denomie Creek.
Source: Mashkiiziibii Natural Resources Department

5.6.7.3 Knickpoint Erosion

Knickpoint erosion is stepped erosion in the bed of a stream channel, resulting in an abrupt change in grade. Waterfalls are examples of knickpoints. Knickpoints typically migrate upstream over time if the channel is in erodible parent material. Knickpoints can self-propagate if the grade of the channel bed is changed. Road culverts that are perched (i.e., have a steep drop off on the downstream side) are evidence of knickpoint erosion migrating upstream toward the culvert. Figure 5.6-26 shows an example of knickpoint erosion downstream of a culvert where Long Road crosses an unnamed tributary of the Marengo River (Site #2 in Figure 5.6-18), which would be crossed by Enbridge's proposed relocation route approximately 0.4 miles downstream. In the photo on the left (the view upstream of the culvert), the stream channel is stable and hydrologically connected to adjacent floodplain wetlands. Downstream (right) the channel is characterized by significant downcutting and bank erosion.

Knickpoints could also form from shortening channel lengths, digging out the bed, and from the removal of beaver dams. Beaver dams create a lower-grade area of a stream system by generating additional wetland area, retaining sediment, and reducing erosive power. Removing a beaver dam could form a knickpoint at the location of removal that would move upstream quickly. A knickpoint at a beaver dam would be susceptible to fast migration because of the amount of fine, erodible sediment which tends to accumulate behind these dams. See Appendix Z for Enbridge's approach to beaver dam removal.

Figure 5.6-26 Knickpoint at a Culvert Crossing

Left: View upstream from the culvert. Right: View downstream of the culvert, towards Enbridge's proposed Line 5 relocation route.

Photos: Jon Simonsen, DNR.

Knickpoint erosion is unlikely to occur during the restoration phase to a degree where pipeline exposure is a threat; the exception is if an extreme rainfall event occurred during restoration, at which point the pipeline could be exposed due to a road washout or other rapid headwater incision event immediately upstream of a culvert. Natural knickpoints are, generally, too far away from the proposed alignment to threaten the pipeline during its service life (assumed to be 50-100 years). In the event of beaver dam removal, it is plausible that knickpoint migration could proceed quickly enough through fine, organic soils to create a threat to the pipeline in relatively short order.

Post-construction, the risk of knickpoint migration is the same for natural knickpoints, but additional time would increase the risk of knickpoint migration from culverted streams close to the pipeline because of the greater probability of an extreme rainfall event. Section 7.4.2 includes discussion of the risk of severe precipitation. It is likely that beaver would be actively extirpated from areas near pipeline construction after completion of the line, meaning it would be unlikely that a complex large enough to create a knickpoint on removal would form before the beaver was removed.

5.6.7.4 Channel Movement & Widening

Channel change, in terms of migration of meandering streams, is the natural process which can involve movement across the valley bottom or floodplain over years to decades. Channel movement can be gradual, like the slow movement of a meander bend, or involve a sudden change such as a meander cutoff or the development of a new channel and abandonment of the old (termed *avulsion*). Channel movement tends to be episodic and associated with floods, which can lead to abandonment of current channels or sudden weathering that bypasses longer meanders. If a channel migrates from its current position at the point of a pipeline crossing, it has the potential to expose the pipeline over time, since the cover depth previously specified for that pipe segment would be incorrect for the new stream configuration. Channel movement can include either changes in channel position on the floodplain, or widening of the channel where there is a control on vertical erosion (for example, shallow bedrock). Much of Enbridge's stabilization planning is oriented around avoiding this problem by fixing (i.e., holding steady) the channel location and configuration at the crossing point. The highest risk of channel migration is at locations on the floodplain. If pipeline depth is shallower in near-stream floodplain areas, these areas are at the greatest risk of exposure due to gradual or sudden channel movement.

Channel widening can happen from upstream changes in runoff, especially the size of frequent rainfall events, which affect the size of the channel. If the frequent flood size increases, a channel will widen or downcut, depending on the erosion resistance of the banks or the bed. Channel widening also happens as a subsequent stage and also propagates upstream in the process of knickpoint migration and channel incision (Schumm, Harvey, and Watson, 1984).

Streams in the region are geologically young and have irregular patterns of floodplain development. Zones prone to avulsion, meandering, and meander cutoffs are also irregular and vary depending on the size of the stream, its slope, and amount of valley development. Stream crossings need to be checked individually for risk. If there is evidence of fast migration, the pipeline could need to be located below the channel bed across the entire active geomorphic zone.

Channel movement would be a potential risk in dynamic areas near trenched crossings as larger floods becomes more probable (Section 7.4.2) and exposure duration would increase. For example, trenched crossings which traverse the floodplain of a smaller stream (for example, the unnamed tributary to Silver Creek, Section 5.7.10.1) have the potential to become exposed if a series of small precipitation events or several larger flooding events cause a channel to change position in its floodplain. This would be a risk because it has the potential to turn an upland area of pipe into a new stream crossing, without the additional protections or depth of cover typically afforded a stream crossing section of pipe and increasing risk of exposure. Stream movement is more likely the more energetic a stream system is; larger streams are more likely to be dynamic in a way that threatens pipeline stability. Movement is also more likely on floodplains, which tend to allow easier movement after floods due to their low gradient.

5.6.7.5 Streambed Scour

Streambed scour is erosion that occurs in the streambed over a relatively short period of time. Scour is typically caused by high-energy flows, which introduce shear stress to the streambank and transport finer particles. Scour is made more likely by increasing the energy of flows at the streambed and is more likely to occur when sediment is unbalanced (i.e. when less sediment is coming into a stream reach or location than is going out). Scour is a localized process which is associated with specific geomorphic features in most cases. If the scour is a large enough feature, it can become a knickpoint, as described in section 5.6.7.3.

The restoration phase will likely see some limited scour from all crossings. There are no plans to provide sediment stabilization within streams themselves, and in general it is impractical to do so. Streambed scour is likely during the restoration phase because backfilling will disturb the natural arrangement of stream sediments which typically reduces the potential for scour (called streambed armoring) which would be broken up by trenching even if Enbridge's plan to segregate streambed sediment is correctly implemented. Scour is even more likely in areas of shallow bedrock, since these places will be backfilled with sand per Enbridge's EPP (Appendix D). Typically, bedrock-bottomed streams have higher near-bed velocities due to the smoother streambed surface, creating a greater shear stress on the streambed. Sand will be more likely to scour in this situation because of the additional shear stress, and would do so under more common flow conditions than otherwise would be the case. Scour would stay localized to the crossing point in this situation assuming there is bedrock upstream and downstream of the backfilled area. Scour underneath disturbed streambeds will predictably lead to some loss of cover in stream crossings over the first few years after pipeline installation.

Scour is less likely under normal circumstances in the long-term as the disturbed portion of the streambed re-armors through natural sediment sorting processes over time. Scour will still occur periodically during high-flow events, but will only exceed that of natural conditions where the streambed has been artificially stabilized in a way which increases the near-bed velocity of water. This would be the case anywhere that is artificially smoothed or permanently armored, and in locations which are artificially narrowed due to restoration. These locations will have greater risk of losing depth of cover to the pipeline because of these armoring techniques.

Wood and brush clearing from the stream channel would increase the risk of scour as well. Typically, wood and brush in a streambed slows down flow by introducing roughness; removing it increases water velocity and would lead to additional scour.

5.6.7.6 Channel Degradation

Channel degradation (downcutting) is the process by which a stream's bed erodes, making it deeper in relation to its banks. Downcutting is a pervasive problem in midwestern streams with histories of deforestation and is caused by increased flow energy profile in the stream itself. Often, the sediment supply to the stream is insufficient to match the energy removing sediment from degrading reaches, causing channel incision. Channel degradation is distinct from scour in that it is happens over a longer stretch of channel from upstream changes in hydrology and runoff as well as from downstream propagating geomorphic processes of knickpoint migration and channel downcutting.

Channel degradation can also cause in-stream pipeline exposure by eroding the layer of cover put over the pipeline in the streambed. This sort of exposure is especially risky because of the more corrosive, abrasive environment of a streambed, which could cause accelerated wear on the pipeline and its coating, leading to failure and direct discharge of oil into the incised stream. Because pipeline operation is considered indefinite, it is important to consider the long-term trajectory of the main geomorphic processes affecting the crossed channel to ensure that its sediment-energy balance will not lead it to degrade further. Downcutting in the area was historically driven by increased runoff (and increased flow energy) from land clearing, which is typical of Midwestern stream response to land use change over the past 200 years (F. A. Fitzpatrick, Knox, and Whitman, 1999). Evidence suggests that peak flows are around 2.5 times larger than pre-development in nearby watersheds (F. A. Fitzpatrick, Knox, and Whitman, 1999). Streams could be more vulnerable to downcutting if they continue to have highly energetic flows from flash flooding or greater inputs of rainfall, or if they experience increases in impervious surface or land clearing for agriculture/development (Section 5.7.9). The channels at greatest risk of incision would be those in locations with erodible beds, typically those with silty beds or other unconsolidated, fine sediments (fine meaning finer than gravel in this case). Streams with finer substrates would lose channel material to degradation at lower shear stresses, and therefore lower stream flows. Channel degradation would not likely be a significant risk during the restoration phase due to the typically long timescales on which it operates.

Reforestation after clearing tends to lead to sediment limitation, which exacerbates the problem. In degrading reaches in North Fish Creek (just west of the project area), the stream bottom dropped 16.4 feet over the course of 55 years (F. A. Fitzpatrick, Knox, and Whitman, 1999). Channel degradation also is propagating upstream, as described previously.

An example of a current Line 5 stream crossing that was determined to be at risk of pipeline exposure via downcutting is an area known as Slope 20, west of the western end of Enbridge's proposed relocation route (Site #1 in Figure 5.6-18). Like the other areas described in this section, Slope 20 is the Lake Superior Clay Plainn, which is identified as having heightened risk of fluvial erosion. The site is in the North Fish Creek watershed, adjacent the Bad River watershed. This watershed has experienced increased fluvial erosion over time in response to long-term changes in land cover and climate (F. A. Fitzpatrick, Knox, and Whitman, 1999). From east to west, the pipeline ROW runs downhill until it reaches stream crossing. It then runs back uphill on the western side. As elsewhere, the ROW is maintained free of forest cover. In recent years, the eastern slope has begun to erode (Figure 5.6-27), possibly in response to or exacerbated by flooding events in 2016 and 2018. The erosion has contributed to instability within the stream channel downslope, which has experienced scour. In 2023, Enbridge determined that the confluence of slope and channel instability posed a long-term risk of pipeline exposure. Enbridge applied for and received DNR permits to armor the stream with riprap and re-grade the eroding section of the ROW along the downward slope leading to the stream from the west (Figure 5.6-28).

Figure 5.6-27 Streambed scour erosion causing slope instability at Slope 20, June 2023.
Photo: Dreux J. Watermolen, DNR

Figure 5.6-28 Enbridge's Slope 20 restoration project (2024), in progress.
The river intersects the ROW from right to left, behind the bulldozer and backhoe.
Photo: DNR

5.6.7.7 Potential Consequences of Stabilization Techniques

Streambed stabilization techniques typically work to defend the banks of a stream against a range of normal flow conditions, usually by increasing the resistance of the bank to erosion. This can be accomplished either by covering the bank with a stronger material (armoring) or by reducing the energy of flow near the bank (increasing roughness); often these are employed together or occur together due to material choice. Enbridge proposes to stabilize stream banks using a variety of tools, generally revegetation on higher slopes coupled with erosion matting, silt fencing, and sometimes armoring on lower slopes, including the use of riprap, biologs, live staking, rootwads, branches, or a combination of these measures (Sections 2.8.6, and 5.6.4).

Harder armoring strategies, especially riprap, have consequences for long-term stream form and behavior in the crossing regions described. Riprap is regulated as an armoring strategy (Section 2.8.6). Riprap prevents the successful establishment of permanent, full ground vegetative cover, limiting suitability for amphibious wildlife and emerging aquatic macroinvertebrates. Riprap also alters the sediment balance of the affected reach, cutting off sediment inputs from banks to the stream itself and leading to localized downcutting and undercutting (Reid and Church, 2015; Stein et al., 2013). These tendencies reduce the long-term stability of the streambed and threaten to accelerate pipeline exposure depending on the power of the stream in question. Evidence is less clear that armoring has a direct effect on in-stream macroinvertebrate habitat, mostly due to correlation between bank armoring and other land use disturbances that also degrade stream habitat (Stein et al., 2013). Research generally has not found a strong downstream effect of hard armoring on biotic condition, at least in already affected areas (Stein et al., 2013).

Riprap and other hard armoring techniques are somewhat different from other energy mitigation measures. The typical size of riprap and other armoring structures means they are fixed even for very high flow conditions which would normally cause sediment loss at the streambank. This can cause undermining over time as the accumulation of high-energy events erodes around edges of the armoring structure. By contrast, forms of erosion control like matting and plantings will deform or fail at lower energies, allowing greater channel adjustment to high-flow stress. Many of these structures also degrade over time.

Enbridge proposes to stabilize slopes at five streams with riprap in various configurations: Bay City Creek, Beartrap Creek, Deer Creek, Rock Creek, and an unnamed tributary to Silver Creek (Table 2.8-1). Bay City Creek, Beartrap Creek, and the unnamed tributary to Deer Creek are proposed to have riprap placed below the ordinary high-water mark, which means that conditions at higher flows would be affected by the riprap, which would potentially modify the way in which the stream erodes and develops over time. Section 2.8.6 and Appendix E provide details on the placement of riprap and other remediation strategies at these locations. Appendix E, Part 9 includes Enbridge's proposed bank stabilization plan designs.

5.6.7.8 Impervious Surfaces

After construction is complete, soils could still be affected due to increases in impervious area, changes in vegetative cover, and disruption of soil profiles during construction. Permanent access roads and valve stations would be sources of new impervious surface associated with Enbridge's proposed project.

Most of the access roads would be temporary or pre-existing and would be restored to their previous condition as part of restoration activities. Most of the proposed construction would be underground piping and is exempt from post-construction storm water performance standards (s. NR 151.121 (2) (c), Wis. Adm. Code). However, some new permanent impervious surfaces would be created as part of the project. These surfaces would typically be gravel pads at valve locations and associated gravel access roads (Section 2.3). Most of these areas would have sheet flow to vegetated areas, allowing the additional runoff to infiltrate into the soil. All the valve sites are expected to have less than one acre of total imperviousness and make up less than 10 percent connected imperviousness of the site area. Due to HDD installation methods, these areas are not connected by continuous land disturbance, and therefore would qualify for an exemption from post-construction storm water performance standards under s. NR 151.121 (2) (a), Wis. Adm. Code, excepting the protective area performance standard (s. NR 151.125, Wis. Adm. Code), which limits the location of impervious surfaces that drain directly to wetlands and waterbodies. The protective area performance standard requires that impervious surfaces be located 10 to 75 feet away from wetlands and waterways to the maximum extent possible. The required distance is dependent on the type of resource and its quality. If there is no practical alternative to locating an impervious surface in the protective area, a site-specific explanation is required as part of the storm water management plan submitted with the Construction Site General Permit application.

5.7 Surface Water Resources

Enbridge’s proposed Line 5 relocation route would cross 34 ditches, 14 rivers, 122 streams, 13 swales, and three ponds, for a total of 186 proposed waterway crossings. Some waterbodies would be crossed multiple times. Figure 5.7-1 shows the watersheds crossed by Enbridge’s proposed relocation route and route alternatives by sub-watershed. Table 5.7-1 lists all waterway crossings along Enbridge’s proposed relocation route along with some basic attributes and Enbridge’s proposed crossing methods. Table 5.7-2, Table 5.7-3, and Table 5.7-4 list waterway crossings along RA-01, RA-02, and RA-03, respectively. Section 5.7.1 and 5.7.2 place these waterbodies in the context of Lake Superior and its management. Section 5.7.3 briefly describes the principal named streams that would be crossed by Enbridge’s proposed Line 5 relocation route. Sections 5.7.5 through 5.7.12 characterize baseline conditions and anticipated effects to surface water resources from Enbridge’s proposed project.

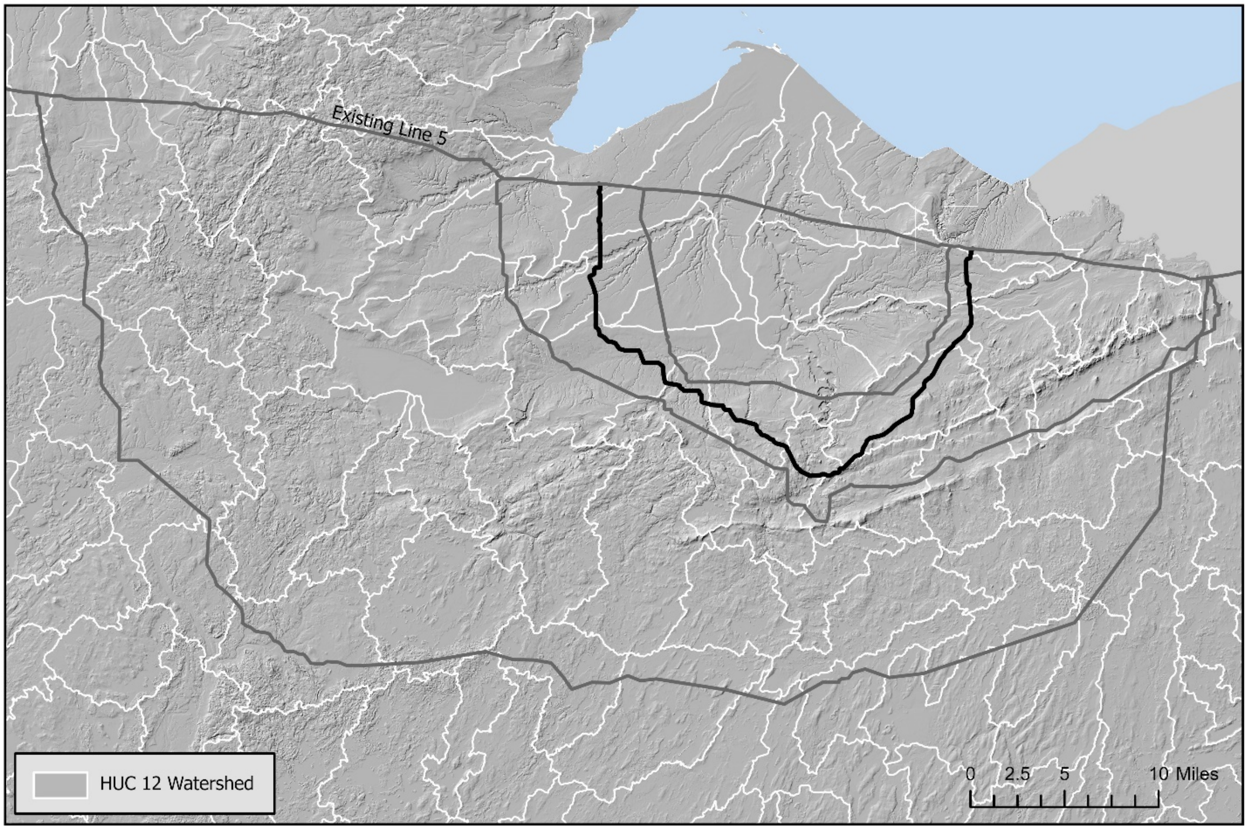


Figure 5.7-1 HUC-12 sub-watersheds crossed by Enbridge's proposed Line 5 relocation route and route alternatives.

Table 5.7-1 Waterway crossings along Enbridge's proposed Line 5 relocation route.

FeatureID[a]	WDNR WBIC	Feature Type	County	MP	Flow	USGS Name	Pipeline Centerline Crossing or Access Road		OHWM Width [j] (feet)	Bank Width [k] (feet)	ORW/ ERW [l]	Agency Classification
							Length (feet)	Crossing Method [c]				
sasa1008e	Not Assigned	Stream	Ashland	0.59	Ephemeral	UNT of Bay City Creek	N/A	N/A	4	6	--	--
sase006p	2891100	Stream	Ashland	0.63	Perennial	Bay City Creek	16.33	DC	12	14	--	--
WDH-02	5001516	WDH [o]	Ashland	1.51	Intermittent	UNT of Little Beartrap Creek	<10	OC/DC	<10 [o]	N/A	--	--
WDH-03	5001523	WDH [o]	Ashland	1.55	Intermittent	UNT of Little Beartrap Creek	<10	OC/DC	<10 [o]	N/A	--	--
WDH-04	5001550	WDH [o]	Ashland	1.88	Intermittent	UNT of Little Beartrap Creek	<10	OC/DC	<10 [o]	N/A	--	--
sasa1021e	Not Assigned	Ditch	Ashland	2.04	Ephemeral	UNT of Little Beartrap Creek	N/A	N/A	2	--	--	--
sasa047i	2891500	Stream	Ashland	2.24	Intermittent	Little Beartrap Creek	10.64	OC/DC	6	9	--	--
sasa046e	Not Assigned	Stream	Ashland	2.28	Ephemeral	UNT of Little Beartrap Creek	6.13	OC/DC	4	6	--	--
WDH-100	5001621	WDH [o]	Ashland	2.68	Intermittent	UNT of Little Beartrap Creek	<10	OC/DC	<10 [o]	N/A	--	--
sasb007i	2891400	Stream	Ashland	2.91	Intermittent	Beartrap Creek	7.35	OC/DC	6	10	ORW	ASNRI-PNW
sasm001e_x1	Not Assigned	Stream	Ashland	3.78	Intermittent	UNT of White River	N/A	HDD	1	1	--	--
sasm001e_x2	Not Assigned	Stream	Ashland	3.79	Intermittent	UNT of White River	1.42	HDD	1	1	--	--
sasw022	5001757	Stream	Ashland	3.82	Intermittent	UNT of White River	4.03	HDD	2	2	--	--
sasw024	Not Assigned	Swale	Ashland	4.02	Ephemeral	UNT of White River	2.22	HDD	1	3	--	--
sasw023p	2892500	River	Ashland	4.04	Perennial	White River	143.14	HDD	65	60	ERW	Class II Trout, ASNRI-PNW
sasa1023i_x1	Not Assigned	Stream	Ashland	4.16	Intermittent	UNT of White River	5.24	HDD	5	7.5	--	--
sasa1023i_x2	Not Assigned	Stream	Ashland	4.26	Intermittent	UNT of White River	6.36	HDD	5	7.5	--	--
sasd013i	5001803	Stream	Ashland	4.69	Intermittent	UNT of White River	3.65	OC/DC	3	11	--	--
sasd014e	Not Assigned	Stream	Ashland	4.72	Ephemeral	UNT of White River	N/A	N/A	2	10	--	--
sasd013i_x	5001803	Ditch	Ashland	4.86	Intermittent	UNT of White River	3.40	OC/DC	3	5	--	--
sasa1020e	Not Assigned	Ditch	Ashland	4.93	Ephemeral	UNT of White River	3.49	OC/DC	2	2	--	--
sasc041p	2893900	Stream	Ashland	5.05	Perennial	Rock Creek	5.54	DC	10	30	--	--
sasa016e	Not Assigned	Ditch	Ashland	5.50	Ephemeral	UNT of Rock Creek	2.22	OC/DC	2	3	--	--
sasc036e	5001870	Stream	Ashland	5.54	Ephemeral	UNT of Rock Creek	2.00	OC/DC	2	5	--	--
sasc037e	5001904	Stream	Ashland	5.79	Ephemeral	UNT of Deer Creek	2.45	OC/DC	2	10	--	--
sasc038e	Not Assigned	Stream	Ashland	5.82	Ephemeral	UNT of Deer Creek	3.01	OC/DC	2	10	--	--
sasc039i	5001917	Stream	Ashland	5.93	Intermittent	UNT of Deer Creek	41.28	OC/DC	12	30	--	--
sasc040e	Not Assigned	Stream	Ashland	5.94	Ephemeral	UNT of Deer Creek	26.04	OC/DC	1	10	--	--
sase022p	2893600	River	Ashland	6.35	Perennial	Deer Creek	51.05	HDD	25	30	--	--

FeatureID[a]	WDNR WBIC	Feature Type	County	MP	Flow	USGS Name	Pipeline Centerline Crossing or Access Road		OHWM Width [j] (feet)	Bank Width [k] (feet)	ORW/ ERW [l]	Agency Classification
							Length (feet)	Crossing Method [c]				
sase021e	Not Assigned	Stream	Ashland	6.39	Ephemeral	UNT of Deer Creek	1.00	HDD	1	5	--	--
sasa067e	5001931	Stream	Ashland	6.64	Ephemeral	UNT of Deer Creek	2.43	OC/DC	2	4	--	--
WDH-101	5001931	WDH [o]	Ashland	6.94	Intermittent	UNT of Deer Creek	<10	N/A	<10 [o]	N/A	--	--
sasa066i	2893700	Stream	Ashland	7.07	Intermittent	UNT of Deer Creek	10.98	OC/DC	8	10	--	--
sasa068e	Not Assigned	Swale	Ashland	7.16	Ephemeral	UNT of Deer Creek	3.08	OC/DC	1	4	--	--
sasd015i	5001967	Stream	Ashland	7.59	Intermittent	UNT of Marengo River	8.15	OC/DC	8	8	--	--
oasd003_x1	Not Assigned	Pond	Ashland	7.83	Perennial	Pond	N/A	N/A	N/A	N/A	--	--
oasd003_x2	Not Assigned	Pond	Ashland	7.88	Perennial	Pond	N/A	N/A	N/A	N/A	--	--
sasd011p	5002051	Stream	Ashland	7.99	Perennial	UNT of Marengo River	9.37	DC	9	15	--	Perennial tributary of trout stream
sasc012e_x	5002051	Ditch	Ashland	8.07	Ephemeral	UNT of Marengo River	24.95	N/A	1	1	--	--
sasc012e_x1	Not Assigned	Ditch	Ashland	8.07	Ephemeral	Ditch	1.00	OC/DC	1	5	--	--
sasc012e_x2	Not Assigned	Ditch	Ashland	8.07	Ephemeral	Ditch	9.10	N/A	1	5	--	--
sasc013e	Not Assigned	Ditch	Ashland	8.64	Ephemeral	Ditch	3.00	OC/DC	3	6	--	--
sasa021e	Not Assigned	Ditch	Ashland	8.65	Ephemeral	Ditch	4.00	OC/DC	4	6	--	--
WDH-102_x1 [t]	5002055	WDH [o]	Ashland	8.81	Intermittent	UNT of Marengo River	N/A	OC/DC	N/A	N/A	--	--
sasa020i	Not Assigned	Stream	Ashland	8.84	Intermittent	UNT of Marengo River	14.97	N/A	6	10	--	--
WDH-102_x2 [t]	5002055	WDH [o]	Ashland	9.03	Intermittent	UNT of Marengo River	N/A	OC/DC	N/A	N/A	--	--
WDH-102_x3	5002055	WDH [o]	Ashland	9.16	Intermittent	UNT of Marengo River	N/A	N/A	N/A	N/A	--	--
sase1001e	5002055	Swale	Ashland	9.27	Ephemeral	UNT of Marengo River	5.38	OC/DC	5	8	--	--
sase1003e	Not Assigned	Ditch	Ashland	10.54	Ephemeral	Ditch	1.00	OC/DC	1	4	--	--
sase1018i	2918900	Stream	Ashland	11.09	Intermittent	UNT of Marengo River	14.52	N/A	7	9	--	--
WDH-10	2918900	WDH [o]	Ashland	11.09	Intermittent	UNT of Marengo River	<10	N/A	<10 [o]	N/A	--	--
sase1004e	Not Assigned	Swale	Ashland	11.13	Ephemeral	UNT of Marengo River	5.42	N/A	2	2	--	--
sase1019i	Not Assigned	Stream	Ashland	11.18	Intermittent	UNT of Marengo River	1.00	Direct Bore	1	3	--	--
sase1020p	2911900	River	Ashland	11.40	Perennial	Marengo River	44.69	Direct Bore	50	58	ORW	Class III Trout, ASNRI-PNW
sase1021e	Not Assigned	Stream	Ashland	11.41	Ephemeral	UNT of Marengo River	N/A	Direct Bore	1	1	--	--
sase1008e	Not Assigned	Ditch	Ashland	11.95	Ephemeral	Ditch	1.00	OC/DC	1	1	--	--
sase1011i	5002299	Stream	Ashland	12.43	Intermittent	UNT of Marengo River	5.02	OC/DC	5	6	--	--
sase1015i	5002282	Stream	Ashland	12.75	Intermittent	UNT of Marengo River	5.78	OC/DC	2	5	--	--
WDH-15	3000115	WDH [o]	Ashland	13.26	Intermittent	UNT of Marengo River	<10	OC/DC	<10 [o]	N/A	--	--

FeatureID[a]	WDNR WBIC	Feature Type	County	MP	Flow	USGS Name	Pipeline Centerline Crossing or Access Road		OHWM Width [j] (feet)	Bank Width [k] (feet)	ORW/ ERW [l]	Agency Classification
							Length (feet)	Crossing Method [c]				
sasd1020e	Not Assigned	Stream	Ashland	13.61	Ephemeral	UNT of Marengo River	N/A	N/A	1	2	--	--
sasd1022p	5002283	Stream	Ashland	13.61	Perennial	UNT of Marengo River	N/A	N/A	8	10	--	Perennial tributary of trout stream
sase1023e	Not Assigned	Stream	Ashland	13.64	Ephemeral	UNT of Marengo River	N/A	N/A	2	4	--	--
sasa1005p	2913800	River	Ashland	14.10	Perennial	Brunsweiler River	60.89	HDD	25	15	ORW	Class III Trout, ASNRI-PNW
sasa1006i	Not Assigned	Stream	Ashland	14.17	Intermittent	UNT of Brunsweiler River	10.55	HDD	9	2	--	--
sasc1004e_x1	Not Assigned	Ditch	Ashland	14.45	Ephemeral	UNT of Brunsweiler River	N/A	N/A	1	5	--	--
sasc1005e	Not Assigned	Ditch	Ashland	14.47	Ephemeral	UNT of Brunsweiler River	2.21	OC/DC	1	5	--	--
sasc1004e_x2	Not Assigned	Ditch	Ashland	14.49	Ephemeral	UNT of Brunsweiler River	121.28	N/A	1	5	--	--
sasc1004e_x3	Not Assigned	Ditch	Ashland	14.50	Ephemeral	UNT of Brunsweiler River	11.73	N/A	1	5	--	--
sasc1006p	5002429	Stream	Ashland	14.73	Perennial	UNT of Brunsweiler River	8.60	DC	8	30	--	Perennial tributary of trout stream
sasc1007e	Not Assigned	Stream	Ashland	14.82	Ephemeral	UNT of Brunsweiler River	N/A	N/A	2	20	--	--
sasc1009e_x1	Not Assigned	Stream	Ashland	14.91	Ephemeral	UNT of Brunsweiler River	N/A	N/A	2	20	--	--
sasc1009e_x2	Not Assigned	Stream	Ashland	14.92	Ephemeral	UNT of Brunsweiler River	2.85	OC/DC	2	20	--	--
sasa1028i	Not Assigned	Stream	Ashland	14.96	Intermittent	UNT of Brunsweiler River	6.70	OC/DC	6	12	--	--
sasa1027e	Not Assigned	Stream	Ashland	15.03	Ephemeral	UNT of Brunsweiler River	6.46	N/A	3	10	--	--
sasa1026e	Not Assigned	Ditch	Ashland	15.08	Ephemeral	UNT of Brunsweiler River	2.75	N/A	3	5	--	--
WDH-18	2915100	WDH [o]	Ashland	15.18	Intermittent	UNT of Brunsweiler River	<10	HDD	<10 [o]	<10	--	--
sasc1010i	5002417	Stream	Ashland	15.28	Intermittent	UNT of Brunsweiler River	3.00	HDD	3	15	--	--
WDH-20	5002291	WDH [o]	Ashland	15.58	Intermittent	UNT of Trout Brook	<10	OC/DC	<10 [o]	<10 feet	--	--
sasc1003p_x1	2914000	Stream	Ashland	15.86	Perennial	UNT of Trout Brook	12.27	DC	8	50	--	Perennial tributary of trout stream
sasc1003p_x2	2914000	Stream	Ashland	15.87	Perennial	UNT of Trout Brook	N/A	N/A	8	50	--	Perennial tributary of trout stream
sasc1001i	Not Assigned	Stream	Ashland	15.98	Intermittent	UNT of Trout Brook	6.69	N/A	5	20	--	--
sasc1012p	2913900	River	Ashland	16.58	Perennial	Trout Brook	24.14	HDD	30	80	--	Class III Trout, ASNRI-PNW
sasc1014p_x1	5002430	Stream	Ashland	16.77	Perennial	UNT of Billy Creek	4.00	HDD	4	20	--	Perennial tributary of trout stream
sasc1014p_x2	5002430	Stream	Ashland	16.77	Perennial	UNT of Billy Creek	N/A	N/A	4	20	--	Perennial tributary of trout stream
sasc028e	Not Assigned	Ditch	Ashland	16.91	Ephemeral	UNT of Billy Creek	N/A	N/A	2	5	--	--
sasc026e	5002381	Stream	Ashland	16.94	Ephemeral	UNT of Billy Creek	2.00	OC/DC	2	5	--	--

FeatureID[a]	WDNR WBIC	Feature Type	County	MP	Flow	USGS Name	Pipeline Centerline Crossing or Access Road		OHWM Width [j] (feet)	Bank Width [k] (feet)	ORW/ ERW [l]	Agency Classification
							Length (feet)	Crossing Method [c]				
sasc025i	5002382	Stream	Ashland	17.09	Intermittent	UNT of Billy Creek	3.97	OC/DC	2	3	--	--
sasb1001e	Not Assigned	Stream	Ashland	17.10	Ephemeral	UNT of Billy Creek	N/A	N/A	2	5	--	--
sasb1002i	5002382	Stream	Ashland	17.12	Intermittent	UNT of Billy Creek	N/A	N/A	2	2	--	--
sasc025i_x	5002382	Stream	Ashland	17.15	Intermittent	UNT of Billy Creek	N/A	N/A	3	6	--	--
sasb1004e	Not Assigned	Stream	Ashland	17.16	Ephemeral	UNT of Billy Creek	N/A	N/A	2	7	--	--
sasb1007e	Not Assigned	Stream	Ashland	17.24	Ephemeral	UNT of Billy Creek	2.04	HDD	2	3	--	--
sasc022p	2913700	Stream	Ashland	17.25	Perennial	Billy Creek	6.69	HDD	6	20	--	Class I Trout, ASNRI-PNW
sasb1005i	Not Assigned	Stream	Ashland	17.28	Intermittent	UNT of Billy Creek	N/A	N/A	3	6	--	--
sasd1012i	Not Assigned	Stream	Ashland	19.08	Intermittent	UNT of Silver Creek	N/A	N/A	3	5	--	--
sasd1013p	Not Assigned	Stream	Ashland	19.09	Perennial	UNT of Silver Creek	3.34	HDD	3	4	--	Perennial tributary of trout stream
sasd1011p_x1	2912300	River	Ashland	19.09	Perennial	Silver Creek	27.86	HDD	15	60	--	Class II Trout, ASNRI-PNW
sasd1011p_x2	2912300	River	Ashland	19.14	Perennial	Silver Creek	33.49	HDD	15	60	--	Class II Trout, ASNRI-PNW
sasd1011p_x3	2912300	River	Ashland	19.20	Perennial	Silver Creek	18.17	HDD	15	60	--	Class II Trout, ASNRI-PNW
oasd1002	Not Assigned	Pond	Ashland	19.71	Perennial	Pond	N/A	N/A	N/A	N/A	--	--
sasa070e	2912500	Stream	Ashland	19.78	Ephemeral	UNT of Silver Creek	5.97	N/A	3	5	--	--
sasa071p	2912500	River	Ashland	19.78	Perennial	UNT of Silver Creek	11.64	N/A	12	15	--	Perennial tributary of trout stream
sasd1017p	2912500	Stream	Ashland	19.78	Perennial	UNT of Silver Creek	N/A	N/A	12	16	--	Perennial tributary of trout stream
sasa071p_x1	2912500	Stream	Ashland	19.79	Perennial	UNT of Silver Creek	N/A	N/A	12	15	--	Perennial tributary of trout stream
sasa071p_x2	2912500	Stream	Ashland	19.79	Perennial	UNT of Silver Creek	N/A	N/A	12	15	--	Perennial tributary of trout stream
sasd1015p	2912500	Stream	Ashland	19.83	Perennial	UNT of Silver Creek	8.04	DC	8	15	--	Perennial tributary of trout stream
sase1007p	2912300	River	Ashland	20.21	Perennial	Silver Creek	32.51	N/A	25	33	--	Class II Trout, ASNRI-PNW
sase005p_x1	2912500	Stream	Ashland	20.61	Perennial	UNT of Silver Creek	19.46	N/A	9	9	--	Perennial tributary of trout stream
sase005p_x2	2912500	Stream	Ashland	20.61	Perennial	UNT of Silver Creek	9.24	DC	9	9	--	Perennial tributary of trout stream
sasv001p	2912700	Stream	Ashland	20.85	Perennial	UNT of Silver Creek	2.51	N/A	1	1	--	Perennial tributary of trout stream
sasv002e	Not Assigned	Stream	Ashland	20.96	Ephemeral	UNT of Silver Creek	8.82	OC/DC	4	5	--	--
sasv004p	5002512	Stream	Ashland	21.28	Perennial	UNT of Silver Creek	5.01	DC	5	5.5	--	Perennial tributary of trout stream
sasv006i	Not Assigned	Stream	Ashland	21.29	Intermittent	UNT of Silver Creek	N/A	N/A	8	8.5	--	--
sasv006i	Not Assigned	Stream	Ashland	21.30	Intermittent	UNT of Silver Creek	5.29	OC/DC	8	8.5	--	--

FeatureID[a]	WDNR WBIC	Feature Type	County	MP	Flow	USGS Name	Pipeline Centerline Crossing or Access Road		OHWM Width [j] (feet)	Bank Width [k] (feet)	ORW/ ERW [l]	Agency Classification
							Length (feet)	Crossing Method [c]				
sasv007i	2912600	Stream	Ashland	21.70	Intermittent	UNT of Krause Creek	4.05	OC/DC	4	8	--	--
sasv020p	Not Assigned	Stream	Ashland	22.01	Perennial	UNT of Krause Creek	9.79	DC	6	8	--	Perennial tributary of trout stream
sasv019p	2929000	Stream	Ashland	22.28	Perennial	Krause Creek	14.96	HDD	15	25	ERW	Class I Trout, ASNRI-PNW
sasd1003e	Not Assigned	Ditch	Ashland	22.58	Ephemeral	UNT of Bad River	N/A	N/A	1	2	--	--
sasd1001e	Not Assigned	Stream	Ashland	22.61	Ephemeral	UNT of Bad River	N/A	N/A	1	1	--	--
sasd1002e	Not Assigned	Stream	Ashland	22.62	Ephemeral	UNT of Bad River	N/A	N/A	1	3	--	--
sasc043i_x1	2929100	Stream	Ashland	22.90	Intermittent	UNT of Krause Creek	53.16	N/A	3	10	--	--
sasc043i_x2	2929100	Stream	Ashland	22.91	Intermittent	UNT of Krause Creek	20.99	N/A	3	10	--	--
sasb005e	Not Assigned	Ditch	Ashland	23.10	Ephemeral	UNT of Bad River	3.86	N/A	1	2	--	--
sasb003e	Not Assigned	Ditch	Ashland	23.18	Ephemeral	Ditch	172.83	N/A	2	3	--	--
sasa008p	5002615	Stream	Ashland	23.72	Perennial	UNT of Bad River	5.00	DC	5	7	--	Perennial tributary of trout stream
sasb006p	2891900	River	Ashland	24.18	Perennial	Bad River	70.30	HDD	60	60	ERW	Class III Trout, ASNRI-PNW
sasd1006e	Not Assigned	Ditch	Ashland	24.72	Ephemeral	UNT of Bad River	1.01	OC/DC	1	2	--	--
sasd1005e	Not Assigned	Stream	Ashland	25.41	Ephemeral	UNT of Montreal Creek	1.20	OC/DC	1	1	--	--
sasv010i	Not Assigned	Stream	Ashland	26.69	Intermittent	UNT of Scott Taylor Creek	5.48	OC/DC	4.5	6	--	--
sasv008i	2923400	Stream	Ashland	27.10	Intermittent	UNT of Scott Taylor Creek	3.00	OC/DC	3	6	--	--
sasv012e	5002539	Stream	Ashland	27.20	Ephemeral	UNT of Scott Taylor Creek	1.48	OC/DC	1	1	--	--
sasv016i	Not Assigned	Stream	Ashland	27.51	Intermittent	UNT of Scott Taylor Creek	1.02	OC/DC	1	3	--	--
sasv013i	Not Assigned	Stream	Ashland	27.56	Intermittent	UNT of Scott Taylor Creek	17.65	OC/DC	3	4	--	--
sasv017e	Not Assigned	Swale	Ashland	27.79	Ephemeral	UNT of Scott Taylor Creek	N/A	N/A	N/A	5	--	--
sasv018i	5002502	Stream	Ashland	27.94	Intermittent	UNT of Scott Taylor Creek	1.03	OC/DC	1	10	--	--
sasa007e_x1	Not Assigned	Ditch	Ashland	28.06	Ephemeral	UNT of Gehrman Creek	1.54	OC/DC	1	2	--	--
sasa007e_x2	Not Assigned	Ditch	Ashland	28.09	Ephemeral	UNT of Gehrman Creek	1.65	N/A	1	2	--	--
sasa006e	Not Assigned	Ditch	Ashland	28.24	Ephemeral	UNT of Gehrman Creek	1.00	OC/DC	1	2	--	--
sasa005e	Not Assigned	Ditch	Ashland	28.25	Ephemeral	UNT of Gehrman Creek	1.00	OC/DC	1	2	--	--
sasa004p	5002519	Stream	Ashland	28.39	Perennial	UNT of Gehrman Creek	8.24	DC	8	10	--	Perennial tributary of trout stream
sasd017e	Not Assigned	Stream	Ashland	28.45	Ephemeral	UNT of Gehrman Creek	23.85	N/A	2	4	--	--
sasd018e	Not Assigned	Stream	Ashland	28.54	Ephemeral	UNT of Gehrman Creek	4.27	N/A	2	2	--	--

FeatureID[a]	WDNR WBIC	Feature Type	County	MP	Flow	USGS Name	Pipeline Centerline Crossing or Access Road		OHWM Width [j] (feet)	Bank Width [k] (feet)	ORW/ ERW [l]	Agency Classification
							Length (feet)	Crossing Method [c]				
sasw011_x2	5002476	Stream	Ashland	28.62	Intermittent	UNT of Gehrman Creek	3.50	N/A	4	6	--	--
sasw011_x3	5002476	Stream	Ashland	28.63	Intermittent	UNT of Gehrman Creek	27.48	N/A	4	6	--	--
sasw011	5002476	Stream	Ashland	28.67	Intermittent	UNT of Gehrman Creek	2.53	OC/DC	4	6	--	--
sasw010	Not Assigned	Swale	Ashland	28.68	Ephemeral	UNT of Gehrman Creek	139.48	N/A	N/A	3	--	--
sasw008_x1	2923500	Stream	Ashland	28.71	Ephemeral	Gehrman Creek	24.96	N/A	5	4	--	Class II Trout, ASNRI-PNW
sasw009_x1	2923500	Swale	Ashland	28.73	Ephemeral	UNT of Gehrman Creek	34.71	N/A	4	4	--	--
sasw009_x2	2923500	Swale	Ashland	28.77	Ephemeral	UNT of Gehrman Creek	159.31	N/A	4	4	--	--
sasw007	2923500	Swale	Ashland	28.78	Ephemeral	UNT of Gehrman Creek	276.43	N/A	N/A	--	--	--
sasw008_x2	2923500	Stream	Ashland	28.79	Ephemeral	Gehrman Creek	18.60	N/A	5	4	--	Class II Trout, ASNRI-PNW
sasw005	2923600	Stream	Ashland	29.81	Intermittent	Camp Four Creek	6.74	OC/DC	6	12	--	Class II Trout, ASNRI-PNW
saws006	Not Assigned	Stream	Ashland	29.87	Ephemeral	UNT of Camp Four Creek	2.29	OC/DC	1	3	--	--
sasw003	2923600	Stream	Ashland	29.88	Intermittent	Camp Four Creek	7.76	N/A	4	4	--	Class II Trout, ASNRI-PNW
sirb010p	Not Assigned	Stream	Iron	30.67	Perennial	UNT of Feldcher Creek	5.51	DC	5	10	--	Perennial tributary of trout stream
sirb1001e	Not Assigned	Stream	Iron	30.75	Ephemeral	UNT of Feldcher Creek	N/A	N/A	1	1	--	--
sirb009p	Not Assigned	Swale	Iron	30.82	Perennial	UNT of Feldcher Creek	17.75	N/A	3	4	--	Perennial tributary of trout stream
sirb1002e	Not Assigned	Stream	Iron	30.87	Ephemeral	UNT of Feldcher Creek	N/A	N/A	2	2	--	--
sirb006e	Not Assigned	Swale	Iron	30.98	Ephemeral	UNT of Feldcher Creek	4.48	N/A	2	3	--	--
sird1006e	Not Assigned	Stream	Iron	31.07	Ephemeral	UNT of Feldcher Creek	N/A	N/A	2	2	--	--
sirb007e	Not Assigned	Swale	Iron	31.10	Ephemeral	UNT of Feldcher Creek	15.33	N/A	1	2	--	--
sird1005i	Not Assigned	Stream	Iron	31.11	Intermittent	UNT of Feldcher Creek	3.23	OC/DC	2	3	--	--
sird1004i	Not Assigned	Stream	Iron	31.25	Intermittent	UNT of Feldcher Creek	N/A	N/A	2	5	--	--
sird1002e	Not Assigned	Stream	Iron	31.32	Ephemeral	UNT of Feldcher Creek	N/A	N/A	1	3	--	--
WDH-103	2923800	WDH [o]	Iron	31.76	Intermittent	Feldcher Creek	<10	DC	<10 [o]	<10 [o]	--	Class II Trout, ASNRI-PNW
sasc031i	Not Assigned	Stream	Ashland	31.83	Intermittent	UNT of Tyler Forks	3.89	N/A	2	5	--	--
sasc030i	Not Assigned	Stream	Ashland	31.91	Intermittent	UNT of Tyler Forks	12.60	N/A	3	10	--	--
sirc008e_x1	Not Assigned	Ditch	Iron	31.97	Ephemeral	Ditch	11.98	N/A	2	5	--	--
sirc008e_x2	Not Assigned	Ditch	Iron	31.99	Ephemeral	Ditch	10.60	N/A	2	5	--	--
sirc006e_x1	Not Assigned	Stream	Iron	31.99	Ephemeral	Ditch	4.51	N/A	2	5	--	--
sirc006e_x2	Not Assigned	Stream	Iron	31.99	Ephemeral	Ditch	89.91	N/A	2	5	--	--

FeatureID[a]	WDNR WBIC	Feature Type	County	MP	Flow	USGS Name	Pipeline Centerline Crossing or Access Road		OHWM Width [j] (feet)	Bank Width [k] (feet)	ORW/ ERW [l]	Agency Classification
							Length (feet)	Crossing Method [c]				
sirc007e	Not Assigned	Ditch	Iron	31.99	Ephemeral	Ditch	129.99	N/A	1	5	--	--
sire002e_x1	Not Assigned	Ditch	Iron	32.02	Ephemeral	Ditch	69.13	N/A	2	4	--	--
sire002e_x2	Not Assigned	Ditch	Iron	32.05	Ephemeral	Ditch	4.13	N/A	2	4	--	--
sire001i	Not Assigned	Stream	Iron	32.15	Intermittent	UNT of Tyler Forks	5.96	N/A	3	3	--	--
WDH-104	2923800	WDH [o]	Iron	32.22	Intermittent	Feldcher Creek	<10	N/A	<10 [o]	N/A	--	Class II Trout, ASNRI-PNW
sird010e_x1	Not Assigned	Stream	Iron	32.46	Ephemeral	UNT of Feldcher Creek	11.69	N/A	7	13	--	--
sird010e_x2	Not Assigned	Stream	Iron	32.64	Ephemeral	UNT of Feldcher Creek	103.08	N/A	7	13	--	--
sira004p	2923100	River	Iron	33.43	Perennial	Tyler Forks	68.45	N/A	25	30	ORW	Class II Trout, ASNRI-PNW
sira006i_x1	Not Assigned	Ditch	Iron	33.45	Intermittent	UNT of Tyler Forks	41.29	N/A	4	6	--	--
sira005i	Not Assigned	Stream	Iron	33.45	Intermittent	UNT of Tyler Forks	5.97	N/A	4	6	--	--
sira006i_x2	Not Assigned	Ditch	Iron	33.46	Intermittent	UNT of Tyler Forks	303.70	N/A	4	6	--	--
sirb012p	2923100	River	Iron	34.04	Perennial	Tyler Forks	57.72	HDD	50	60	ORW	Class II Trout, ASNRI-PNW
sirc005e	Not Assigned	Stream	Iron	34.08	Ephemeral	UNT of Tyler Forks	6.07	HDD	6	15	--	--
sirc002p	2924100	Stream	Iron	34.31	Perennial	Vogue Creek	14.30	N/A	10	20	--	Class II Trout, ASNRI-PNW
WDH-105	2924100	WDH [o]	Iron	34.44	Perennial	Vogue Creek	<10	N/A	<10 [o]	N/A	--	Class II Trout, ASNRI-PNW
sirw002	Not Assigned	Swale	Iron	35.72	Ephemeral	UNT of Potato River	191.29	N/A	N/A	1	--	--
sira001i	Not Assigned	Stream	Iron	35.91	Intermittent	UNT of Potato River	7.43	OC/DC	6	15	--	--
sirw001	3000151	Stream	Iron	36.55	Intermittent	Coil Creek	46.78	N/A	6	8	--	Class II Trout, ASNRI-PNW
WDH-106	2907400	WDH [o]	Iron	36.84	Perennial	Coil Creek	<10	N/A	<10 [o]	N/A	--	Class II Trout, ASNRI-PNW
sirc1004e	Not Assigned	Ditch	Iron	37.03	Ephemeral	UNT of Potato River	148.60	N/A	1	3	--	--
sirc1003i	Not Assigned	Stream	Iron	37.03	Intermittent	UNT of Potato River	19.48	N/A	3	5	--	--
sirv001p	2907400	Stream	Iron	37.63	Perennial	UNT of Potato River	26.26	N/A	20	20	--	Class II Trout, ASNRI-PNW
sird001p	2906200	River	Iron	37.86	Perennial	Potato River	33.43	HDD	40	5	ORW	Class II Trout, ASNRI-PNW
sird004e	2906450	Stream	Iron	38.60	Ephemeral	UNT of Vaughn Creek	4.05	OC/DC	3	6	--	--
sird005e	2906450	Stream	Iron	38.64	Ephemeral	UNT of Vaughn Creek	N/A	N/A	3	7	--	Class II Trout, ASNRI-PNW
sird006e	Not Assigned	Stream	Iron	38.69	Ephemeral	UNT of Vaughn Creek	N/A	N/A	2	10	--	--
sird009p	2906500	Stream	Iron	39.00	Perennial	UNT of Vaughn Creek	2.00	DC	2	2.5	--	Perennial tributary of trout stream
sird011i	Not Assigned	Stream	Iron	39.35	Intermittent	UNT of Vaughn Creek	N/A	N/A	8	25	--	--
sird016p	2906300	Stream	Iron	39.56	Perennial	Vaughn Creek	22.01	HDD	10	20	ERW	Class II Trout, ASNRI-PNW
WDH-107_x2 [t]	5001801	WDH [o]	Iron	39.79	Intermittent	UNT of Vaughn Creek	<10	N/A	N/A [s]	N/A	--	--

FeatureID[a]	WDNR WBIC	Feature Type	County	MP	Flow	USGS Name	Pipeline Centerline Crossing or Access Road		OHWM Width [j] (feet)	Bank Width [k] (feet)	ORW/ ERW [l]	Agency Classification
							Length (feet)	Crossing Method [c]				
WDH-107_x1 [t]	5001801	WDH [o]	Iron	39.82	Intermittent	UNT of Vaughn Creek	<10	Trench	N/A [s]	N/A	--	--
sirc1001e	Not Assigned	Ditch	Iron	40.27	Ephemeral	UNT of Vaughn Creek	2.00	OC/DC	2	5	--	--
sbad1005e	Not Assigned	Stream	Bayfield	N/A	Ephemeral	UNT of North Fish Creek	N/A	N/A	2	5	--	--

[a] Wetland/waterbody unique identification is based on 2019/2020 field survey data and Wisconsin Wetland Inventory Desktop Mapping (DNR, 1992)

[b] Anticipated blasting areas were determined based on a multi-phase study including (1) desktop analysis of publicly available soils information including Natural Resources Conservation Service soils data, USGS bedrock outcrop data, historical well data, and geotechnical soil bore data; (2) field investigations including additional geotechnical borings, electrical resistivity imaging, and hammer probing to a depth of 12 feet or multiple probe refusal; and (3) data analysis. Areas identified as "Likely" may encounter bedrock at a depth above the planned pipeline installation depth.

[c] OC: Open trench method used in conditions of no water present at the crossing location, sometimes referred to as the “Wet Trench” method.

DC: Open trench method used in conditions where water is present in the waterbody; referred to as the “Dry Crossing” method, where the construction zone is isolated and either a dam and pump or a flume pipe are used to route water around the isolated work area.

HDD: Horizontal Directional Drill method used to install the pipeline using a trenchless technique. Crossings proposed as HDD will require temporary installation of tracking cables across waterbodies.

Direct Bore: Direct Pipe installation method used to install the pipeline using a trenchless technique.

[d] PEM = Palustrine Emergent; PSS=Palustrine Scrub Shrub; PFO = Palustrine Forested (Cowardin et al., 1979).

[e] Type 1 = Seasonally flooded basin or flat; Type 2 = Inland fresh meadow; Type 3 = Inland shallow marsh; Type 4 =Inland deep marsh; Type 6 = Shrub swamp; Type 7 = Wooded swamp; Type 8 = Bog (Shaw and Fredine, 1956).

[f] (Eggers and Reed, 2015).

[g] Acreage includes temporary workspace, operational workspace, and additional temporary workspace. Values listed as '0.00' are <0.01 acre in size.

[h] Conversion = Acreage of forested/scrub-shrub wetlands within the operational ROW that will be maintained as emergent wetlands. Values listed as '0.00' are <0.01 acre in size.

[i] Permanent Fill = Acreage of wetlands that will be permanently filled.

* Pipeline Centerline does not intersect the wetland.

\- No impact in this category.

N/A = Not Applicable

[j] OHWM: ordinary high-water mark measured as a perpendicular straight line distance from ordinary high mark to ordinary high mark

[k] Bank Width: Bank width measured as a perpendicular straight-line distance from top of bank to top of bank.

[l] ORW: outstanding resource water; ERW: exceptional resource water

[m] DNR 24K Hydrography Data feature verified as either wetland or upland during field surveys. Navigability determination completed by the DNR and feature determined to be non-navigable.

[o] Waterbody feature is shown on a public WDH data layer.

[n] Bridge types: A - Typical timber mat bridge; B - Engineered bridge 20 feet to 60 feet wide; C - Engineered bridge 60 feet wide or greater.

[p] Stream timing restriction waiver requested for installation of temporary clear span bridge

[q] Est. stream bank disturbance associated with installation of bridge headers on each stream bank, measuring approximately 25 feet by 16 feet. Actual disturbance will be based on site-specific conditions.

[r] Est. stream bottom area of trench line disturbance in square feet.

[s] Est. volume of excavation material based on a trench width of 18 ft wide at the top, 6 ft wide at the bottom, and 7 ft depth of trench crossing distance. Actual volume will be dependent on-site conditions.

[t] Feature was field reviewed by DNR Staff and determined to be non-navigable.

[u] Existing culvert present. Will require matting/spanning to prevent damage.

[v] Existing snowmobile bridge present. Will require upgrades or require spanning to support construction traffic.

[w] Pipeline centerline does not cross feature; however, a 9-foot buffer on the pipeline centerline may intersect the wetland. This feature has therefore been conservatively included in the crossing method column

Table 5.7-2 Proposed waterway crossings along RA-01.

Feature type	County	Latitude	Longitude	Flow regime	Name[a]
Stream/River	Ashland	46.5459178	-90.8479226	Intermittent	UNT
Stream/River	Ashland	46.5422732	-90.8485887	Intermittent	UNT
Stream/River	Ashland	46.5390363	-90.8491980	Perennial	Little Beartrap Creek
Stream/River	Ashland	46.5299471	-90.8486874	Perennial	Beartrap Creek
Artificial path	Ashland	46.5172467	-90.8407271	No attributes	White River
Stream/River	Ashland	46.4967990	-90.8358837	Intermittent	UNT
Stream/River	Ashland	46.4790971	-90.8305158	Intermittent	Hyms Creek
Stream/River	Ashland	46.4691180	-90.8275807	Intermittent	Meadow Creek
Stream/River	Ashland	46.4653695	-90.8264591	Intermittent	UNT
Stream/River	Ashland	46.4340963	-90.8162425	Intermittent	UNT
Artificial path	Ashland	46.4277590	-90.8138166	No attributes	Marengo River
Stream/River	Ashland	46.4201872	-90.8069333	Perennial	Brunsweiler River
Stream/River	Ashland	46.4105348	-90.7976213	Intermittent	UNT
Stream/River	Ashland	46.4099218	-90.7976082	Intermittent	UNT
Stream/River	Ashland	46.4097993	-90.7976056	Intermittent	UNT
Stream/River	Ashland	46.4068444	-90.7937690	Intermittent	UNT
Stream/River	Ashland	46.4068815	-90.7911001	Intermittent	UNT
Stream/River	Ashland	46.4069520	-90.7855240	Intermittent	UNT
Stream/River	Ashland	46.4070182	-90.7782105	Intermittent	UNT
Stream/River	Ashland	46.4070247	-90.7736116	Perennial	Trout Brook
Stream/River	Ashland	46.4070096	-90.7632348	Intermittent	Billy Creek
Stream/River	Ashland	46.4073107	-90.7542894	Intermittent	UNT
Stream/River	Ashland	46.4072514	-90.7484300	Perennial	UNT
Stream/River	Ashland	46.4065668	-90.7406591	Intermittent	UNT
Stream/River	Ashland	46.4062146	-90.7362353	Intermittent	UNT
Stream/River	Ashland	46.4061042	-90.7265720	Perennial	Silver Creek
Stream/River	Ashland	46.4068210	-90.7172469	Intermittent	UNT
Stream/River	Ashland	46.4069419	-90.7130284	Intermittent	UNT
Stream/River	Ashland	46.4070187	-90.7002150	Intermittent	UNT
Stream/River	Ashland	46.4062348	-90.6945765	Intermittent	Billy Creek
Stream/River	Ashland	46.4031499	-90.6827724	Intermittent	UNT
Stream/River	Ashland	46.4011511	-90.6744666	Intermittent	UNT
Artificial path	Ashland	46.3955453	-90.6404936	No attributes	Bad River
Stream/River	Ashland	46.3975252	-90.6291910	Intermittent	UNT
Artificial path	Ashland	46.3995150	-90.5808608	No attributes	Tyler Forks
Stream/River	Ashland	46.3989683	-90.5717330	Intermittent	Feldcher Creek
Artificial path	Iron	46.4194639	-90.5370815	No attributes	Tyler Forks
Stream/River	Iron	46.4578586	-90.5089716	Intermittent	UNT
Artificial path	Iron	46.4623108	-90.5054042	No attributes	Potato River
Stream/River	Iron	46.4747359	-90.5053567	Intermittent	UNT
Stream/River	Iron	46.4804911	-90.5086242	Intermittent	UNT
Stream/River	Iron	46.4838399	-90.5087944	Intermittent	UNT
Stream/River	Iron	46.4872838	-90.5075408	Perennial	Vaughn Creek
Stream/River	Iron	46.4971487	-90.5068388	intermittent	UNT

[a] UNT - Unnamed Tributary

Table 5.7-3 Proposed waterway crossings along RA-02.

Feature type	County	Latitude	Longitude	Flow regime	Name [a]
Stream/River	Bayfield	46.54908988	-91.01066589	Intermittent	UNT
Artificial Path	Bayfield	46.54237376	-91.01007785	No attributes	South Fish Creek
Stream/River	Bayfield	46.53742356	-91.00627085	Intermittent	UNT
Stream/River	Bayfield	46.53085203	-91.00628504	Perennial	UNT
Stream/River	Bayfield	46.52774822	-91.00629254	Intermittent	UNT
Stream/River	Bayfield	46.49930913	-91.00246397	Intermittent	UNT
Stream/River	Bayfield	46.48747188	-91.0004153	Intermittent	UNT
Stream/River	Bayfield	46.47729271	-0.99825908	Intermittent	UNT
Artificial Path	Bayfield	46.47335104	-0.99835119	No attributes	White River
Stream/River	Bayfield	46.46623921	-90.9919468	Intermittent	UNT
Stream/River	Bayfield	46.44427782	-0.96926828	Intermittent	UNT
Stream/River	Bayfield	46.42183653	-0.93785015	Intermittent	UNT
Stream/River	Bayfield	46.4207342	-0.93226214	Intermittent	UNT
Stream/River	Bayfield	46.41694954	-90.92579218	Intermittent	UNT
Stream/River	Ashland	46.4147438	-90.91372183	Perennial	Marengo River
Stream/River	Ashland	46.41430531	-90.91217636	Perennial	Troutmere Creek
Stream/River	Ashland	46.41314171	-90.90847422	Intermittent	UNT
Stream/River	Ashland	46.41245499	-90.90631356	Intermittent	UNT
Stream/River	Ashland	46.41197462	-90.90480218	Intermittent	UNT
Stream/River	Ashland	46.41005566	-90.89938312	Intermittent	UNT
Stream/River	Ashland	46.40774847	-90.89090103	Intermittent	UNT
Stream/River	Ashland	46.40539271	-90.88353912	Intermittent	UNT
Stream/River	Ashland	46.403693	-90.87858878	Intermittent	UNT
Stream/River	Ashland	46.40205354	-90.87350598	Intermittent	UNT
Stream/River	Ashland	46.40098721	-90.87020005	Intermittent	UNT
Stream/River	Ashland	46.39964677	-90.86599295	Intermittent	UNT
Stream/River	Ashland	46.3986814	-90.8629402	Intermittent	UNT
Stream/River	Ashland	46.3977690	-90.8600548	Intermittent	UNT
Stream/River	Ashland	46.3975334	-90.8593098	Intermittent	UNT
Stream/River	Ashland	46.3958851	-90.8540973	Intermittent	UNT
Stream/River	Ashland	46.3926930	-90.8258141	Perennial	Brunsweiler River
Stream/River	Ashland	46.3821057	-90.8117150	Intermittent	UNT
Stream/River	Ashland	46.3796661	-90.8054312	Intermittent	UNT
Stream/River	Ashland	46.3766853	-90.7960663	Intermittent	UNT
Stream/River	Ashland	46.3680777	-90.7714551	Perennial	Trout Brook
Stream/River	Ashland	46.3601622	-90.7490178	Intermittent	UNT
Stream/River	Ashland	46.3563433	-90.7420843	Perennial	UNT
Stream/River	Ashland	46.3534075	-90.7307164	Perennial	Silver Creek
Stream/River	Ashland	46.3500766	-90.7218731	Perennial	UNT
Stream/River	Ashland	46.3464596	-90.7122699	Perennial	UNT
Stream/River	Ashland	46.3441504	-90.7061391	Perennial	UNT
Stream/River	Ashland	46.3397784	-90.6839350	Perennial	Krause Creek
Stream/River	Ashland	46.3385276	-90.6838952	Perennial	Krause Creek
Stream/River	Ashland	46.3383389	-90.6838892	Perennial	Krause Creek

Feature type	County	Latitude	Longitude	Flow regime	Name [a]
Artificial Path	Ashland	46.3155421	-90.6811528	No attributes	Bad River
Stream/River	Ashland	46.3057208	-90.6572682	Intermittent	UNT
Stream/River	Ashland	46.3005407	-90.6401994	Perennial	UNT
Stream/River	Ashland	46.3019167	-90.6391082	Perennial	City Creek
Artificial Path	Ashland	46.3072814	-90.6372804	No attributes	UNT
Stream/River	Ashland	46.3073085	-90.6374558	Perennial	UNT
Stream/River	Ashland	46.3099109	-90.6369220	Perennial	Devils Creek
Stream/River	Ashland	46.3128220	-90.6365252	Intermittent	UNT
Stream/River	Ashland	46.3186331	-90.6363577	Perennial	UNT
Connector	Ashland	46.3238498	-90.6265588	No attributes	UNT
Stream/River	Ashland	46.3238390	-90.6265491	Perennial	UNT
Stream/River	Ashland	46.3288803	-90.6128844	Intermittent	UNT
Stream/River	Ashland	46.3278287	-90.6068951	Intermittent	UNT
Stream/River	Iron	46.3376130	-90.5253561	Perennial	Dunn Creek
Stream/River	Iron	46.3425517	-90.5168288	Perennial	Javorsky Creek
Artificial Path	Iron	46.3478238	-90.4945473	No attributes	Tyler Forks
Stream/River	Iron	46.3480183	-90.4902935	Intermittent	UNT
Stream/River	Iron	46.3515203	-90.4785859	Perennial	UNT
Stream/River	Iron	46.3568203	-90.4649336	Perennial	Rouse Creek
Stream/River	Iron	46.3579035	-90.4610358	Perennial	UNT
Stream/River	Iron	46.3617095	-90.4474434	Perennial	UNT
Stream/River	Iron	46.3637471	-90.4399798	Perennial	Erickson Creek
Stream/River	Iron	46.3657834	-90.4325466	Perennial	UNT
Stream/River	Iron	46.3663831	-90.4303424	Perennial	UNT
Stream/River	Iron	46.3694812	-90.4199306	Perennial	UNT
Stream/River	Iron	46.3705233	-90.4166192	Perennial	UNT
Stream/River	Iron	46.3713875	-90.4119281	Perennial	Potato River
Stream/River	Iron	46.3714434	-90.4040277	Perennial	UNT
Stream/River	Iron	46.3793791	-90.3744035	Intermittent	UNT
Stream/River	Iron	46.3819148	-90.3683111	Intermittent	UNT
Stream/River	Iron	46.3934246	-90.3470405	Intermittent	UNT
Stream/River	Iron	46.4379854	-90.2369549	Perennial	West Fork Montreal River

[a] UNT = Unnamed tributary

Table 5.7-4 Proposed waterway crossings along RA-03.

Feature type	County	Latitude	Longitude	Flow regime	Name[a]
Stream/River	Bayfield	46.5619009	-91.5084833	Perennial	Muskeg Creek
Stream/River	Bayfield	46.3322455	-91.3901071	Intermittent	UNT
Artificial Path	Bayfield	46.3237996	-91.3746957	No attributes	UNT
Stream/River	Bayfield	46.3188166	-91.3661017	Intermittent	UNT
Artificial Path	Bayfield	46.2008527	-91.2434781	No attributes	Namekagon River
Stream/River	Bayfield	46.1994679	-91.2419142	Perennial	Spring Creek
Stream/River	Bayfield	46.1967547	-91.2397582	Perennial	Spring Creek
Stream/River	Bayfield	46.1954986	-91.2306298	Perennial	Cap Creek
Stream/River	Bayfield	46.1864953	-91.2006352	Perennial	UNT
Stream/River	Bayfield	46.1856319	-91.1649599	Perennial	Cap Creek
Stream/River	Bayfield	46.1917527	-90.9755221	Perennial	West Fork Chippewa River
Stream/River	Bayfield	46.1916892	-90.9629559	Perennial	West Fork Chippewa River
Stream/River	Bayfield	46.1914014	-90.9601454	Perennial	West Fork Chippewa River
Stream/River	Bayfield	46.1911011	-90.9574982	Perennial	West Fork Chippewa River
Stream/River	Bayfield	46.1906025	-90.9531021	Perennial	West Fork Chippewa River
Stream/River	Bayfield	46.1896908	-90.9450649	Perennial	UNT
Stream/River	Bayfield	46.1836803	-90.9365979	Perennial	West Fork Chippewa River
Stream/River	Bayfield	46.1833431	-90.9358653	Perennial	West Fork Chippewa River
Stream/River	Bayfield	46.1829329	-90.9350839	Perennial	West Fork Chippewa River
Artificial Path	Bayfield	46.1829329	-90.9350839	No attributes	West Fork Chippewa River
Artificial Path	Bayfield	46.1811840	-90.9331274	No attributes	UNT
Stream/River	Ashland	46.1722247	-90.9095225	Perennial	West Fork Chippewa River
Artificial Path	Ashland	46.1747714	-90.8908348	No attributes	UNT
Stream/River	Ashland	46.1748999	-90.8906308	Perennial	UNT
Stream/River	Ashland	46.1748206	-90.8830055	Perennial	UNT
Stream/River	Ashland	46.1779426	-90.8250247	Perennial	Dingdong Creek
Stream/River	Ashland	46.1768350	-90.6308905	Perennial	UNT
Stream/River	Ashland	46.1787675	-90.6232737	Perennial	UNT
Stream/River	Ashland	46.1854507	-90.5884709	Perennial	Dryden Creek
Stream/River	Ashland	46.1833232	-90.5407876	Perennial	Meyers Creek
Stream/River	Ashland	46.1883194	-90.5137871	Perennial	Magee Creek
Stream/River	Ashland	46.2087991	-90.4273329	Perennial	Augustine Creek
Stream/River	Iron	46.2134691	-90.4076187	Perennial	Augustine Creek
Stream/River	Iron	46.2140619	-90.4051162	Perennial	Augustine Creek
Stream/River	Iron	46.2149784	-90.4012471	Perennial	Augustine Creek
Stream/River	Iron	46.2209440	-90.3760634	Perennial	Augustine Creek
Stream/River	Iron	46.2595859	-90.3261679	Intermittent	UNT
Stream/River	Iron	46.2650241	-90.3204173	Perennial	Pleasant Lake Outlet

Feature type	County	Latitude	Longitude	Flow regime	Name[a]
Stream/River	Iron	46.2682111	-90.3170472	Perennial	UNT
Stream/River	Iron	46.2703832	-90.3147503	Perennial	UNT
Stream/River	Iron	46.2821339	-90.3023246	Intermittent	UNT
Stream/River	Iron	46.3014657	-90.2818821	Perennial	UNT
Stream/River	Iron	46.3169280	-90.2695083	Perennial	UNT
Artificial Path	Iron	46.3434022	-90.2664222	No attributes	UNT
Stream/River	Iron	46.3634370	-90.2640868	Intermittent	UNT
Connector	Iron	46.3670720	-90.2636631	No attributes	UNT
Stream/River	Iron	46.3670785	-90.2636798	Intermittent	UNT
Stream/River	Iron	46.3814707	-90.2619846	Intermittent	UNT
Stream/River	Iron	46.3849261	-90.2615818	Perennial	East River
Stream/River	Iron	46.3925359	-90.2606948	Intermittent	UNT
Stream/River	Iron	46.4057362	-90.2591561	Perennial	UNT
Stream/River	Iron	46.4316101	-90.2304786	Perennial	West Fork Montreal River
Stream/River	Iron	46.4528870	-90.2213239	Perennial	UNT
Stream/River	Iron	46.4786045	-90.2179234	Perennial	Kaari Creek
Stream/River	Iron	46.4891736	-90.2174698	Perennial	Kaari Creek
Stream/River	Iron	46.4892534	-90.2174850	Perennial	UNT
Stream/River	Iron	46.4895529	-90.2174653	Perennial	Kaari Creek
Stream/River	Iron	46.4896418	-90.2174642	Perennial	Kaari Creek

[a] UNT = Unnamed Tributary

5.7.1 Lake Superior & Mississippi River Basins

Enbridge's proposed Line 5 relocation route and route alternatives are located within the Lake Superior Basin (Figure 3.4-1; Figure 5.7-1). Lake Superior is the largest freshwater body in the world, covering an area of 31,700 square miles, and is the third largest freshwater lake in the world by volume. Lake Superior is the deepest Great Lake having a maximum depth of 1,332 feet and the coldest having an average water temperature of 40° F. Land use within the lake basin is primarily forested, with very little agriculture due to the cool climate and poor soils. Lake Superior discharges into Lake Huron, which eventually flows to the St. Lawrence Seaway through Lakes Erie and Ontario (DNR, 2015b). The lake (Gichiigaming) is a significant cultural resource for the Ojibwe people who reside in the area (Section 4.2.1.4), particularly for the Bad River and Red Cliff Bands of Lake Superior Chippewa Indians.

Within the Lake Superior Basin, Enbridge's proposed wetland and waterbody crossings are located within the watersheds of streams tributary to Lake Superior including the Fish Creek, Lower Bad River, White River, Marengo River, Upper Bad River, Tyler Forks, Potato River, and Montreal River watersheds (Figure 4.1-3). RA-01 crosses the same watersheds as Enbridge's proposed relocation route but does not extend into the Fish Creek watershed. RA-02 is in the same watersheds as Enbridge's proposed relocation route. Within the Lake Superior Basin, RA-03 is located outside of the Bad River watershed within the Montreal River, Bois Brule River, and Iron River watersheds (Figure 3.4-1).

RA-03 extends into the Mississippi River Basin while crossing through the watersheds of the East Fork Chippewa River, the West Fork Chippewa River, the Upper Namekagon River, the Totagatic River, and the Upper St. Croix and Eau Claire River (Section 3.4.2.3; Figure 3.4-1).

5.7.2 Lake Superior Management Plans

The restoration and protection of Lake Superior has been a priority focus of the United States and Canadian governments. The DNR's Office of Great Waters works closely with partners and other DNR programs on a range of efforts centered on Lake Superior and the basin's natural resources. This work is guided by various management programs and plans that align with each other.

The United States and Canada developed a Binational Program to Restore and Protect the Lake Superior Basin. The Binational Program focuses on the entire Lake Superior ecosystem–air, land, and water–to restore degraded areas and protect this unique headwater lake for the people and wildlife that use it. The Binational Program is administered by federal, tribal, provincial, and state agencies through the Superior Work Group and Task Force with the assistance of a public involvement and outreach group known as the Lake Superior Binational Forum.

The Lake Superior Lakewide Action and Management Plan (LAMP), developed by the Binational Program, is an ecosystem-based strategy for protecting and restoring Lake Superior (Environment and Climate Change Canada, 2023). The Lake Superior LAMP is updated and implemented to facilitate information sharing, set priorities, and coordinate binational environmental protection and restoration activities. The Lake Superior LAMP outlines the commitments made by the U.S. and Canadian governments under the binational Great Lakes Water Quality Agreement.

The DNR's Lake Superior Action Plan establishes priorities for Wisconsin's portion of the Lake Superior basin and identifies actions that DNR will take to accomplish objectives in the LAMP and Great Lakes Water Quality Agreement (DNR, 2020a). The priorities and actions identified by the DNR's resource managers align with other existing regional plans, including runoff management efforts focused on restoring and protecting regional hydrology by "slowing the flow." A partnership of landowners, communities, and other agencies and organizations in the Lake Superior basin developed the priorities and actions.

The Binational Program's Lake Superior Biodiversity Conservation Strategy contributes to a Great Lakes Water Quality Agreement commitment to develop lake-wide habitat and species protection and restoration conservation strategies (Lake Superior Binational Program, 2015). The Strategy provides a common framework for the implementation of actions and for assessing and reporting on shared progress. The Biodiversity Conservation Strategy indicates that the overall health of Lake Superior is "Good," and the lake is in a state of health that is within the natural range of variation, but some management intervention may be required for some elements.

The DNR's Lake Superior Fisheries Management Plan (DNR, 2020b) guides management of sport and commercial fisheries management in Wisconsin's Lake Superior waters for the 2020-2029 period. The goals, objectives, and tactics discussed in the plan provide a framework for the DNR's management of Wisconsin's Lake Superior fisheries to benefit the state's citizens within the productive capacity of the resources.

5.7.3 Bad River Watershed

Enbridge's proposed Line 5 relocation route, RA-01, and RA-02 are primarily located within the Bad River watershed (Figure 3.4-1; Figure 4.1-3). The Bad River watershed is one of the largest watersheds in the Great Lakes Basin draining over 1,000 square miles. The watershed drains parts of Bayfield, Ashland, and Iron counties and can be divided into six major sub-watersheds: the Upper Bad River, Lower Bad River, White River, Marengo River, Tyler Forks, and Potato River. The DNR includes Beartrap Creek, Wood Creek Slough, and the Kakagon River sub-watersheds within the Lower Bad River watershed, in part, owing to the connections between the Kakagon Slough and Bad River Slough along the coast of Lake Superior (DNR, 2020c; Bad River Watershed Association, 2020). Enbridge's proposed Line 5 relocation route crosses through all six sub-watersheds (Figure 4.1-3).

The hydrology of the Bad River watershed was evaluated by the USGS in 2015 as part of a modeling effort focused on surface and groundwater interactions in the watershed (USGS, 2015). The Bad River watershed was divided into three hydrogeographic zones: the southern uplands, transition zone, and Lake Superior lowlands. The southern uplands are located south of the Penokee Hills-Gogebic Range (Section 5.5.1.3) and are primarily located within the North Central Forest Ecological Landscape (Section 5.9.1.2). The area has low relief and has a layer of sandy glacial sediments over crystalline bedrock. Drainage patterns are primarily dendritic, a common drainage pattern that resembles the branching of tree roots. Stream base flows are low in comparison to total stream flows (USGS, 2015). This area extends south from the southern side of the Gogebic Range and as such is south of the southern limit of Enbridge's proposed Line 5 relocation route, although RA-02 and RA-03 cross through this area.

The transition zone includes the Penokee Hills-Gogebic Range. Glacial deposits in the transition zone are thin to absent. Local bedrock units are steeply north-dipping metamorphosed sedimentary rocks and igneous rocks. Groundwater flow patterns are likely from local topographic high to nearby perennial streams. Groundwater flow is generally through interconnected bedrock fractures or thin layers of glacial sediments. Streams tend to have trellised drainage patterns resulting from the underlying bedrock fracture and faulting patterns. Stream base flows are low in comparison to total stream flows. Numerous springs and perennial headwater streams occur in the transition zone (USGS, 2015). The southern central section of Enbridge's proposed route and sections of RA-02 and RA-03 cross through the transition zone.

The Superior lowlands zone, which is located within the Lake Superior Coastal Plain Ecological Landscape (Section 5.9.1.1), extends from the transition zone to Lake Superior. Precambrian sandstones and conglomerates of the Oronto and Bayfield groups occur beneath glacial sediments of the Miller Creek and Copper Falls formations (Section 5.5.1.2). Local glacial lake sandy beach deposits at the southern extent of the Miller Creek Formation connect with outwash and sandy tills of the Copper Falls Formation. The

USGS considered the sandstones and conglomerates of the bedrock aquifer as providing most of the local groundwater supply capacity (USGS, 2015). The mantle of the clayey Miller Creek Formation over the water bearing units results in artesian conditions to the north.

Drainage patterns in the Superior lowlands zone tend to be dendritic. In the Superior lowlands, larger rivers that cut through the clayey layer of the Miller Creek Formation, such as the White River, have higher ratios of base flow to total flow. Small streams that are entirely within the clayey materials tend to be flashy and have low ratios of base flow to total flow (USGS, 2015). Enbridge's proposed Line 5 relocation route and route alternatives cross through the Superior lowlands. RA-01 is located entirely within the Superior lowlands.

The lower Bad River watershed reflects a river carrying a significant load of sediment and capable of carrying a tremendous amount of water. Clayey soils limit infiltration of precipitation and result in rapid runoff following precipitation. Stream water levels rise rapidly in response to runoff. Sand layers interbedded in the clayey sediments increase the erodibility and instability of streambanks, and the rivers can move tremendous amounts of sand downstream. Eroded bank sediments contribute to stream sediment loads and turbid waters; fine clayey sediments generally cannot settle in moving waters and can contribute to sediment plumes where these waterways discharge into Lake Superior. Section 5.6 discusses erosion and sedimentation concerns in more detail. In addition to erosion of soils, significant amounts of woody debris can be mobilized by the erosive and transport capacities of the river.

In 1970s, a plan to reduce erosion and sedimentation in Lake Superior tributaries was developed. An interagency committee worked with private landowners to implement and assess the efficacy of a variety of projects intended to reduce erosion and sedimentation (F. A. Fitzpatrick, Peppler, et al., 2015). These efforts largely focused on restoring and protecting hydrology by "slowing the flow" using a watershed-scale hydrologic restoration approach. Local natural resource managers and partners have implemented forest management, wetland restoration, channel restoration, agricultural BMPs, and green infrastructure projects to restore a natural hydrologic regime, with an expectation of improvements to water quality and habitat. Demonstration and restoration projects in the basin have been implemented since the mid-20th Century.

The USGS studied the Bad River sources of sediments, sediment movement, and sediment deposition. The preliminary results of the ongoing study were that the erosion, transport, and deposition of sediment in the Bad River watershed are elevated above pre-settlement rates. Changed rates were interpreted to result from watershed land use practices and more frequent large floods (Section 7.3.4). The primary source of sediments was interpreted to be landslides/bluff erosion along the river main stems and tributaries that flow in valleys having sandy deposits. Rates of sediment erosion, sediment transport, and sediment deposition are dependent on watershed and local geologic setting and position within the drainage network (USGS, 2016). The USGS has identified the Bad River as having the highest sediment load of all tributaries to Lake Superior, and the Marengo River is estimated to be the largest contributor of sediment to the Bad River. The USGS (2016) considered the river sediment loadings a possible threat to the Kakagon and Bad River Sloughs coastal wetland complex, a culturally significant resource (Section 4.2.1.5).

The Bad River watershed remains largely forested and at risk of experiencing the effects of clearcutting and logging traffic in areas of erodible soils. Much of this watershed was at one time covered by boreal forest and mixed conifers, species that protected the easily disturbed soils with their deeper root systems, protective canopies, and relationship with soil moisture. Today these forests are dominated by aspen and low-quality second growth hardwoods (DNR, 2015b). Maintenance of vegetation within the watershed helps to lower the speed of runoff and decreases stream flashiness that leads to streambank erosion and subsequent sedimentation in aquatic habitats.

Concerns about anticipated cumulative effects of Enbridge's proposed Line 5 relocation on the Bad River watershed have been raised. For example, in a letter to the USACE, the former chairman of the Bad River Band argued, "The Reservation and watershed are already facing numerous environmental stressors from other impending projects and past industrial contamination…" including "the disruptive effects of the Xcel transmission line, hazardous liquid leaks from oil tankers and steel plants, and runoff and mercury deposition from new and historic mining in the region" (Wiggins Jr., 2022b).

5.7.3.1 Bay City Creek

Bay City Creek is a relatively short (less than five miles long) stream that flows northeasterly from its headwaters in open agricultural lands through the City of Ashland into Lake Superior's Chequamegon Bay, just to the west of the Bad River Reservation and about 500 feet from the City of Ashland's drinking water intake. Bay City Creek is a generally turbid, warmwater stream with an unstable bottom of silt and sand (Figure 4.1-3). More than 30 storm drains lead directly into the creek and the city's main snow storage is on the banks of the corridor. Bay City Creek supports warmwater forage fish. Enbridge proposes crossing Bay City Creek using dry crossing trench construction (Section 2.5.1; Table 5.7-1).

5.7.3.2 Bad River

The Bad River (Figure 2.1-5) originates in Caroline Lake then flows north to Lake Superior. The upstream portion has a moderate gradient. The middle portion, in the Mellen area, is a bedrock and boulder bottomed section of high gradient with rapids and several waterfalls, including the falls in Copper Falls State Park. The downstream one-third tends to be broad and sluggish with a low gradient and is significantly influenced by Lake Superior seiche effects. Except for the areas of bedrock, the stream has mostly a sand bottom. A 6.5-mile stretch of the river is considered an exceptional resource water. Numerous tributaries contribute their flow to the Bad River, including the White, Marengo, Tyler Forks, and Potato rivers and their tributaries. Sediment and erosion dynamics within the watershed are summarized in the preceding introduction and in Section 5.6.

The Bad River is characterized as a cool-warm water mainstem fishery and is important for spawning walleye and lake sturgeon. The river also supports annual migratory runs of trout and salmon species. Other fish found in the lower portion of the river include muskellunge, northern pike, rock bass, pumpkinseeds, bullheads, black crappies, smallmouth bass, and yellow perch (DNR, 2020c). The main stem of the Bad River, downstream of the confluence with the Marengo River, supports a diverse fish community, with lake sturgeon and walleye being the most well-known species inhabiting this portion of the river (Bad River Band of Lake Superior Chippewa, 2001). The Upper Bad River, upstream of the confluence with the Marengo River, along with the rivers' major tributaries, contain resident brook and brown trout, and provide spawning and nursery areas for numerous other species (Bad River Band of Lake Superior Chippewa, 2001). The Bad River provides an important subsistence fishery for the Bad River Band, and the Bad River Falls is a traditional site for fishing lake sturgeon, walleye, and muskellunge (Wiggins Jr., 2022a; Leoso, 2022).

Enbridge proposes crossing the Bad River using HDD methods and crossing unnamed tributaries of the Bad River using a combination of open cut and dry crossing trench construction (Section 2.5.2; Table 5.7-1).

5.7.3.3 Kakagon River

The Kakagon River is a short (approximately 1 mile long), broad, sluggish, low-gradient stream that drains into the Kakagon Slough. The stream corridor is mostly shrub swamp. Flows fluctuate considerably like those of other rivers in the area. Fish species composition includes northern pike, walleye, largemouth bass, panfish, suckers, and minnows. Beaver and waterfowl use portions of the stream. Enbridge does not propose crossing the Kakagon River as part of the Line 5 relocation project but does propose crossing the Bad River raising concerns due to the interconnected nature of the Kakagon and Bad River Sloughs.

5.7.3.4 Kakagon & Bad River Sloughs

The Kakagon and Bad River Sloughs are located at the mouths of the Kakagon and Bad rivers where these waterways drain into Lake Superior (Figure 5.7-1). Located landward of a coastal barrier spit, the sloughs are protected from the wave energy of Lake Superior. The DNR describes the basic geometry of the Bad River Slough as a 173-acre lake having a maximum depth of 24 feet and the Kakagon Slough as a 71-acre lake having a maximum depth of 26 feet (DNR, 2021c). In the Wisconsin Land Legacy Report, the Kakagon and Bad River Sloughs are described as an extensive estuary with very significant ecological values (DNR, 2006). The Wisconsin Wetland Association (WWA, 2015) describe the Kakagon and Bad River Sloughs as one of the highest quality coastal wetland systems in the entire Great Lakes and identified them as a Wetland Gem®. The USFWS described the system as composed of sloughs, bogs, and coastal lagoons that harbor the largest natural wild rice bed on the Great Lakes (USFWS, 2019a). The complex is a significant cultural resource for the Ojibwe people who reside in the area (Section 4.2.1.5), being closely tied to the Bad River Band's origin story (Section 4.2.1.1).

The Kakagon and Bad River Sloughs are considered outstanding resource waters. In 2012, the Kakagon and Bad River Sloughs were officially recognized as a Ramsar Wetland of International Importance and designated as site number 2001. Ramsar wetlands are sites that meet the criteria for identifying wetlands of international importance in accordance with an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Wetlands of international importance are significant in terms of ecology, botany, zoology, limnology, or hydrology (Ramsar, 2021). According to the USFWS, the Kakagon Sough was recognized as a National Park Service National Natural Landmark, Nature Conservancy Priority Conservation Area, Wisconsin Land Legacy Place, Wisconsin Bird Conservation Initiative Important Bird Area, and Wisconsin Coastal Wetland Primary Inventory Site. The Kakagon and Bad River Sloughs are identified as Conservation Areas in the Bad River Reservation Integrated Resources Management Plan (Bad River Band of Lake Superior Chippewa, 2001).

Figure 5.7-2 The Kakagon and Bad River Sloughs estuary and Chequamegon Point.
Photo: Christina Isenring, DNR

5.7.3.5 Beartrap Creek

Beartrap Creek (Figure 2.1-1) is a warmwater drainage stream that flows in the Kakagon Slough. Minnows, creek chubs, and trout perch inhabit the stream, along with northern pike. An 11-mile stretch of the river is considered an outstanding resource water. Beartrap Creek exhibits extreme fluctuations in flow and water levels due to rapid runoff from agricultural lands in its headwaters area. It carries the highest amount of sediment among the streams entering the sloughs. The wetlands near its outlet provide habitat for waterfowl and other migratory birds. Beavers are present along some stretches. Enbridge proposes crossing Beartrap Creek using a combination of open cut and dry crossing trench construction (Section 2.5.1; Table 5.7-1).

5.7.3.6 Little Beartrap Creek

Little Beartrap Creek is a 6.67-mile-long river that flows through Ashland County. Enbridge proposes crossing Little Beartrap Creek and its unnamed tributaries using a combination of open cut and dry crossing trench construction (Section 2.5.1; Table 5.7-1).

5.7.3.7 White River

The White River (Figure 2.1-2) forms at the confluence of the East, West, and South Forks of the White River southwest of Enbridge's proposed Line 5 relocation route and eventually connects to the mainstem of the Bad River in the Lower Bad River Watershed. The White River watershed is primarily forest (75.10%), wetland (14.60%), and a mix of grassland (4.90%) and other uses (5.30%). The White River is a Class I trout stream for brook and brown trout for the first two river miles, and from there to the confluence with the Bad River, the stream is classified as a Class II trout water. The river supports migratory fish species from Lake Superior to the White River Flowage dam in western Ashland County (DNR, 2020d). Mattes and Nelson (2001) found evidence of adult and larval lake sturgeon successfully using the upper reaches and spawning in the area. Enbridge proposes crossing the White River using HDD methods and crossing unnamed tributaries of the White River with a combination of HDD methods, open cut, and dry crossing trench construction (Section 2.5.2; Table 5.7-1).

5.7.3.8 Deer Creek

Deer Creek is a tributary to the White River. This small stream has an unstable sand bottom, extreme fluctuations in water levels, and poor in-stream cover. Enbridge proposes crossing the Deer Creek using HDD methods and crossing unnamed tributaries of Deer Creek with a combination of HDD methods, open cut, and dry crossing trench construction (Section 2.5.2; Table 5.7-1).

5.7.3.9 Rock Creek

Rock Creek is a 5.53-mile-long stream that flows through Bayfield and Ashland counties before emptying into the White River. Enbridge proposes crossing Rock Creek using dry crossing trench construction techniques and crossing unnamed tributaries of Rock Creek with a combination of open cut and dry crossing trench construction (Section 2.5.1; Table 5.7-1).

5.7.3.10 Marengo River

The Marengo River (Figure 2.1-3) originates in Bayfield County, curves through a region of lakes, wetlands, forests, and high hills in the Gogebic Range, then flows down through the transition zone of sandy soils into a region of red clay soils and lands cleared for agriculture, before flowing into the Bad River Indian Reservation to meet the Bad River. The river drains more than 80 square miles of Bayfield County before crossing into Ashland County. Land use in the Marengo River watershed is primarily forest

(63.80%), wetland (25.40%) and a mix of grassland (5.40%) and other uses (5.50%). Generally, the river has an unstable bottom and a low gradient. The river is a cool water (cold–transitional) fishery. Cold-water fishes are common to uncommon, transitional fishes are abundant to common, and warmwater fishes are uncommon to absent (DNR, 2020e). The lower stretches of the river are classified as a Class III trout stream and the upper reaches are a Class II trout stream. Minnow species are the most common species encountered. Migrating sea lamprey from Lake Superior historically spawned in the lower reaches of the Marengo River.

The Marengo River and its watershed have been the focus of several recent studies focused on characterizing its geomorphology and hydrologic condition (F. A. Fitzpatrick, 2005b; Cahow and Fitzpatrick, 2005; Bad River Watershed Association, 2012). The focus on the Marengo River comes in large part because it is estimated to be the largest contributor of sediment to the Bad River. The Marengo River Watershed has become a focus area for highlighting “slow the flow,” the key management strategy for reducing sedimentation in the Lake Superior Basin. Section 5.6-7 discusses fluvial erosion concerns that are prevalent in the watershed. Enbridge proposes crossing the Marengo River using direct bore methods and crossing unnamed tributaries of the Marengo River with a combination of direct bore methods, open cut, and dry crossing trench construction (Section 2.5.2.1).

5.7.3.11 Billy Creek

Billy Creek is a small spring-fed, Class I trout stream tributary to the Marengo River. Land cover surrounding Billy Creek is comprised primarily of upland hardwoods, but several of its intermittent feeder streams drain open agricultural lands in the watershed. Billy Creek supports a small naturally reproducing trout population as well as migratory Lake Superior trout and salmon species. Enbridge proposes crossing Billy Creek using HDD methods and crossing unnamed tributaries of Billy Creek with a combination of HDD methods, open cut and dry crossing trench construction (Section 2.5.2; Table 5.7-1).

5.7.3.12 Silver Creek

Silver Creek, a small, spring-fed, Class II and Class III trout stream with good water quality, flows north into the Marengo River. Stream bank cover is predominantly upland hardwoods, with some streambank pasturing. Although the water quality in Silver Creek has traditionally been good, water levels in the stream fluctuate considerably. Rainbow trout are most abundant and reproduce well in this stream. Brook trout are also common. Occasionally, migratory rainbow trout enter the stream from Lake Superior by way of the Bad River. Enbridge proposes crossing Silver Creek using HDD methods and crossing unnamed tributaries of Silver Creek with a combination of HDD methods, open cut, and dry crossing trench construction (Section 2.5.1; Table 5.7-1).

5.7.3.13 Brunsweiler River

This 22-mile-long stream has several warmer lakes of glacial origin in its headwaters and feeders, making the upper reaches more suitable for warmwater forage communities. As it passes along valleys at the feet of the Gogebic Range, the water quality and river characteristics change markedly. The Brunsweiler changes from a warmwater drainage stream to a rocky, hard-bottomed, high-gradient stream in its midsection, and finally back to a warmer, low-gradient stream at its outlet. It is a Class II or Class III trout stream along a good portion of its length. The principal tributaries contributing to the river’s flow are Spider Creek, Hell Hole Creek, Camp Six Creek, and several unnamed streams. Trout streams include McCarthy Creek, Spring Brook, Trout Brook, as well as several unnamed streams. Below the outlet of Beaver Dam Lake, spring water raises the water quality to that of a medium quality brook, brown, and rainbow trout stream down to the confluence with Spring Brook. From this point to Highway 13 the trout habitat deteriorates due to unstable bottom conditions and erosion in the red clay area. A few migratory rainbow trout are present between Highway 13 and the confluence with the Marengo River, but mostly the stretch from Highway 13 to the mouth is considered a warmwater sport fishery featuring muskellunge, smallmouth bass, perch, bluegills, black crappies, rock bass, pumpkinseeds, and a variety of forage species. Extreme water level fluctuations make habitat management challenging. A large portion of the Brunsweiler flows through the Chequamegon National Forest and other forest lands where potential exists for logging activities. In 2009, approximately a 10-mile section of the Brunsweiler River located within the Chequamegon National Forest was designated as a state Wild River. This same stretch of river is designated as a federal Wild and Scenic River. Enbridge proposes crossing the Brunsweiler River using HDD methods and crossing unnamed tributaries of the Brunsweiler River with a combination of HDD methods, open cut, and dry crossing trench construction (Section 2.5.2; Table 5.7-1).

5.7.3.14 Trout Brook

Trout Brook flows north from the outlet of English Lake into the Brusweiler River on the Bad River Reservation, just before the Brunsweiler's confluence with the Marengo River. This stream supports a population of brook, brown, and rainbow trout. Several of its tributaries are also trout streams. Springs help maintain the cold water necessary for trout, but extreme water level fluctuations can be problematic. The upstream reaches are in upland hardwood, while the lower half is mostly pastured. Land cover surrounding Trout Brook is comprised primarily of upland hardwoods (Figure 2.1-4) with some agricultural lands along its lower reaches. During survey work conducted as part of a coastal wetlands evaluation, one rare species of macroinvertebrate was found in Trout Brook. Enbridge proposes crossing Trout Brook using HDD methods and crossing unnamed tributaries of Trout Brook with a combination of open cut and dry crossing trench construction (Section 2.5.2; Table 5.7-1).

5.7.3.15 Krause Creek

Krause Creek is a small, trout stream with better than average water quality that flows into the Bad River. The lower six miles are Class I trout waters. Krause Creek has a generally stable bottom comprised primarily of sand and gravel. Flow fluctuates considerably. Land cover around Krause Creek is primarily upland hardwoods with occasional areas of hardwood swamp. Enbridge proposes crossing Krause Creek using HDD methods and crossing unnamed tributaries of Krause Creek with a combination of open cut and dry crossing trench construction (Section 2.5.2; Table 5.7-1).

5.7.3.16 Tyler Forks

Flowing from Iron County into east central Ashland County, Tyler Forks connects to the mainstem of the Bad River at the boundary between the Upper and Lower Bad River Watersheds. Land use in the watershed is primarily forest (73.20%), wetland (24.30%) and a mix of grassland (1.50%) and other uses (1.00%). Much of the land is in county ownership. The entire river is considered trout water, including a one-mile section designated an exceptional resource water for supporting a Class I trout fishery. Several of its tributaries are also trout streams. The river has variable flow rates, with low flows being problematic for elevated temperatures, particularly downstream from State Highway 77. The stream supports beaver, muskrat, and migratory waterfowl (DNR, 2020f). Enbridge proposes crossing Tyler Forks and an unnamed tributary of Tyler Forks using HDD methods (Section 2.5.1).

5.7.3.17 Camp Four Creek

Camp Four Creek is a short (3.7 miles long), small but good quality, Class II trout stream flowing into the Tyler Forks River. Brook trout are common, and a few brown trout are present. The creek provides a good trout reproduction area for the Tyler Forks. Most of the streambank habitat is upland hardwoods, with some alder thickets. Enbridge proposes crossing Camp Four Creek and an unnamed tributary of Camp Four Creek using a combination of open cut and dry crossing trench construction (Section 2.5.1; Table 5.7-1).

5.7.3.18 Feldcher Creek

Feldcher Creek is a small, spring-fed, Class II trout stream tributary to Tyler Forks that provides spawning habitat for trout. The stream bank is predominantly upland hardwoods. Siltation tends to make the bottom somewhat unstable. During survey work conducted as part of a coastal wetlands evaluation, one rare species of macroinvertebrate was found in Feldcher Creek. Enbridge proposes crossing Feldcher Creek and unnamed tributaries of Feldcher Creek using a combination of open cut and dry crossing trench construction (Section 2.5.1; Table 5.7-1).

5.7.3.19 Gehrman Creek

Gehrman Creek flows through a partly pastured upland hardwood region into Tyler Forks, a little more than a mile above its confluence with the Bad River. The stream has an abundance of brook trout, and it provides spawning area for the nearby river. Although there are extreme fluctuations of water levels, they do not generally affect the habitat conditions for fish. During survey work conducted as part of a coastal wetlands evaluation, one rare species of macroinvertebrate was found in Gehrman Creek. Enbridge proposes crossing unnamed tributaries of Gehrman Creek and unnamed tributaries of Gehrman Creek with a combination of open cut and dry crossing trench construction (Section 2.5.1; Table 5.7-1).

5.7.3.20 Potato River

The Potato River (Figure 2.1-6) flows from Iron County into northern Ashland County and then into the Lower Bad River. The river tends to form large meanders in a broad valley, many becoming small oxbow ponds in the flood plain. Land use in the watershed is primarily forest (79.70%), wetland (16%) and a mix of grassland (2.40%) and other uses (2%). Most of the forested land is managed for commercial production. This watershed also contains a number of gravel pits and skirts a region that for many years was one of the largest copper and iron mining areas in the world. A little over nine miles of the Potato River are considered a Class III trout fishery for brook, brown, and rainbow trout, and are used by migratory species of trout and salmon from Lake Superior. The stream has extreme variations in flow and has an unstable sand and clay bottom (DNR, 2020g). Potato River Falls, which in total descends over 90 feet, is located approximately one mile downstream of the confluence of Barr Creek and the Potato River. The stream supports beaver. Beavers are frequently active in the upper reaches of the river, where migratory and nesting waterfowl are also found. Enbridge proposes crossing the Potato River using HDD methods and crossing an unnamed tributary of the Potato River with a combination of open cut and dry crossing trench construction (Section 2.5.2; Table 5.7-1).

5.7.3.21 Vaughn Creek

Vaughn Creek is a Class III trout stream in its lower reaches near the confluence with the Potato River, and a Class II trout fishery in its upper reaches until it becomes largely bounded by wetlands. In Ashland County, the stream flows through the Bad River Indian Reservation where it empties into the Potato River. Vaughn Creek has fluctuating water levels and generally unstable bottom conditions. Streambank vegetation is primarily upland forest cover. The community of Saxon discharges effluent to Vaughn Creek just a few miles from the headwaters in an area of wetlands. Enbridge proposes crossing Vaughn Creek using HDD methods and crossing unnamed tributaries of Vaughn Creek with a combination of open cut and dry crossing trench construction (Section 2.5.2; Table 5.7-1).

5.7.3.22 Fish Creek

Fish Creek starts at the confluence of North Fish Creek and South Fish Creek, which flows through open marsh known as Fish Creek Slough. Most of the flow comes from North Fish Creek, with South Fish Creek providing largely intermittent drainage. Fish Creek serves as a nursery area for nearly every variety of fish found in Chequamegon Bay, and as a spawning area for northern pike. Fish Creek is capable of supporting a Class II trout population due to the excessive sand bedload and absence of large woody debris in the stream (DNR, 2020h). The North Fish Creek fishery is thought to have contributed up to 15 percent of the total migratory fishery in Wisconsin waters of Lake Superior through its production of rainbow and brown trout, coho salmon, and northern pike. North Fish Creek watershed supports a diverse population of reptiles and amphibians, including wood turtles in the slough areas at the river mouth, as well as white-tailed deer, black bear, beaver, woodcock, and snowshoe hare, and numerous migratory birds (DNR, 2020i). South Fish Creek is a flashy stream flowing through a large area of red clay. The creek flows through a severely eroded channel and experiences many large floods that destroy bank cover. More than 65 percent of the watershed upstream of mile two is agricultural land, with dairy farming the primary land use. This creek is intermittent during dry periods and thus its fishery value is likely poor (DNR, 2020h). Enbridge's proposed Line 5 relocation route and RA-02 pass through the Fish Creek watershed but do not cross Fish Creek. RA-02 would cross South Fish Creek.

5.7.3.23 Montreal River

The Montreal River flows from southeast to northeast, discharging into Lake Superior. The river forms part of the border between northeastern Iron County and Michigan. The West Fork flows from Island Lake, through the Gile Flowage and paralleling the East Fork for many miles before meeting. The East Fork of the Montreal River originates at Pine Lake. The mouth of the Montreal River was identified by the Lake Superior Binational Program as important to the integrity of the Lake Superior ecosystem for old growth forest, coastal wetlands, and fish and wildlife spawning and nursery grounds (DNR, 2020j). In June and July, the area is used by spawning white suckers and sturgeon and emerald and spottail shiners. In general, the Montreal River is considered a Class II trout fishery. The West Fork of the Montreal River above Gile Flowage is considered a warm water fishery including young walleye, perch, crappies, northern pike and the occasional brook trout. Downstream from the Gile Flowage, walleye, muskellunge, and some brook trout occur. The mouth and lower river are also used by spawning coho salmon, pink salmon, and rainbow trout. RA-02 and RA-03 would cross the Montreal River.

5.7.3.24 Unnamed Streams & Tributaries

Enbridge's proposed Line 5 relocation route would cross numerous smaller waterbodies including unnamed ditches, streams, and tributaries (Table 5.7-1). Many of these are groundwater-fed headwater streams, including two Class I and nine Class II trout streams (Table 5.7-13), that provide critical habitats for the cold-water fish community at various life stages. These headwater streams are key to the dominance of the cold-water fish community in the Bad River watershed, providing high quality spawning habitat for adults, crucial nursery habitat for juveniles, and thermal refuge for all ages, imperative for persisting through warmer summer months. Enbridge proposes crossing these unnamed tributaries using a combination of open cut and dry crossing trench construction (Section 2.5.1; Table 5.7-1).

5.7.3.25 Seeps & Springs

Seeps are generally referred as a subset of springs. A seep is type of spring that has very low flow rates. In general, seeps and springs form when ground water intersects the land surface or the bed of a waterbody. Whenever groundwater is forced to escape or finds a permeable layer to exit, a seep or spring is formed. Springs and seeps can be a primary water source for wetlands located in upland areas away from streams and are a cold-water resource to many trout streams.

Seeps, due to their comparatively lower flow rate and ephemeral nature, have not been comprehensively mapped across the state and are rarely know to other than local landowners. The Wisconsin Geological and Natural History Survey (WGNHS) mapped and surveyed known spring locations in Wisconsin from 2014 and 2017. The inventory includes 415 springs with flow rates greater than or equal to 0.25 cubic feet per second. Enbridge conducted a GIS analysis using the WGNHS inventory data and the proposed Line 5 relocation route and route alternatives. No crossings of springs were identified within the 120-foot-wide corridor of any of the four route alternatives. However, RA-03 did have one spring located near the route, approximately 50 feet outside of the proposed ROW.

During the 2019 and 2020 wetland delineations, Enbridge identified approximately 60 wetland complexes within the proposed Line 5 relocation project area that have or likely have groundwater seeps (Figure 5.7-3). The DNR requested Enridge evaluate wetland delineation and field data for known, likely, or possible groundwater-fed wetland. This included reviewing data for presence of skunk cabbage (*Symplocarpus foetidus*) and marsh marigold (*Caltha palustris*), which can be indicators for groundwater-fed wetlands. Enbridge determined approximately 157 wetland complexes, approximately 50.3 acres, within their proposed Line 5 relocation corridor contained data that indicated the presence of seeps, springs, discharge, skunk cabbage, or marsh marigold. During additional review of wetland data by the DNR, wetlands wasd1028, wase057, wase1024, wire1001, and wira013 contained information that may indicate the presence of seepage wetlands. These five wetland complexes, approximately 1.7 acres, did not appear to be included in Enbridge's determinations.

Based on Enbridge and DNR review, the approximately 52 acres of wetlands where indicators of seeps, springs, and groundwater discharge were observed would be impacted by Enbridge's proposed project (blasting, excavation, placement of matting, vehicular access, etc.), which includes approximately 19.3 acres of permanent wetland conversion (18.4 PFO, 0.9 PSS). Additional discussion on groundwater and groundwater effects can be found later in this chapter and in Sections 5.5 and 6.4. The wetlands where seeps were observed or likely present would be affected by Enbridge's proposed Line 5 relocation (Section 5.8.4.6.6).

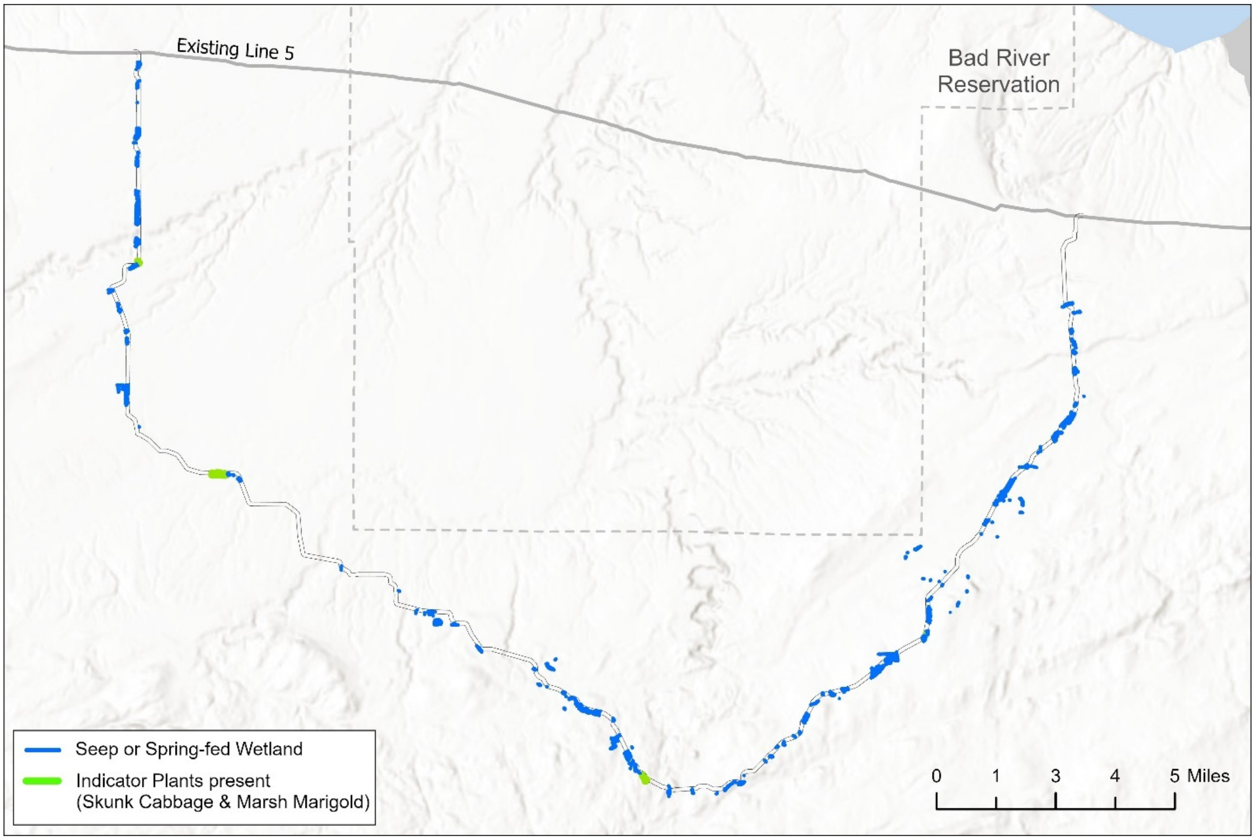


Figure 5.7-3 Seeps and spring-fed wetlands identified by Enbridge along Enbridge's proposed Line 5 relocation route.
Source: Enbridge

5.7.4 Other Watersheds

Enbridge's proposed Line 5 relocation route, RA-01, and RA-02 are located within the above-described watersheds. RA-03 does not extend through the Bad River Watershed. RA-03 crosses through the Montreal River, East Fork Chippewa River, West Fork Chippewa River, Upper Namekagon River, Totagatic River, Upper St. Croix and Eau Claire Rivers, Bois Brule River, and Iron River watersheds (Figure 3.4-1). These watersheds will not be described in detail in this Final EIS.

5.7.5 Surface Water Data & Models

The DNR assessed baseline conditions of the affected waterways using a combination of available data and modeling approaches. Table 5.7-1 lists waterways crossed by Enbridge's proposed Line 5 relocation route. Table 5.7-2, Table 5.7-3, and Table 5.7-4 show the crossings for RA-01, RA-02, and RA-03. respectively.

All waterway and wetland crossings proposed by Enbridge were surveyed by Enbridge during the proposed project's planning phase (Section 5.8.4), providing a snapshot of their physical characteristics at the time of the surveys. DNR staff corroborated some of the observations during site visits in 2023. Enbridge classified approximately 140 of the 186 waterways as ephemeral or intermittent streams. These streams were predominantly smaller headwaters streams. Enbridge's size categorization may not align with state or federal classifications. Although smaller size categories constitute most of the effected streams (and most stream-miles in the state), mapping and monitoring efforts for smaller streams tend to be limited and these waterbodies tend to be poorly covered by federal and state databases, GIS data layers, etc., In many cases, the only available information for the smaller affected waterbodies is an Enbridge-conducted survey. The waterbodies at roughly 55 proposed stream crossings are large enough to show up in statewide and regional data products (depending on the tool). Most of these streams are perennial, with some intermittent streams also included.

The DNR compiled and reviewed the best available empirical data to assess the baseline conditions of potentially affected waterways. While these data provide some coverage of the project area, it is important to note that samples were collected in different ways for different objectives by different organizations, often unrelated to the purpose of characterizing baseline conditions. Most of the available samples were taken at point stations with sparse coverage across the watersheds, limiting how generalizations can be made to waterways where data were lacking. These available data were incomplete in the sense of a traditional baseline survey.

To address some of the limitations in the available observations, the DNR created or used existing models to fill in as many gaps as possible. The resulting modeled data layers were limited in accuracy by the quality and applicability of the model to the project area and by what data were used for the modeling exercise (often a coarser layer than the engineering-scale materials provided by Enbridge). Nonetheless, the results provide a realistic picture of streams in proximity to Enbridge's proposed Line 5 relocation route. The DNR also requested additional water quality data from Enbridge. Enbridge sampled a subset of waterway crossings (those with baseflow during the driest part of the year) for baseline water quality data (Appendix U). Assessments of the crossings for Enbridge's route alternatives were based on a desktop survey and so are less detailed than those for the proposed ROW dataset.

5.7.5.1 Observational Data Used for Analysis

Extant data on a limited subset of in-watershed locations were available in the EPA's STORET system. These data cover a small subset of locations and best describe temperature, dissolved oxygen, and some chemical parameters of larger waterways in the Bad River watershed, including the Bad River itself, Tyler Forks, and the White River. These larger rivers can be considered to integrate certain loading parameters (such as total suspended solids, total phosphorus, nitrogen, etc.) but will poorly represent other streams for other parameters like dissolved oxygen and temperature which vary naturally over a stream or river system.

Enbridge collected water quality data for select stream crossings (those with water at the time of a survey in September, during the period of lowest baseflows) using grab samples to record a snapshot of the chemical and physical conditions of these streams. Enbridge characterizes this sample as a "baseline sample," but the sample does not characterize any stream's daily, seasonal, annual, or interannual variability in water quality. Nonetheless, these water quality data are valuable to infer some characteristics of sampled streams, even if they are not sufficient to statistically determine whether effects occur there.

Further information on stream conditions comes from sampling Enbridge conducted in the fall of 2023 on a subset of stream crossings along the proposed route (Table 5.7-5); this sampling encompassed the basic parameters in the STORET system and a few additional metrics geared toward detecting the effects of pipeline construction, such as the presence of an oil sheen and bank stability. These samples were collected at paired upstream/downstream locations, generally 100 feet apart, with some ephemeral sites lacking upstream comparators.

Table 5.7-5 Enbridge water quality sample coverage of crossings by waterbody category, 2023.

Waterbody type	Not sampled	Sampled	Total line items	% not sampled	% sampled
Ephemeral Streams	193	12	205	94%	6%
Intermittent Streams	76	54	130	58%	42%
Perennial Streams	5	79	84	6%	94%
Intermittent WDH	49	12	61	80%	20%
Wetlands	961	17	978	98%	2%
Total	**1,284**	**174**	**1,458**	**88%**	**12%**

As shown in Table 5.7-5, the most well-covered category is perennial streams, which were well-sampled compared to their overall prevalence. Ephemeral streams were the least-well-sampled stream types, with only six percent sampled. Ephemeral and intermittent streams make up most of the stream miles and habitat areas in the Bad River watershed. Poor sample coverage was driven mostly by lack of flowing water at the time of sampling. Enbridge's water quality monitoring plan (Appendix T) stipulates that samples only be taken when sufficient flowing water is present to collect a sample without fouling instrumentation. Wetlands have the poorest coverage as a category, with 98 percent of locations not sampled for water quality. Enbridge chose to sample during the period of lowest flow during the year, limiting their ability to fully characterize the water quality conditions for streams which run dry even for short periods during dry months.

5.7.5.2 Modeled Data Used for Analysis

Two sets of modeled data were used to assess the baseline conditions from an ecological perspective: ELOHA (Diebel et al., 2015) and FishViz (Stewart et al., 2016). These models both use a random forest classification approach based on climatological and hydrologic variables to classify suitability of stream reaches for different species of fish. FishViz predicts shifts in population due to modifications of flow and temperature extremes due to climate change, whereas ELOHA focuses on community suitability shifts from hydrologic modification due to aquifer drawdown (Stewart et al., 2016; Diebel et al., 2015). Each models temperature extremes, either in the form of July or August temperature, computed with an artificial neural network approach. Both also estimate minimum streamflow conditions encountered in late summer, as these tend to limit the extent of fish and other aquatic organisms.

Additional modeled data were acquired from regional groundwater modeling done by the USGS across a few domains. These models were produced in GFLOW and MODFLOW, both industry standard pieces of modeling software which describe the movement of groundwater through the aquifers in the area at a regional scale. These models also contain estimates of groundwater–stream interaction (Leaf et al., 2015; Bradbury et al., 2018).

5.7.6 Discharge Characteristics

Discharge is often considered a ‘master variable’ governing the ecological and physical conditions in rivers and streams (Poff, 2018). The magnitude and variability in flow conditions defines the physical habitat of streams by shaping the depth, width, and flooding experienced by that river over years, decades, and centuries. Discharge of the correct magnitude, at the correct time, is critical for the survival of macroinvertebrates and fish in stream ecosystems (Poff, 2018).

Discharge for the Bad River watershed is best characterized by the USGS gaging station at Odanah (USGS, 1994). The gage continuously records water levels in the Bad River and has decades of historic data to provide a picture of the behavior of streams in the region. Figure 5.7-4 shows the range of behaviors exhibited by the Bad River at its Odanah gage, including daily minimum, maximum, and mean statistics and the standard deviation around the mean for each daily flow. The maxima of the graph show large storm events, including the July 11, 2016, flooding event which was the absolute extreme for gage height in the river.

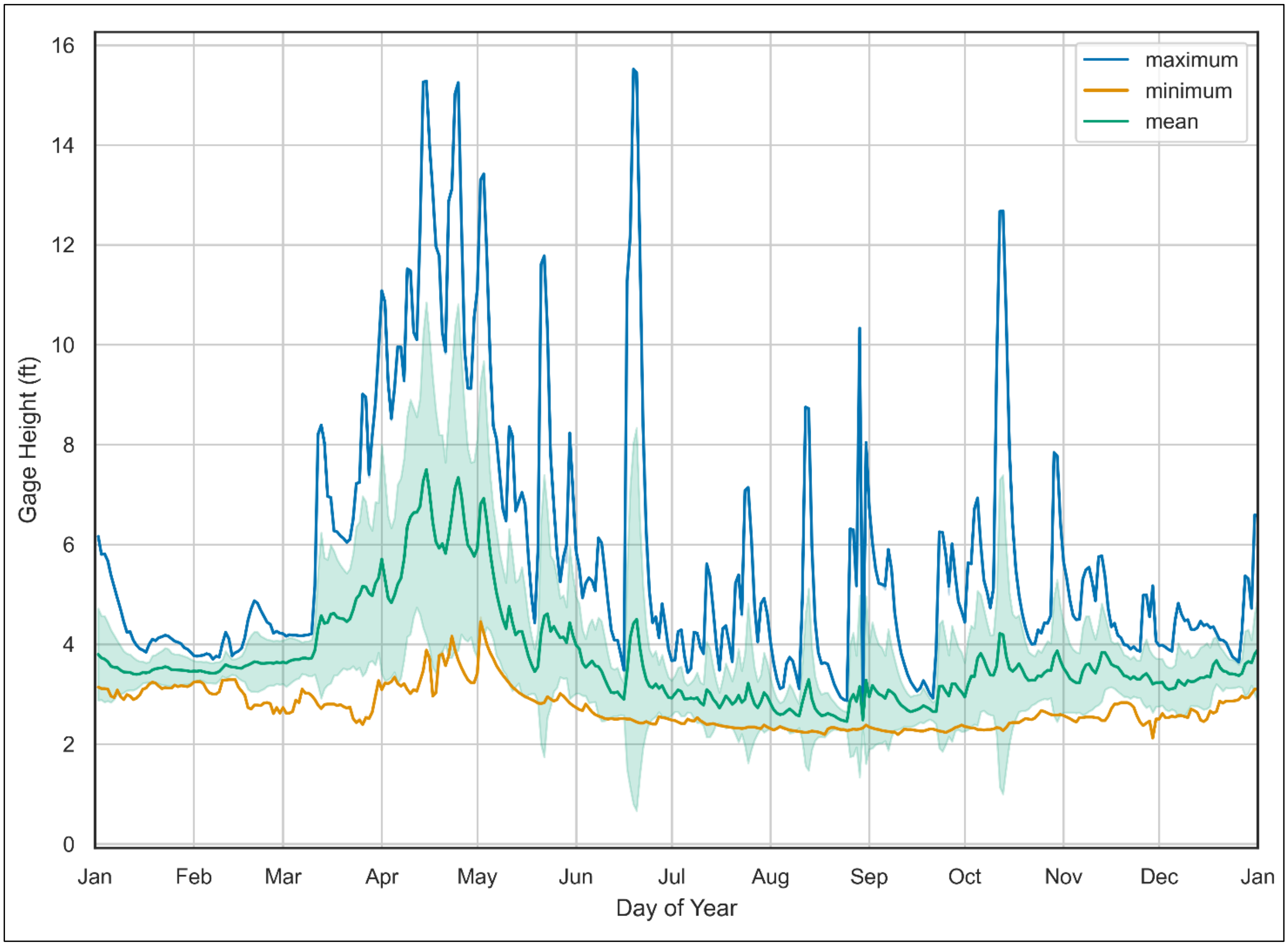


Figure 5.7-4 Daily summary of gage height behavior of the Bad River at Odanah.
Includes daily minimum (orange), mean (green), standard deviation (green fill) and maximum (blue) values.
Source: USGS

The behavior of the Bad River, as the largest river in the region and the terminal waterway draining to Lake Superior, can be thought of as the average of the behavior of all the waterways above it in the watershed. While there are very few other regional long-term gauge records, the record of the Bad River at Odanah communicates that most of the runoff in the watershed occurs in the spring, and that the summer and fall are a period of low flow. The increase in mean precipitation between days 60 and 120 indicates that snowmelt and spring rain drive the system, and that this is likely the period of highest disturbance of the year. The period is also when ephemeral and intermittent streams are most likely to have flowing water. In general, intermittent and ephemeral streams will behave similarly to the Bad River, but with a lower magnitude of flow and greater relative extremes. For example, an ephemeral stream could run dry instead of running low in the baseflow season and will have gauge heights of one to two feet instead of four to 10 feet.

One important caveat to the DNR's system characterization is that there are a number of groundwater-fed streams in the project area. These streams are typically headwaters and usually have stable baseflows year-round, meaning that summer low flows (and high temperatures) are less important stressors for these streams. Because of their greater thermal and flow stability, these streams are often important habitats for aquatic species, especially juvenile fish.

5.7.7 Effects on Stream Water Quality Characteristics

5.7.7.1 Temperature

Temperature is important because it is a key constraint that limits the ability of organisms to survive in their environment. Temperature also interacts with dissolved oxygen, limiting the amount of air that aquatic organisms can breathe. Temperature is particularly relevant for the project area, which supports a cold-water fishery with species that are highly sensitive to fluctuations in water temperature throughout the year. Temperature is also one of the primary environmental parameters affected by climate change (Chapter 7). Section NR 102.24, Wis. Adm. Code, establishes general water quality criteria for temperature: there may be no temperature changes that may adversely affect aquatic life, and natural daily and seasonal temperature fluctuations shall be maintained.

Enbridge sampled stream temperature as part of their water quality sampling effort in September 2023. The results of their sampling show the median temperature was consistent across all categories of streams at around 59° F (Figure 5.7-5). This is just above the ideal range for brook trout (50° F to 57° F). Intermittent streams had warmer extremes than perennial or ephemeral streams.

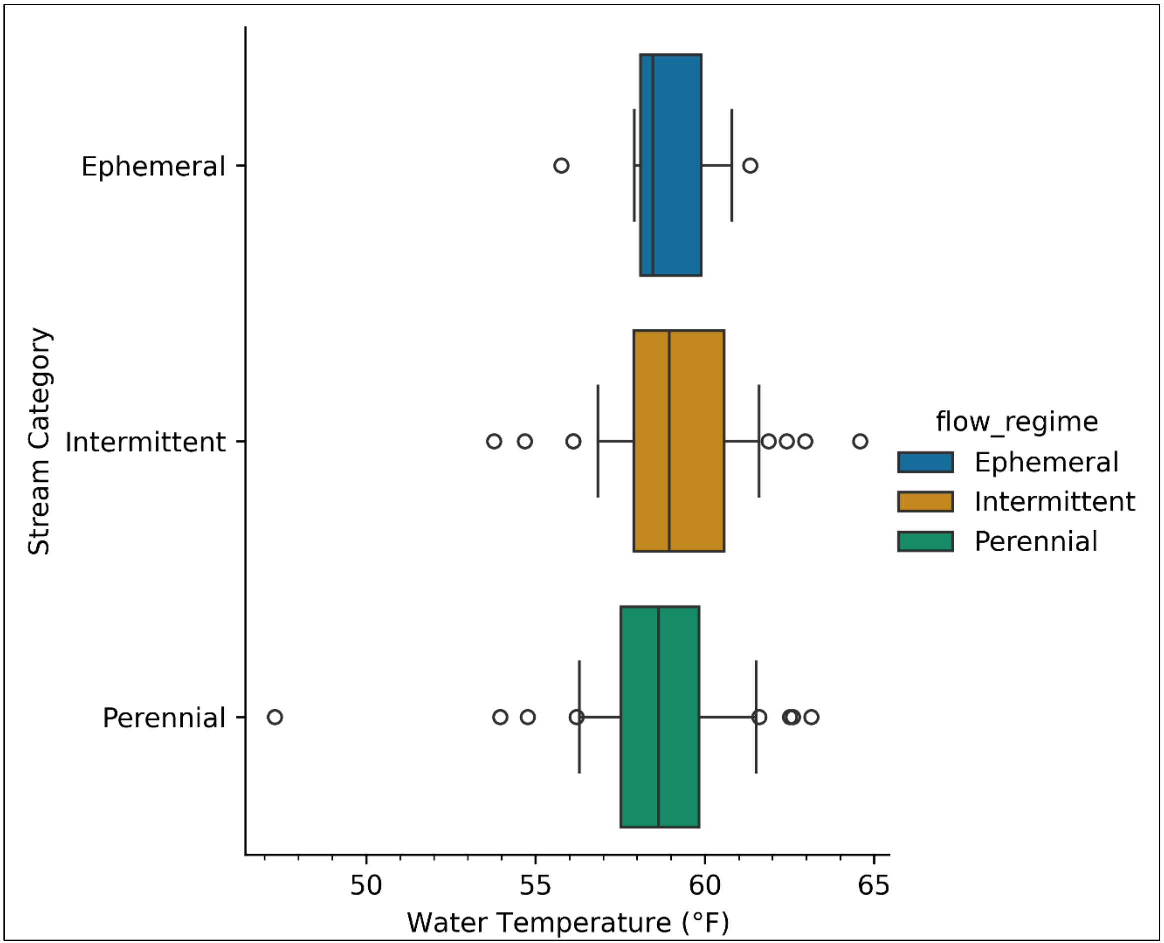


Figure 5.7-5 Temperature distribution of Enbridge-sampled stream crossing locations.

Temperatures are highly variable based on location within the project area; for example, the low (47° F) and high (64° F) temperature extremes in the perennial category (Figure 5.7-5) were recorded 24 hours apart from one another. In both cases, the water temperature was somewhat cooler than the air temperature; local temperature records from the Ashland County Airport show that the maximum temperature on both days was 85° (NOAA National Centers for Environmental Information, 2023). The Bad River system is typically considered a cool-cold water system, especially at the headwaters in well-forested areas. Forested locations are generally the areas with the coolest water, as are spring-fed locations.

Temperature would be unlikely to increase greatly from the clearing of otherwise-forested crossing sites during the summer months. The DNR's heat-balance modeling (details in Appendix X, Part 2) based on Enbridge-sampled crossing information (channel dimensions, flow rate) indicates that the mean increase in temperature due to added solar radiation (i.e., incoming sunlight instead of shade) would be 0.018° F. This result encompasses worst-case conditions for streams which were sampled for temperature, and which had more than zero flow at the time of sampling. Exposure time is the key factor driving this result. Streams which dry to pools during the summer low-flow season would see greater heating in pools in cleared areas because their exposure time would be greater, and those pools would tend to evaporate more, and get lower, during this time. Under high-flow conditions, water would tend to move too fast to appreciably increase in temperature from sun exposure.

Literature examining streams that are crossed by logging roads shows higher temperature increases than the DNR's energy-balance modeling suggests. For example, a small stream (three feet wide, ~one foot deep) in an otherwise undisturbed coniferous watershed gained 0.36° F on average when crossing a 65-foot road ROW with assumptions similar to those modeled by the DNR (Herunter, Macdonald, and MacIsaac, 2003). Wider crossings had much more pronounced heating (Herunter, Macdonald, and MacIsaac, 2003). Local, nonsteady effects could cause heating of up to 7.2° F over baseline in the most extreme case, which in the summer would cause stress to fish and macroinvertebrates and would reduce total dissolved oxygen by between 0.2 ppm and 0.7 ppm. Similar research found that temperature recovery generally occurred relatively fast upon stream reentry to a forested landscape (Moore, Spittlehouse, and Story, 2003). Because the DNR modeling results disagree with empirical measurements, the DNR gave deference to the empirical measurements when analyzing anticipated effects.

Smaller streams in general would be the most vulnerable to changes in temperature from sun exposure, since they have slower flows and lower volumes to warm. Most smaller streams are also fed more substantially by precipitation than groundwater sources (with some exceptions; Section 5.7.6) and have naturally greater temperature fluctuations as a result. Higher peaks and lower lows would likely result from clearing. Most days, however, would not see increases that are ecologically relevant due to clearing.

During the winter, streams would lose more heat to cleared areas than to forested ones, since trees act as an insulator, especially conifers. Again, exposure time is the most important factor for how much heat would be lost to the atmosphere in this situation. Low flows would be less likely in the winter, since rivers and streams generally have higher discharges during these months regionally (Section 5.7.6) than during the summer, so heat loss from low-flow pools would be less of a concern.

Oil and gas pipelines operate at elevated temperatures compared to the ambient environment. Where pipelines cross streams, there would be the potential for upwelling groundwater to be heated as it flows past the pipe, elevating the streambed and near-streambed water temperatures at the point of pipeline crossing and for some distance downstream (Figure 5.7-6).

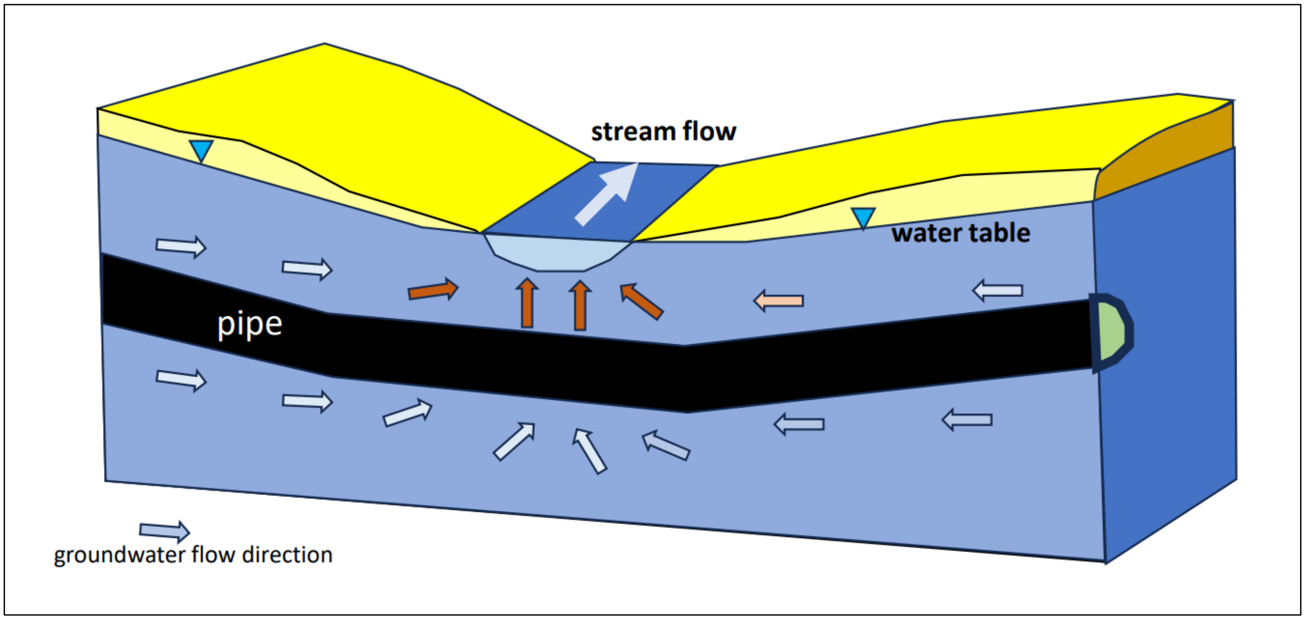


Figure 5.7-6 Conceptual diagram of groundwater flow model from Barr Consulting
Source: Barr (2024)

Enbridge monitors Line 5 temperatures at both the surface of the pipe and in the liquid moving through the pipe. Pipeline liquid temperature is measured at pumping stations to avoid conflict with other in-line monitoring probes, which traverse the length of the pipe and would damage thermal probes placed in-line. Liquid temperatures are collected four to 10 times per hour and are used to monitor the fluid properties of materials in the pipeline, which is then used to monitor for leaks and adjustments to operating parameters. Pipeline exterior temperatures are measured, at pumping stations, to verify that exterior coatings of the pipeline are within their rated temperatures for operation. The DNR requested pipeline monitoring data at 15-minute intervals to validate how operating temperature fluctuated on a sub-monthly basis. Enbridge declined to provide 15-minute data, instead providing monthly average, minimum, and maximum operating temperatures. The annual maximum operating temperature (84.9° F) is 7.5° F above the maximum monthly average, 77.4° F. This discrepancy shows a potentially wide variability in the operating temperature of the pipeline throughout the year, with the potential for acute effects larger than the monthly average.

Enbridge's consultant (Barr Consulting) provided the DNR with groundwater flow model outputs describing the effect that pipeline temperature would have on stream and streambed temperatures (Barr Engineering Co., 2024; Appendix X, Part 1). The model uses a simplified 3-dimensional groundwater configuration based on geotechnical data from a single Line 5 crossing (UNT Silver Creek, MP 19.3) to describe the potential for groundwater temperature increases. The groundwater model's pipeline temperatures are based off monthly averages of heating, without incorporating the variability of the maximum and minimum temperatures. Figure 5.7-7 depicts Enbridge's input data (blue, green, and orange lines) versus the monthly average climate of Ashland County (blue bars).

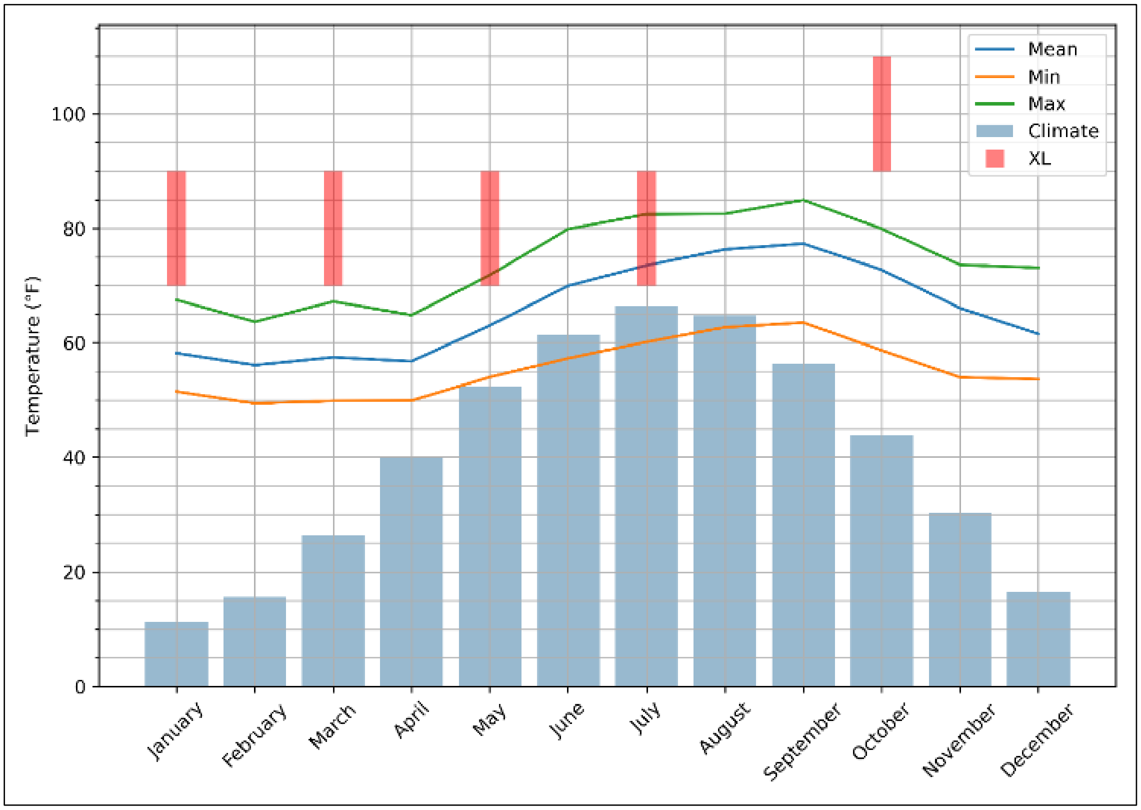


Figure 5.7-7 Current Line 5 operating temperature (solid lines) vs. monthly average temperatures (blue bars) and Keystone XL modeled operating temperature range at Glasgow, MT (red bars).
Data source: Enbridge, Exp Energy Services, NOAA

The DNR used temperature profile data from the Keystone XL pipeline temperature report (Exp Energy Services, 2013) to contextualize the Line 5 temperatures in Figure 5.7-7. The Keystone XL pipeline was projected to operate at a higher temperature than the Line 5 pipeline; in January, the XL pipeline would have operated at between 70° F and 90° F (values taken from approximately equivalent latitude), whereas Figure 5.7-7 suggests that Line 5 currently operates at a temperature between 51° F and 67° F at this time of the year. In July, the mean and maximum temperatures for pipeline operation at the Ino pumping station overlap with the range of pipeline temperatures modeled for Keystone XL. Summer temperatures do not show large discrepancies with Keystone XL outputs, but Line 5 temperatures are lower than the modeled results for the Keystone XL pipeline in fall and spring. Enbridge claims that these temperature differences are due to the products transported by Line 5 being lower viscosity than those of other pipelines. Section 1.3.2 discusses the types of hydrocarbon products transported by Line 5.

The model created by Barr (2024) (Appendix X, Part 1) describes the temperature of groundwater flowing around the Line 5 pipeline throughout the year. The authors state that the maximum increase in groundwater temperature between the pipeline and the streambed would be 5.4° F, that the season of maximum groundwater temperature would be in the early fall, and that on average hyporheic flow near the pipeline would increase by around 2.07° F based on the entire year. The model states that the pipeline would also keep portions of the streambed and riparian zones above 60° F into November based on their assumptions of temperature. Figure 5.7-8 shows model-output temperature oscillations at the pipeline, on the streambed, between the streambed and the pipeline, and below the pipeline.

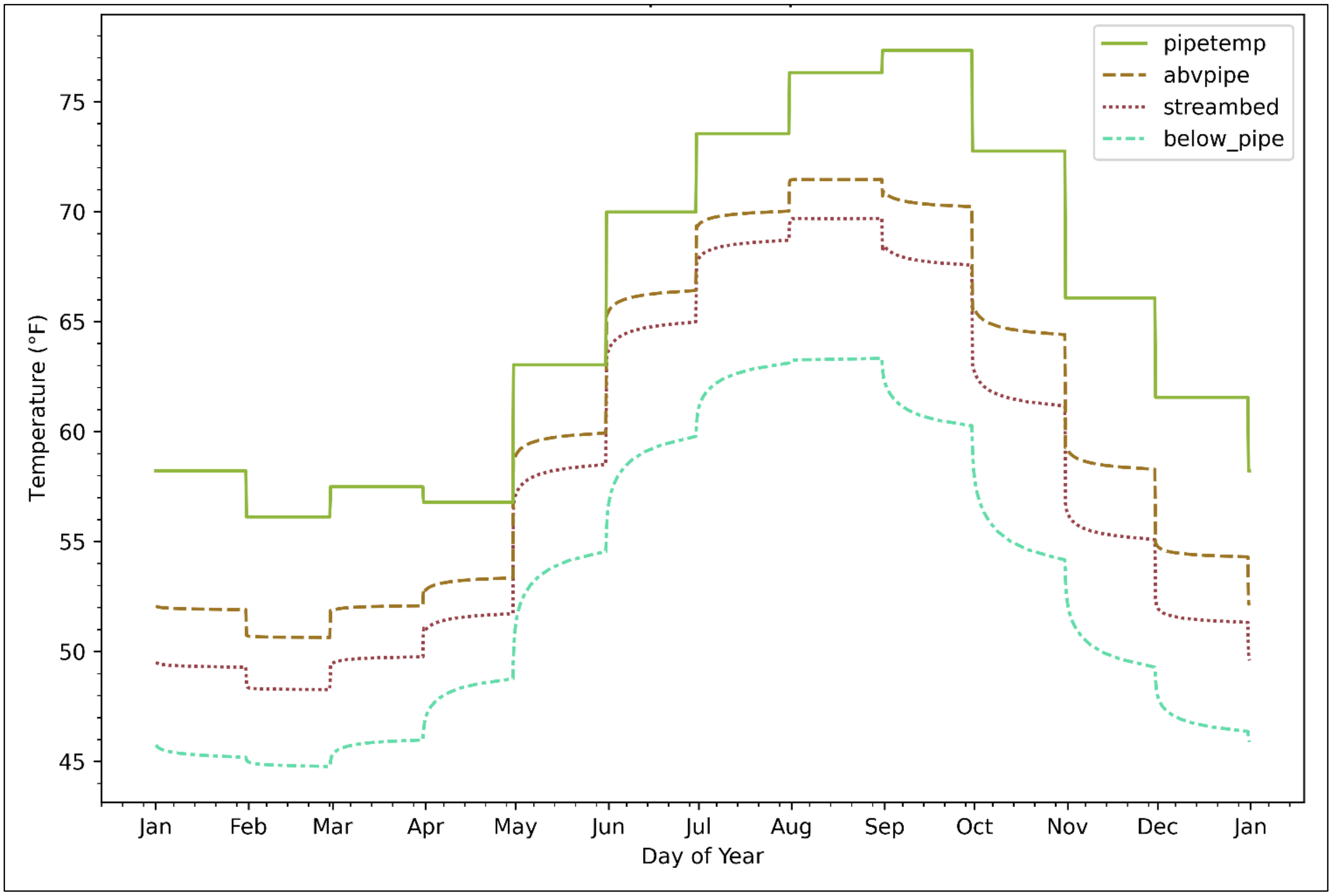


Figure 5.7-8 Time series of modeled groundwater, streambed, and pipe temperature, taken at the midpoint of the intersection between the modeled stream and the pipeline across one year of modeled output.

Data Source: Barr (2024)

Barr (2024) also provided the DNR with the gridded output of the model for all time steps evaluated, allowing visualization of modeled temperatures for the entire domain over time. The DNR chose two times (coldest part of winter and warmest part of summer) from Barr's model to represent this dataset graphically. Figure 5.7-9 and Figure 5.7-10 show the top-down winter and summer views of the temperature as modeled; Figure 5.7-11 and Figure 5.7-12 show winter and summer profiles along the length of the pipeline and the subsurface temperatures above and below it. The model does not show a downstream plume of warmer groundwater because the hydraulic gradient assumed by Barr (2024) was very small (Appendix X; Part 1).

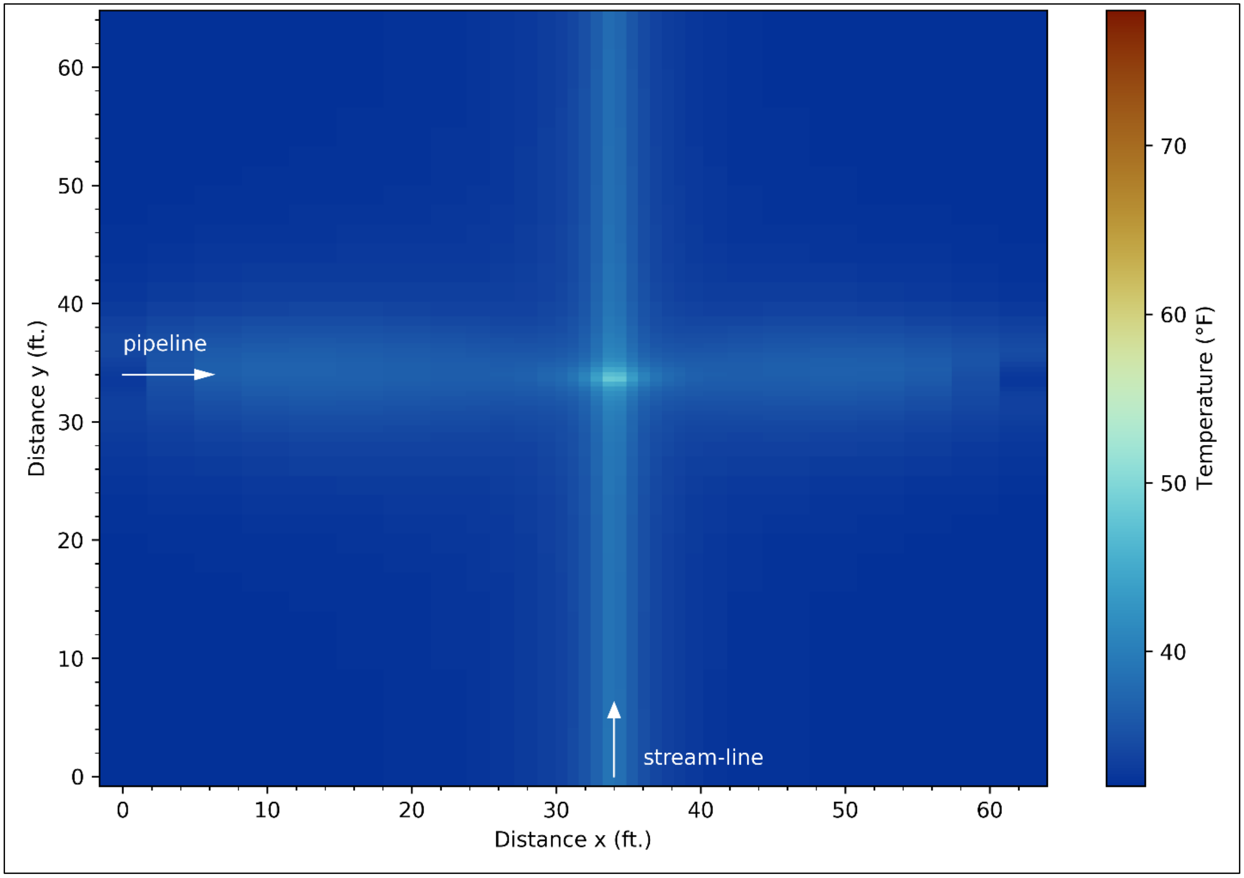


Figure 5.7-9 Winter top-down view of groundwater modeling domain.
Source: Adapted from Barr (2024)

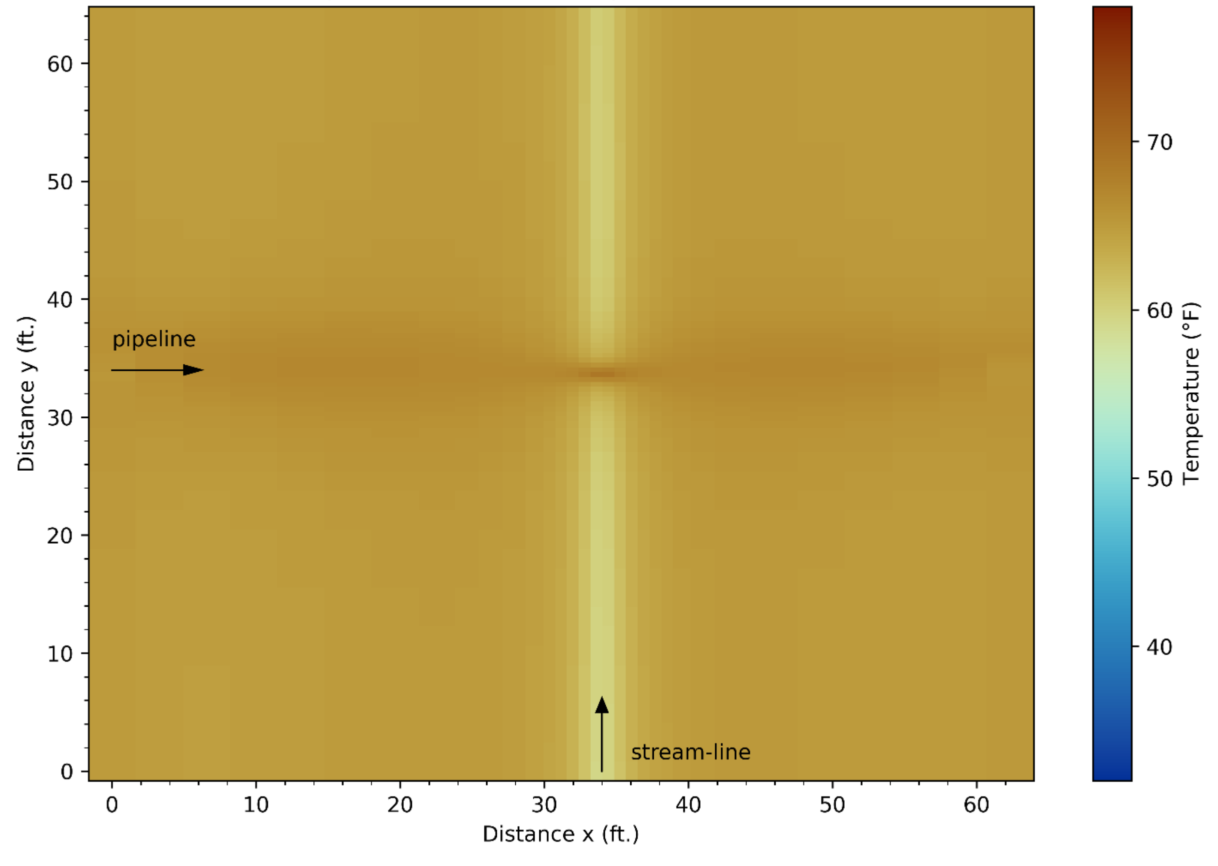


Figure 5.7-10 Summer top-down view of groundwater modeling domain.
Source: Adapted from Barr (2024)

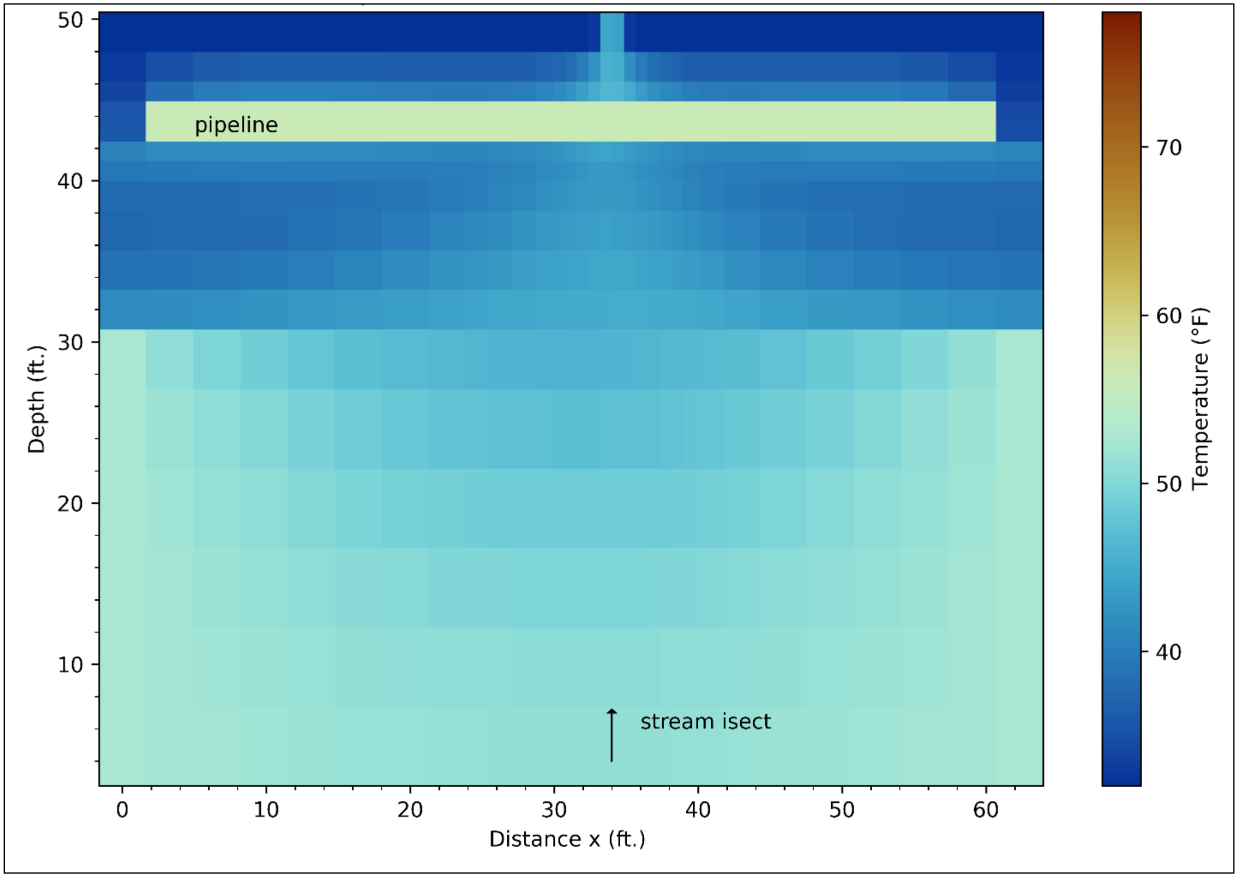


Figure 5.7-11 Winter cross-section view looking along the pipeline in the ground.
Source: Adapted from Barr (2024)

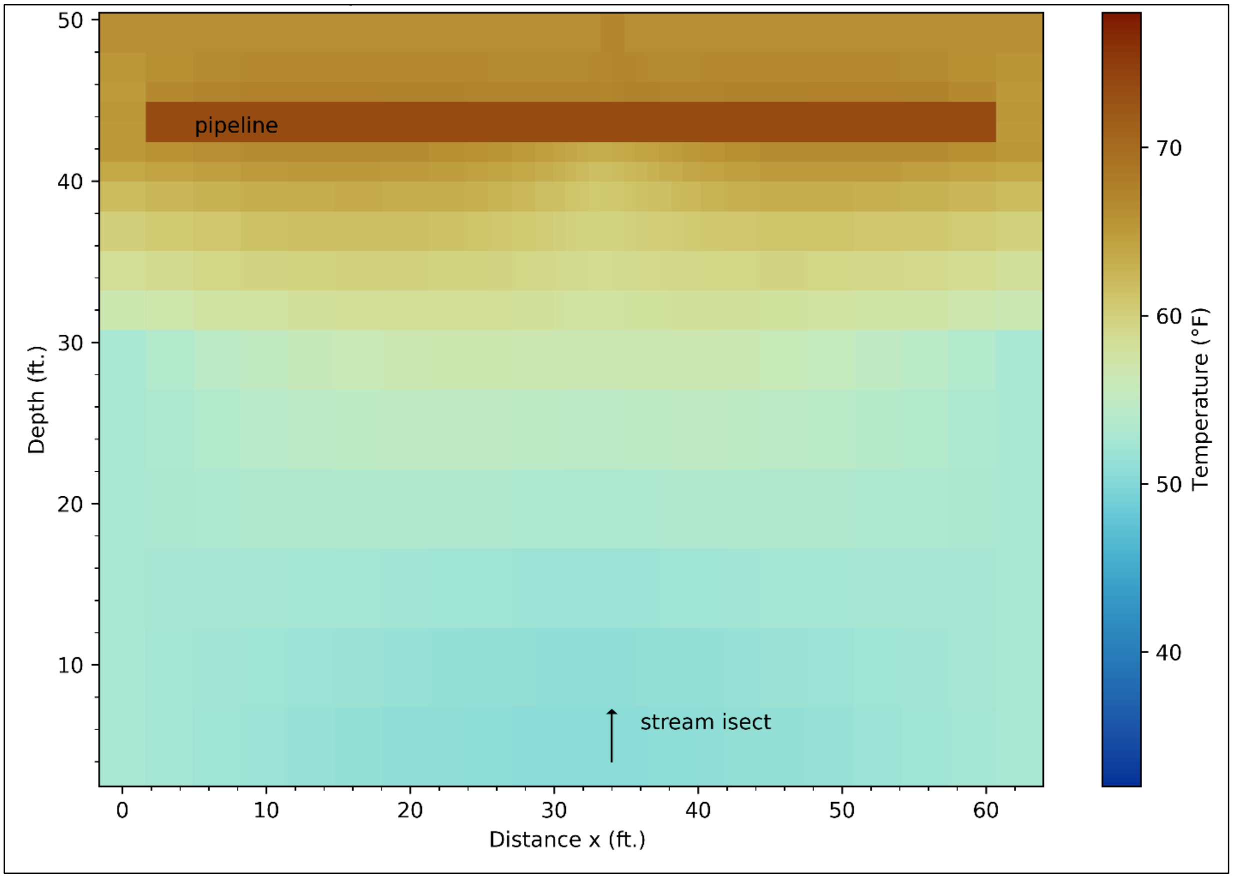


Figure 5.7-12 Summer cross-section view looking along the pipeline in the ground.
Data: Adapted from Barr (2024)

Barr's groundwater model appears to overestimate the burial depth of the pipeline. Other materials submitted by Enbridge assume the pipe is typically buried to a depth of 30 inches at stream crossings or 18 inches in the case of rocky areas (Table 2.6-1), whereas the Barr (2024) model assumes five feet of cover between the pipeline and the surface. In this case, groundwater flowing around the pipe would likely be closer to the temperature near the pipe surface, as opposed to values represented at the stream-interface in Enbridge's modeling summary materials; this could account for as much as a 3.5° F difference in temperature from the change in distance.

Streams at the greatest risk are those where the pipeline crossing would be shallow (particularly trenched crossings), and potentially in areas with shallow bedrock (depending on the groundwater exchange characteristics), since these are places where the pipeline would be closest to the surface. Streams with greater proportions of groundwater upwelling would also be at greater risk, since these places would have a greater volume of water potentially heated by the pipeline than those fed primarily by surface water. Streams which have lower summer flows would also be more vulnerable to temperature effects, because there would be less water to dilute the effects of temperature during critical periods of high temperature and therefore biotic stress. Slower summer flows would also allow greater heating from the cleared section of the ROW (see above) which could cause additional heat stress. In most cases and on most days, it is unlikely that the additional heat input would strongly affect the temperature of the flowing water being transported downstream. Temperature at the streambed could, however, be strongly affected in the local area, because this portion of the stream is governed more by groundwater temperatures than by surface water temperatures, affecting benthic organisms in the area where groundwater upwelling occurs.

Elevated temperatures due to climate change could contribute to the effects of pipeline operating temperatures. The average annual temperature across the Ceded Territories is projected to rise by 2.9° F to 5.5° F by the mid-21st Century relative to the 1980-1999 average (Figure 7.3-9) (GLIFWC Climate Change Team, 2023). The largest increase in average temperature (3.5° F to 6.6° F) is projected to occur in summer, which would lead to increased groundwater and surface water temperatures and ultimately reduced dissolved oxygen, as well as the potential for heat to aggravate temperature stress at localized crossing points. One way of examining this shift is to view the climate analog for the temperature warming; for example, projected warming in Hurley, MI (just over the border to the east of the proposed project area) will be similar to the current-day climate of St. Louis, MO, with average temperatures around 12° F warmer than today, drier summers, and wetter winters (M. C. Fitzpatrick and Dunn, 2019), likely increasing pipeline operating temperatures. Over the same change in latitude, the Keystone XL pipeline was modeled to increase temperature by 12° F, which provides corroboration for a predicted increase in pipeline operating temperature (Exp Energy Services, 2013).

Erosion and downcutting hazards (Section 5.6.7.5) would also increase temperature risks. If pipeline cover depth decreases over time, temperatures at the streambed would increase due to proximity to the pipe, leading to greater heating effects. For streams in areas with already shallow depth of cover (i.e., streams with rocky soils or which are closer to bedrock), this threat would be especially high, since the pipeline is already closer to the surface of the streambed and more likely to be a groundwater-interface zone.

5.7.7.2 Dissolved Oxygen

Dissolved oxygen is a critical component of water quality and is strongly connected to temperature (Section 5.7.7.1). Warmer waters hold less dissolved oxygen, generally favoring stress-tolerant organisms. Dissolved oxygen levels vary throughout the year in sync with temperature and with the intensity of biological activity in a waterway. Dissolved oxygen is one of the water quality parameters regulated for trout streams, which require high levels to sustain a population.

The DNR evaluated dissolved oxygen concentrations reported from streams in the project area. Dissolved oxygen levels were relatively high in perennial streams, averaging around nine ppm (Figure 5.7-13). Intermittent and ephemeral streams had generally lower average values of dissolved oxygen. Extremes in ephemeral and intermittent stream dissolved oxygen values could be due to variations in water source; colder water usually has higher dissolved oxygen content, so higher dissolved oxygen content suggests a groundwater source to some extent. By contrast, lower dissolved oxygen concentrations signify higher temperatures. Particularly low values could arise from biological demand for oxygen.

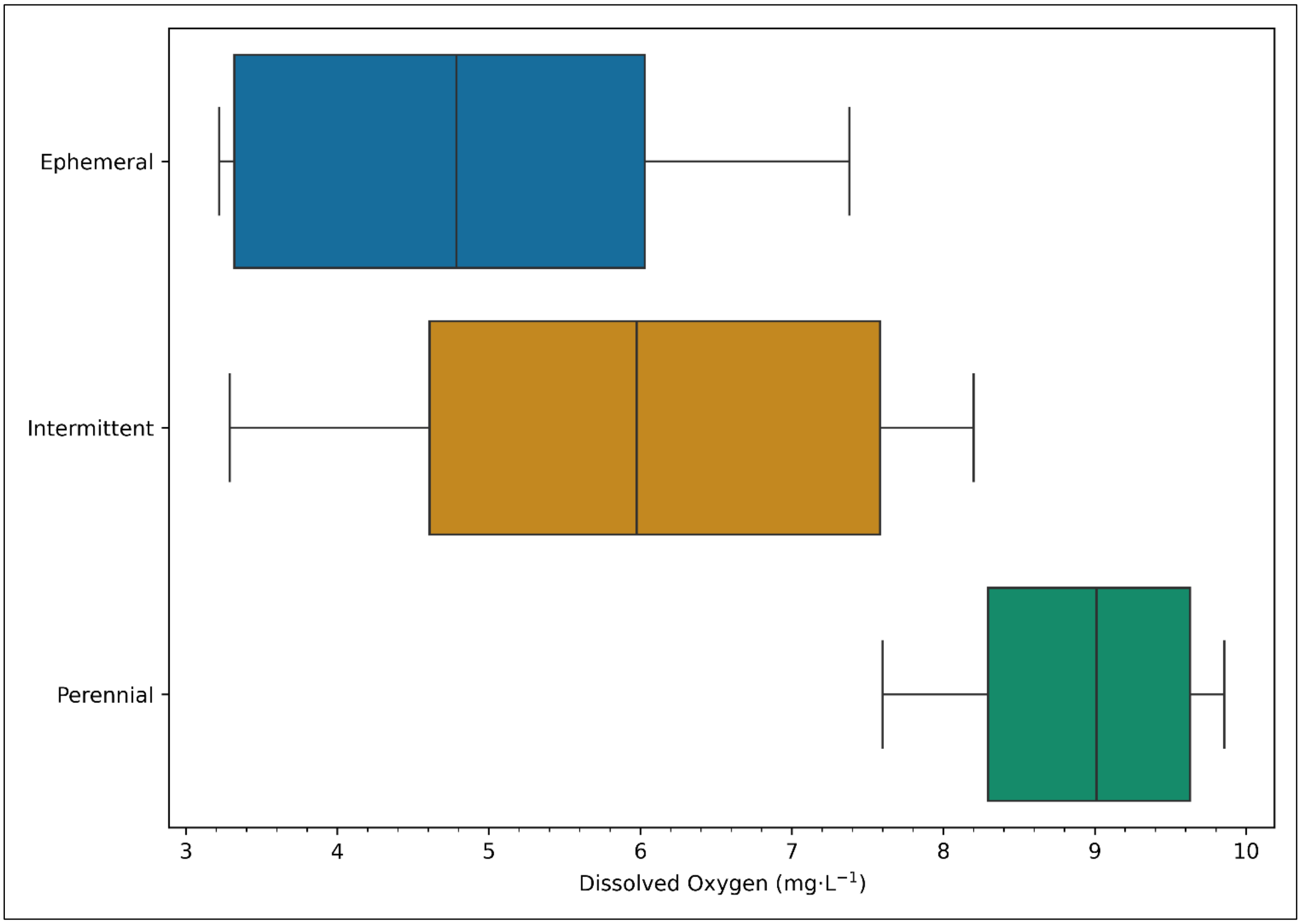


Figure 5.7-13 Dissolved oxygen concentrations by stream category.
Whiskers extend to 10th and 90th percentile of observed values.

Dissolved oxygen effects are closely tied to those from temperature and to increased biological activity in streams. As water warms, the equilibrium concentration of oxygen decreases, causing a reduction in oxygen available for organisms. The blue line in Figure 5.7-14 shows the limit of saturated oxygen concentration as a function of temperature to demonstrate this. Black dots show the observed dissolved oxygen concentrations of sampled streams with respect to their temperature. Many streams are close to saturation point, with a fairly large number of streams well below saturation. The temperature shifts caused by Enbridge’s proposed pipeline construction, on an equilibrium basis alone, would not substantially reduce oxygen concentrations. If a stream has greater exposure to clearing, for example when flow slows to isolated pools or very limited water exchange during the summer, heat inputs from clearing in addition to effects from the pipeline would contribute to enough reduced oxygen solubility and increased heat to cause biological stress, which would be localized to areas which are cleared or within the area of influence for increased pipeline operating temperature.

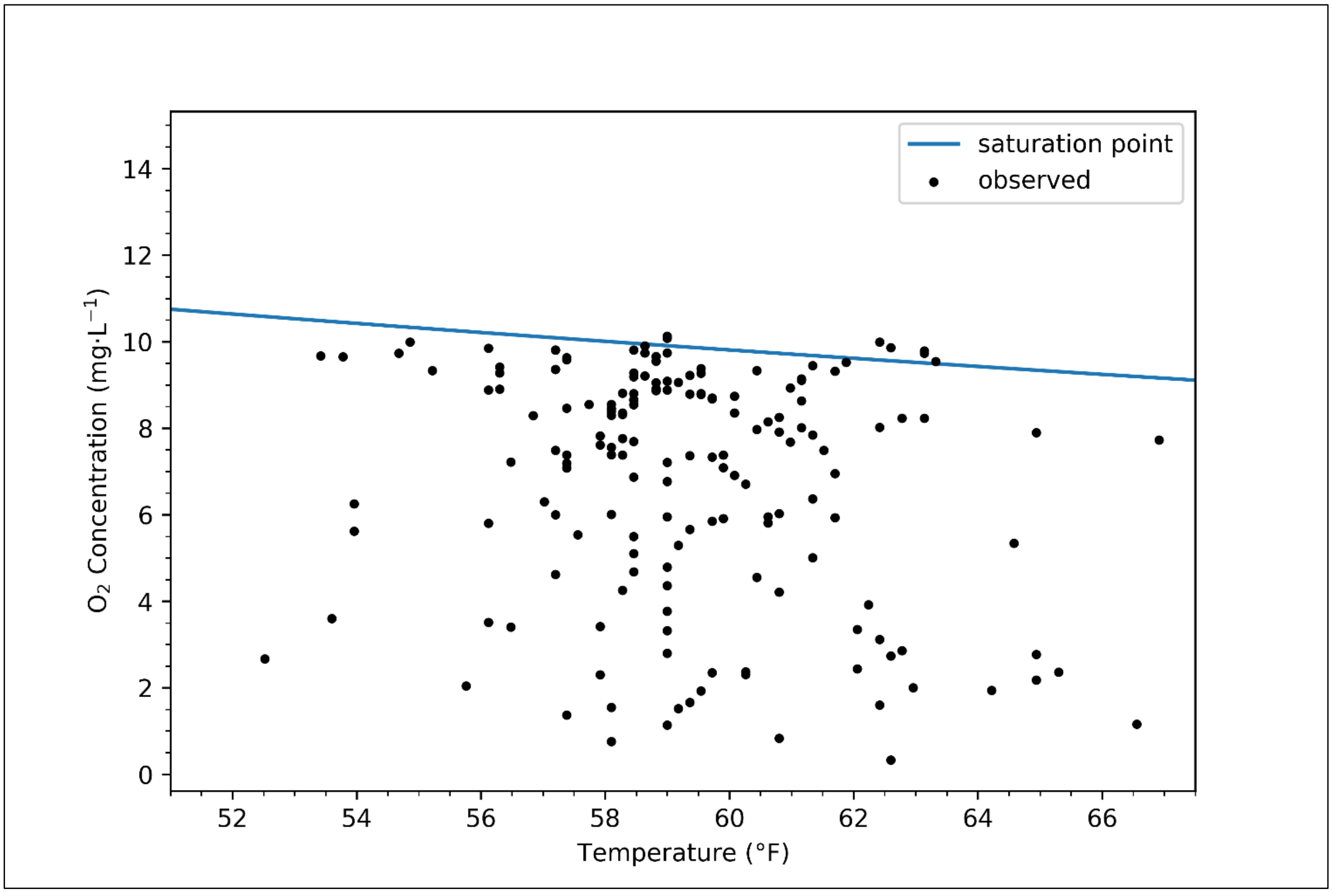


Figure 5.7-14 Observed dissolved oxygen concentrations vs. temperature in comparison to saturation concentration.

Major shifts in dissolved oxygen concentration would be unlikely to occur due to pipeline temperature increases or due to pipeline construction; dissolved oxygen would likely be affected in currently forested streams as a result of additional sunlight reaching the water, which would stimulate some growth (and therefore respiration) by algae, but the magnitude of this dissolved oxygen change would be unlikely to be large.

5.7.7.3 Conductivity

Conductivity is a measure of the amount of dissolved, charged particles in water. Higher conductivity values imply the presence of more dissolved ionic material. Samples collected by RPS included conductivity, reported in conductance units of $\mu S \cdot cm^{-1}$ (conductance of water over 1 cm of distance). Distilled water has conductivity ranging from 0.5 to 3 $\mu S \cdot cm^{-1}$, and typical, healthy surface waters are usually somewhat higher, up to an upper bound around 500 $\mu S \cdot cm^{-1}$ (U.S. EPA, 2012). Conductivity can help explain the sources of surface waters; groundwater tends to have higher conductivity than surface water, because it dissolves soluble minerals from rock where present .

Most streams in the region have relatively low conductivity, between 0 and 300 $\mu S \cdot cm^{-1}$. More perennial streams tend to have lower overall conductivities due to dilution, and a larger range (Figure 5.7-15).

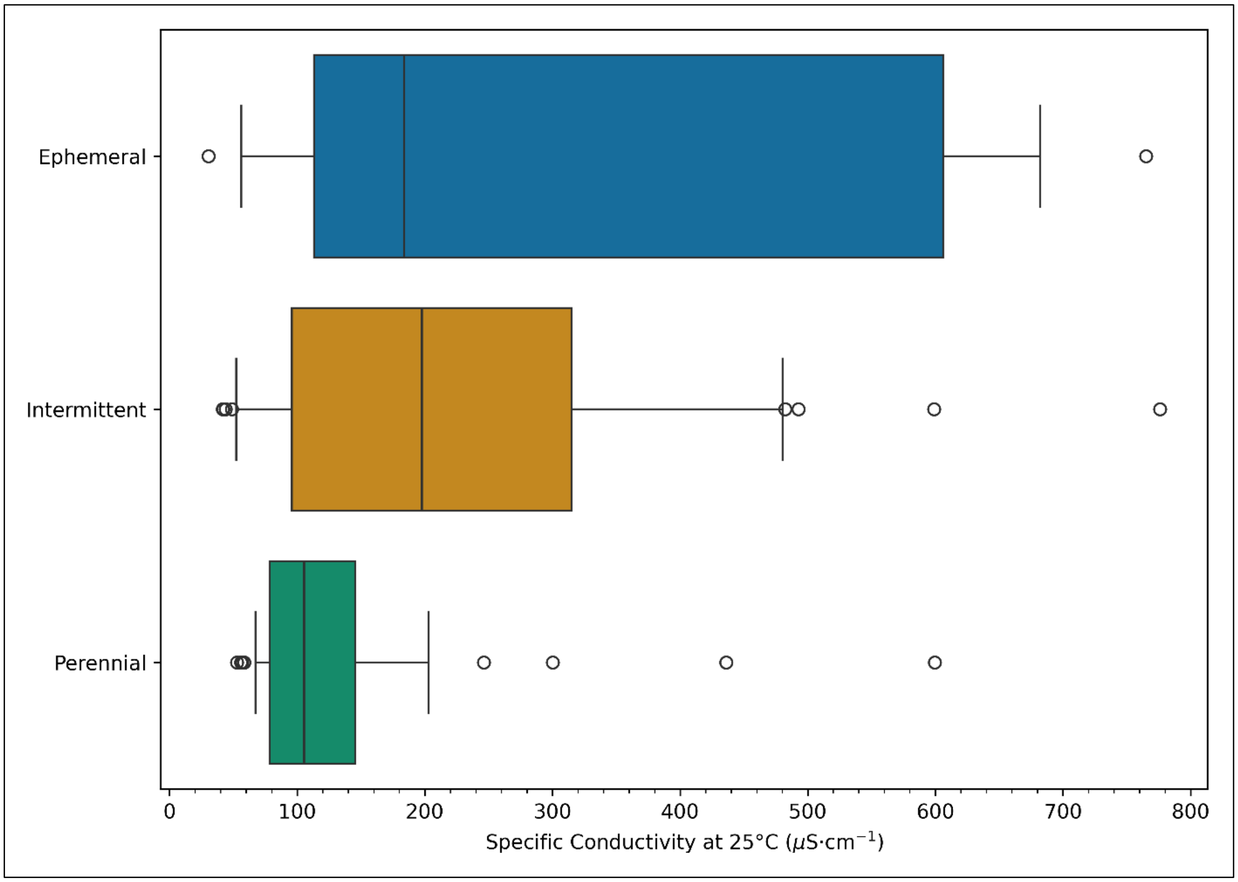


Figure 5.7-15 Conductivity by stream category.
Whiskers encompass the 10th and 90th percentile values.

Examining conductivity in relation to pH shows how the two relate to each other across streams. Figure 5.7-16 shows the relationship between pH and conductivity for the set of waterways sampled. Most streams follow a general positive relationship–greater conductivity means a higher (less acidic) pH. Streams with high conductivity and high pH can be expected generally to get more water from rain, since rain is more acidic (around pH 5.5) and tends to have lower conductivity. Ephemeral streams especially had more examples of acidity and low conductivity, and the minimum pH/conductivity increased for intermittent and perennial streams. In Figure 5.7-16, streams along the fitted lines likely source their water more from groundwater further to the right, and more from surface runoff further to the left overall. A number of intermittent and perennial streams, however, also had low conductivity and low specific conductivity (Figure 5.7-16), outside of the line between groundwater-fed to rainwater-fed streams.

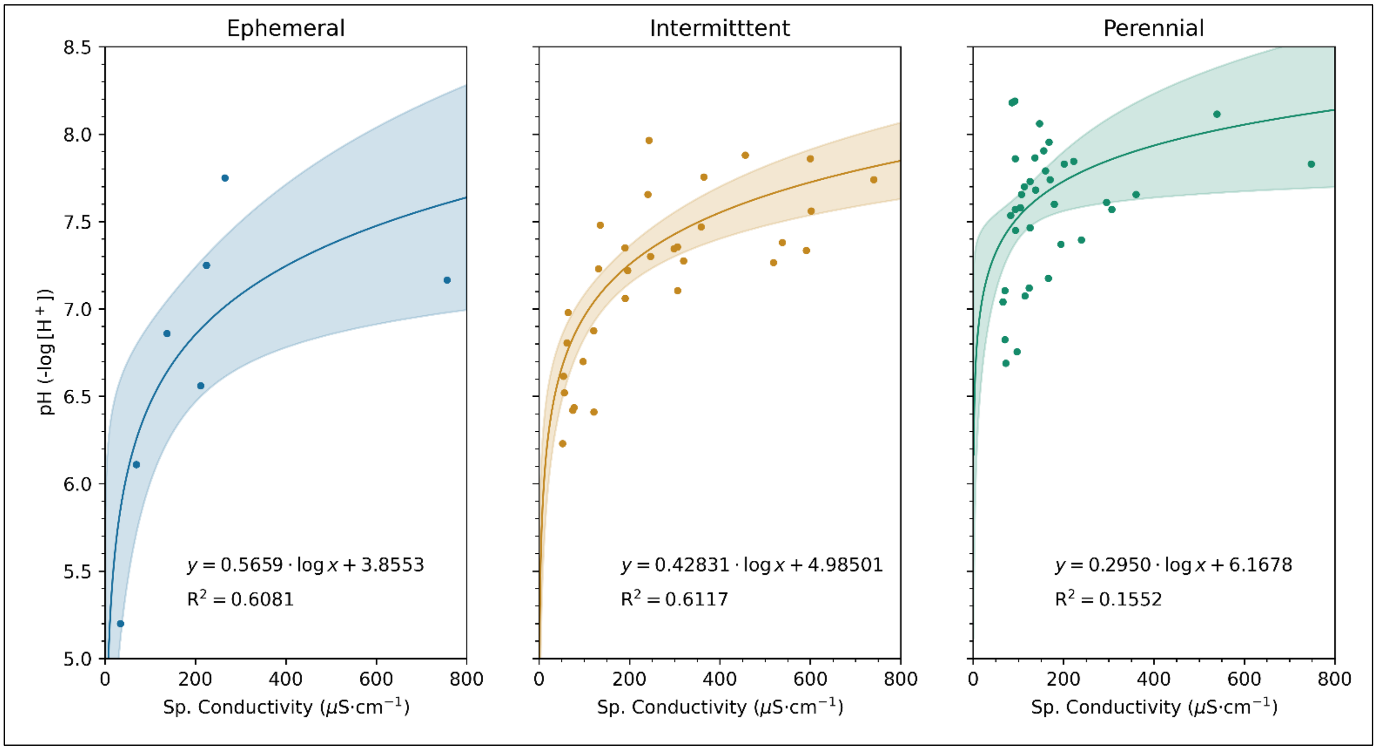


Figure 5.7-16 Conductivity-pH relationship by stream category sampled; shaded areas represent confidence intervals around regression estimate.

Conductivity would increase in step with the soluble fraction of soil material released from construction activities, especially with soil salt content (i.e., potassium, sodium, magnesium) which is not well-characterized for the project area. The salt concentration of soils in the project area would be very unlikely to cause biologically relevant elevation of dissolved solids in streams in the project area. Direct construction would be unlikely to increase conductivity loads to streams by a substantial amount, even under scenarios where a very large amount of sediment would be released.

5.7.7.4 Total Phosphorus

Phosphorus is a critical nutrient for plant life and acts as a fertilizer for plant growth. Aquatic plants are especially sensitive to its presence and grow aggressively when exposed to even relatively small concentrations, especially in clear waters. Increased growth due to nutrient concentrations is often termed *eutrophication*, which implies an ecologically problematic increase in aquatic primary production. Eutrophic waterways are often so full of algae or other nuisance plant species that fish and macroinvertebrates struggle to survive, especially when algae consume dissolved oxygen and increase biological oxygen demand when they die. Eutrophication is a widespread issue in the agricultural Midwest, affecting both lakes and streams connected to agricultural lands.

Streams are less vulnerable to phosphorus pollution than lakes because it is harder for fast-growing algae to establish in moving waters, and because there is often sediment which blocks sunlight from aquatic plants and algae, limiting growth (Litke, 1999). Phosphorus loading in the Bad River watershed eventually drains to Lake Superior, where it could contribute to long-term loading patterns of phosphorus in shallow bays where overturn occurs during the spring.

Section NR 102.06, Wis. Adm. Code, establishes general limits for total phosphorus in flowing waters at 75 $\mu g \cdot L^{-1}$, or very roughly six ounces in an Olympic-sized swimming pool, with some larger rivers (like the Bad River from its confluence with the Marengo River downstream to Lake Superior) under a looser standard of $100 \mu g \cdot L^{-1}$ (NR 102.06 (3) (a) 2, Wis. Adm. Code). Total phosphorus includes phosphorus from bioavailable sources, like plant and animal tissue, as well as sources in suspended sediment. Typically, detailed phosphorus analyses are conducted by analyzing smaller fractions of total phosphorus, including orthophosphate (PO_4^{3-}) which is the most quickly taken up fraction, and phosphorus specifically contained in other reservoirs (soil, biological material, etc.).

When looking at total phosphorous levels in area streams, most measured above the total phosphorus standards (Figure 5.7-17). Perennial streams have lower concentrations, likely because they dilute the total phosphorus load with a higher total volume of water and sustained flows. Ephemeral streams have the greatest median total phosphorous levels and have the largest range, due to having lower total volume of water and being closer to sources of phosphorus on the landscape, like farmland.

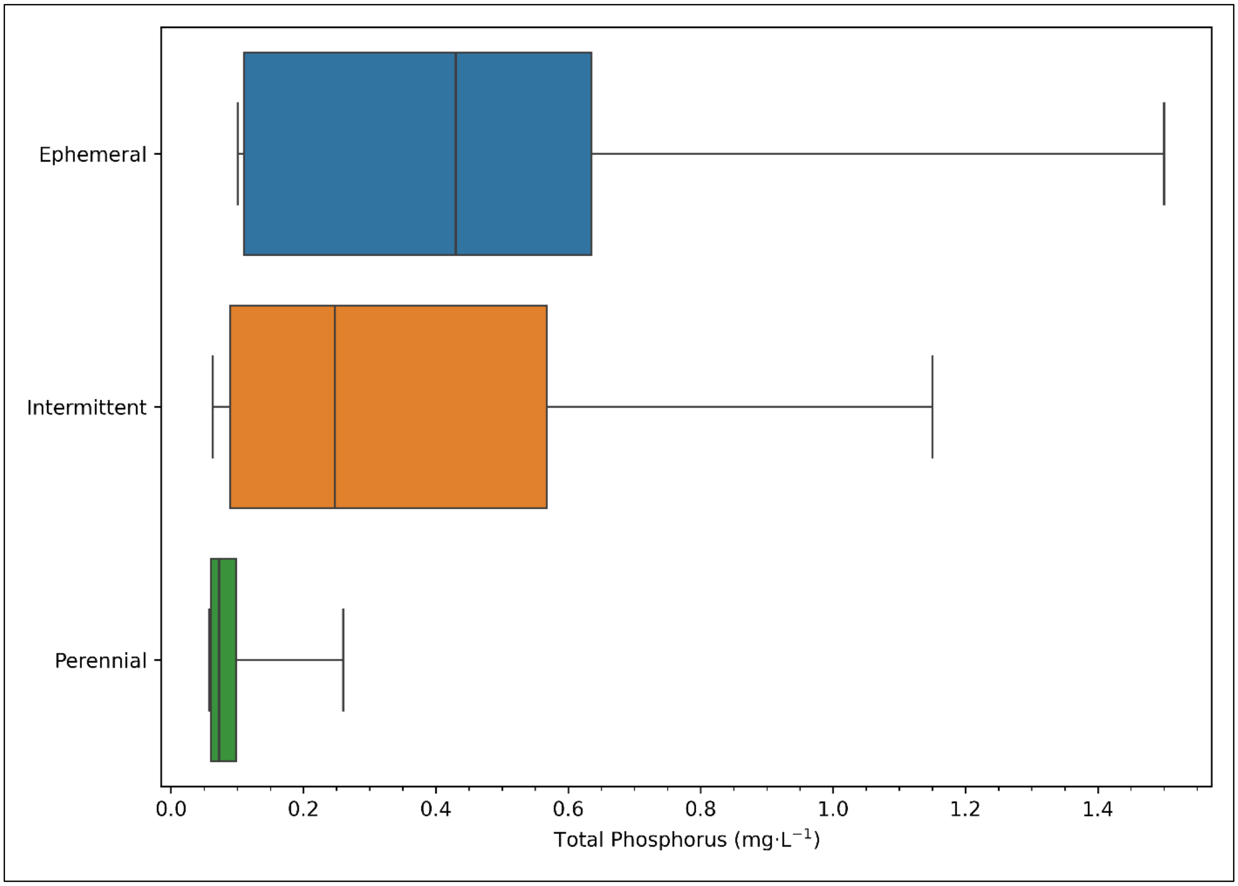


Figure 5.7-17 Distribution of total phosphorus concentrations by stream category.

Phosphorus deposition is tied to sediment movement and deposition. Added erosion, from pipeline construction or other activities, would tend to contribute phosphorus to streams. Any fertilizer amendments used in streambank stabilization would also contribute to phosphorus loads in the short term, until the establishment of permanent vegetated cover. Contributions of phosphorus loads from pipeline construction activities would be low in proportion to other sources of waterway pollution like agricultural runoff and would likely be temporary, occurring in conjunction with construction-related erosion effects. Additional phosphorus from pipeline construction would not likely be sufficient on a mass-loading rate to contribute to eutrophication of Lake Superior, based on the comparative size of sediment loss effects, total phosphorous loading, and the volume of the lake and its subbasins.

5.7.7.5 Nitrogen

Nitrogen has the potential to impair waterbodies much like phosphorus; it acts as a fertilizer for algae and other aquatic plants, especially in slow moving flows. Nitrogen occurs in several forms in the environment, depending on the chemical, biological, and geological conditions of the waterbody in question. Unlike phosphorus, nitrogen compounds, especially nitrates, tend to dissolve into water.

Total Kjeldahl nitrogen aggregates ammonia (NH_3^+), ammonium (NH_4^+), and any nitrogen bound up in organic matter, describing the amount of nitrogen that is either in organisms or that is most-easily taken up by organisms. Perennial streams in the project area have the least total Kjeldahl nitrogen overall (Figure 5.7-18) and a much smaller range than intermittent and ephemeral streams. As with all concentration-based measures, dilution will cause some of this variation naturally. The large range in ephemeral stream total Kjeldahl nitrogen concentrations could be the result of either land use (e.g., inputs of fertilizer) or more vegetative material in/near the streambed. Perennial streams also generally have lower total Kjeldahl nitrogen because ammonia is very easily taken up by aquatic organisms, and water reaching perennial streams usually has had sufficient time for organisms to take up most to all of the total Kjeldahl nitrogen fractions of nitrogen in the water column.

Nitrate (NO_3^-) and nitrite (NO_2^-) are typically more prevalent in streams than ammonium and ammonia, since ammonium and ammonia tend to oxidize and convert to nitrate and nitrite. The lower overall concentrations in Figure 5.7-19 are due to the isolation of two dissolved compounds as opposed to including other organic compounds (like amino acids) in the measure. Relative concentrations of nitrate/nitrite and total Kjeldahl nitrogen are inverted; perennial streams have the highest median and largest range in concentrations, and very few ephemeral streams have concentrations above the method detection limit. The additional concentration is likely due to the higher concentration of dissolved oxygen in perennial streams (Figure 5.7-13) leading to a more oxidizing environment, and because perennial streams are downstream of ephemeral and intermittent streams, allowing time for the ammonia and ammonium inputs from upstream to be converted to nitrate and nitrite.

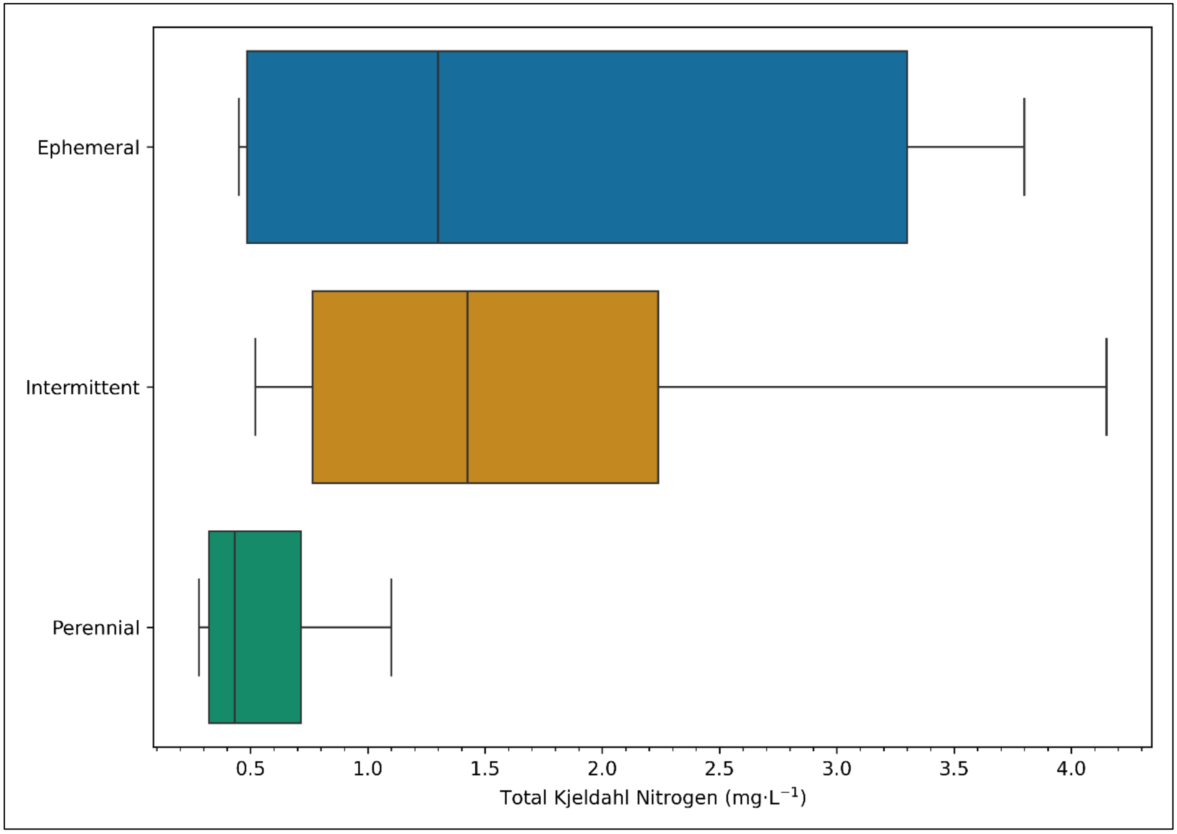


Figure 5.7-18 Distribution of total Kjeldahl nitrogen concentrations by stream category.

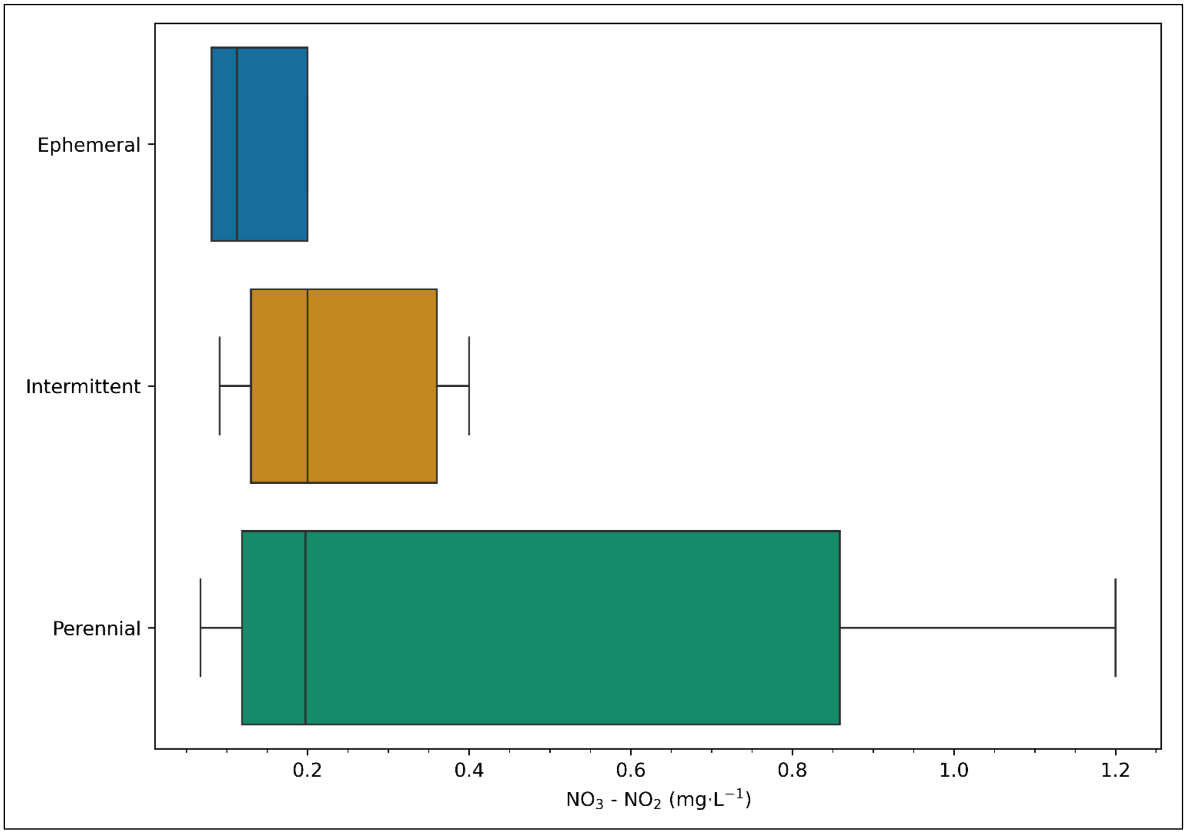


Figure 5.7-19 Distribution of nitrate and nitrite concentrations by stream category.

Nitrogen is mostly transported as nitrate (NO_3^-) in the environment since this form is water soluble and is less preferred by organisms for uptake. Whole-ecosystem studies of nitrogen cycling provide evidence that nitrate is lost from ecosystems in response to deforestation. For example, Likens et al. (1970) deforested an entire sub-watershed of the Hubbard Brook Experimental Forest to compare nitrogen loss in area streams to control streams elsewhere. Publicly available data offered by the Hubbard Brook experiment (Likens et al., 1970; Hubbard Brook Watershed Ecosystem Record, 2024) indicate that nitrate loss was much higher in the experimental stream than the control stream (55 ppm vs. two ppm). Deciduous forests tend to lose more of their nitrogen than coniferous forests (Gosz, 1981) meaning the effect would be more pronounced in coniferous deforested areas. Since pipeline operation is considered indefinite, nutrient loss rates would remain high in deforested areas, but the total loss would decline as total levels of nitrogen fall. Total nitrogen levels would fall because the total crop of biomass (which holds a great deal of nitrogen) would be lower because of deforestation.

How nitrate losses from uplands translate to stream concentration increases is less clear; on a whole-watershed basis, the effect of deforestation associated with Enbridge's proposed Line 5 relocation would likely be modest. However, the effect would likely be larger for small streams, for which the pipeline's ROW would be a larger fraction of the total watershed area. Nitrates could also move to groundwater and adjacent wetlands if connected. Wetlands tend to be efficient at processing nitrate effluent, especially at long residence times (Uuemaa et al., 2018). Shallow groundwater would tend to denitrify over time due to microbial activity.

Nitrates could also enter streams due to Enbridge's blasting operations. The most common blasting agent used for trenching is a mixture of ammonium nitrate and fuel oil, referred to as ANFO. The ammonium nitrate fraction of ANFO is a highly water-soluble compound and can release its constituent nitrate, ammonia, and nitrite into soils and groundwater (Brochu, 2010). Detonating ANFO in a wet environment can lead to incomplete reaction of the compound and release of ammonia, nitrate, and nitrite. The Canadian Defense Ministry recommends performing an environmental assessment of soils where ANFO is used (Brochu, 2010, 15). The primary strategy for preventing nitrate release from blasting is limiting the amount of ANFO used to blast the trench.

The environmental risks of nitrate relate mostly to its properties as a fertilizer. Because nitrate is an in-demand nutrient, many aquatic plant species grow vigorously when exposed to it, including aquatic macrophytes and nuisance algae. Nuisance algae also increase biological oxygen demand and decrease dissolved oxygen concentrations due to eutrophication (Section 5.7.7.4).

5.7.7.6 Biological & Chemical Oxygen Demand

Biological oxygen demand (BOD) is commonly used as a wastewater standard to determine the amount of organic pollution present in a water sample. In the context of wastewater, BOD tends to be used to limit the amount of waste left in water before it is discharged to rivers or streams. In the context of a water sample from a natural waterbody, BOD describes the amount of organic matter which is easily digested by microorganisms in the waterbody. This organic material could be like that in typical wastewater effluent (normally in much lower concentrations) or could be easily digestible, naturally occurring plant or plankton material. 'Oxygen demand' refers to the amount of oxygen consumed by bacteria as they digest the organic material in the waterbody. A typical value for wastewater effluent standards is 30 ppm (NR 210.05 (1) (a) 1, Wis. Adm. Code).

BOD levels decrease with larger stream categories in the area of the proposed project (Figure 5.7-20); ephemeral streams tend to have the highest BOD values, with decreasing amounts for intermittent and perennial streams. Perennial streams had very low values, and most perennial streams did not register a detectable value from BOD testing. Ephemeral streams and intermittent streams generally will have higher values due to their closer dependence on conditions in the landscape (Allan, Castillo, and Capps, 2021; Vannote et al., 1980). Flow variability also plays a role in ephemeral and intermittent stream BOD values. During low-flow periods, isolated pools (present in the set of monitoring sample data) will tend to accumulate organic matter and could have higher BOD values.

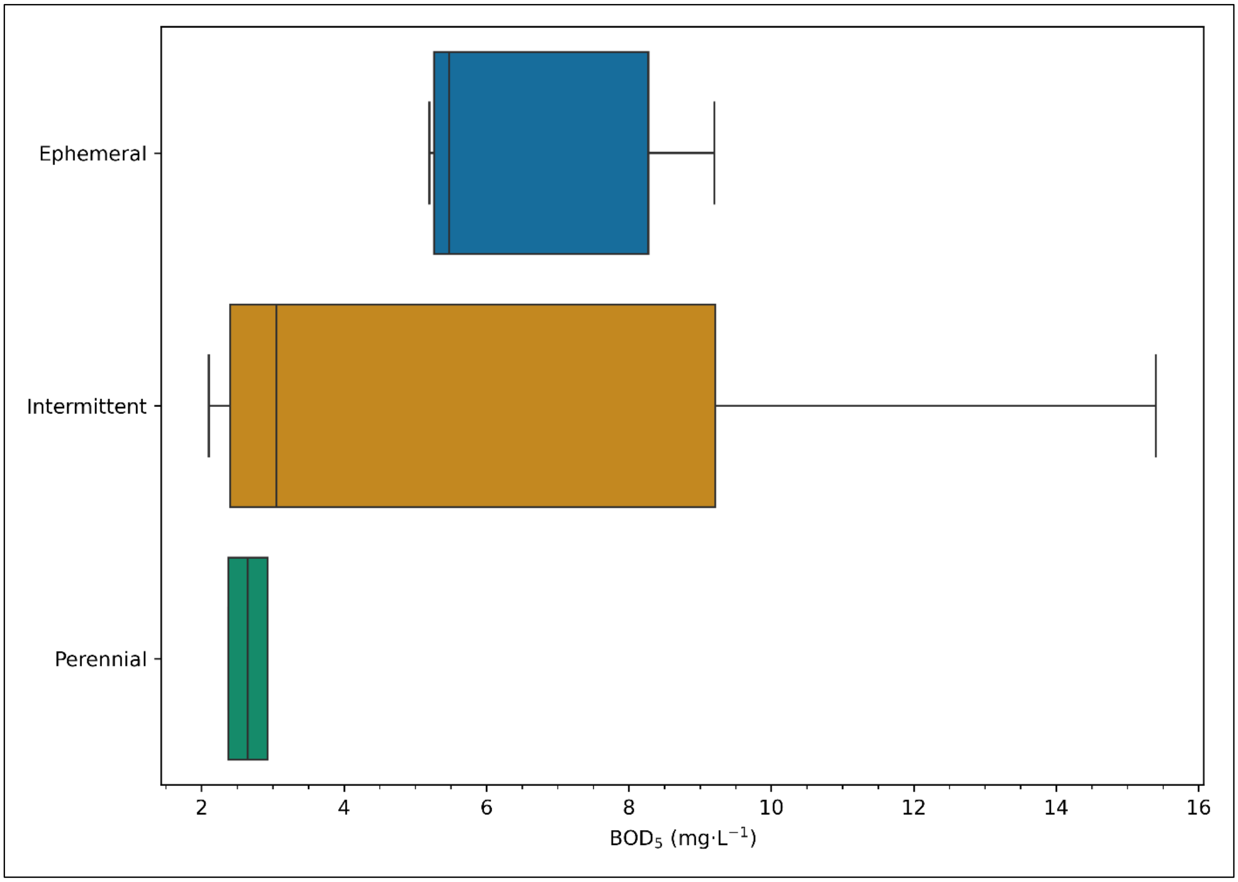


Figure 5.7-20 Distribution of biological oxygen demand (BOD) by stream category.

Chemical Oxygen Demand (COD) describes the amount of organic matter which can be fully oxidized chemically. COD captures all organic matter present in a sample, not just the amount that is digestible quickly by organisms. This would include runoff from wetlands and organic matter that is harder for organisms to digest.

COD follows a similar pattern to BOD among streams in the area of Enbridge's proposed project. Ephemeral streams had the highest levels, while intermittent and perennial streams had decreased amounts (Figure 5.7-21). As shown in Figure 5.7-19, ephemeral streams had a large right tail to their distribution, with some streams having extremely high values relative to the rest of the distribution. This is likely due to the increased amount of organic matter present naturally in these streams. The lower COD values in perennial streams are likely due to a combination of dilution and processing; lower-order ephemeral and intermittent streams tend to be the places where organic matter is processed, especially when there are blockages present (Allan, Castillo, and Capps, 2021). Perennial streams also generally dilute inputs in a larger quantity of water, reducing concentrations of COD.

Another possible explanation for higher concentrations of COD in ephemeral waters is their proximity to wetlands, which can be large sources of organic matter, especially dissolved organic matter (Allan, Castillo, and Capps, 2021; Gergel, Turner, and Kratz, 1999). Research specific to Wisconsin found that concentrations of dissolved organic carbon (a metric which will capture similar particles to chemical oxygen demand) were associated strongly with the extent of wetlands in the surrounding watershed, especially in the fall (Gergel, Turner, and Kratz, 1999), which is when Enbridge's samples were collected.

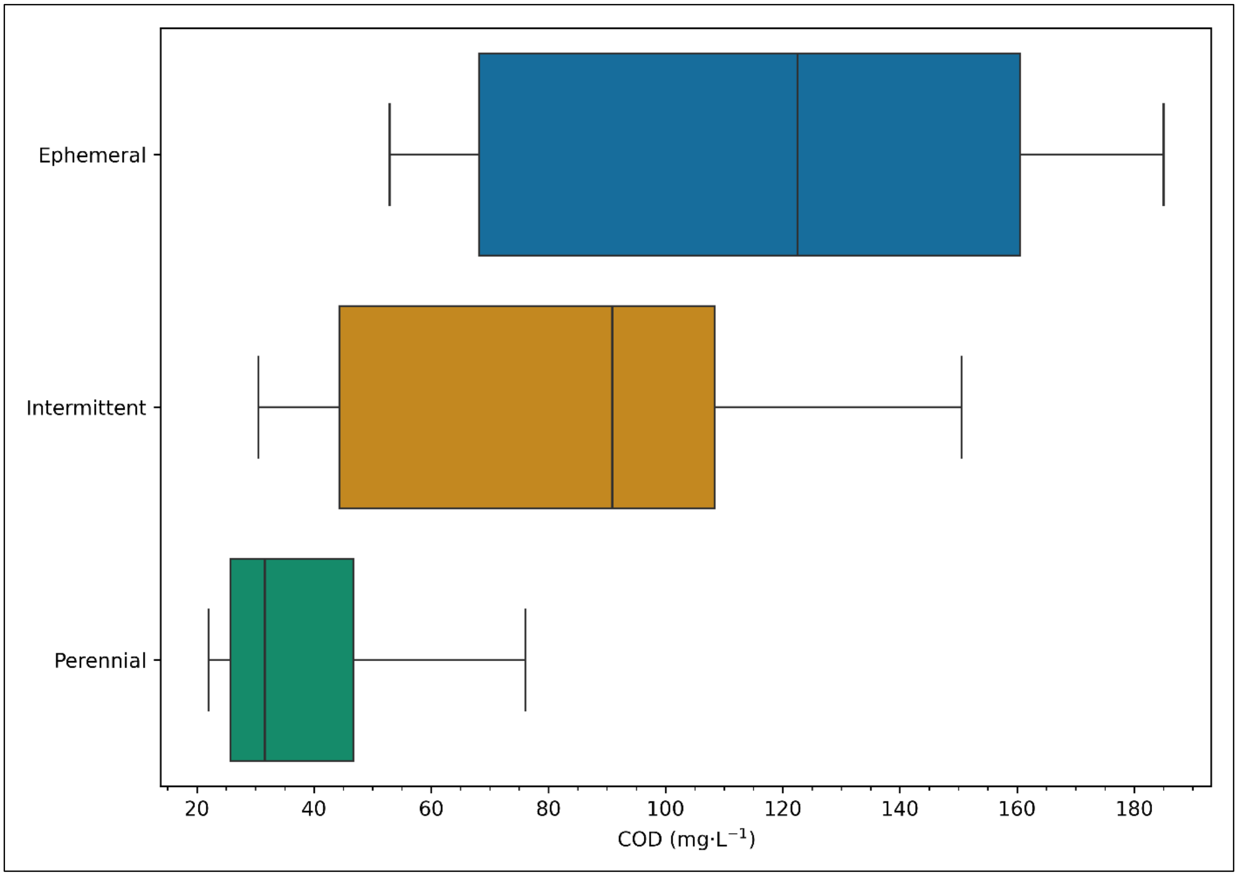


Figure 5.7-21 Distribution of chemical oxygen demand (COD) by stream category.

BOD would be unlikely to increase substantially as an effect of Enbridge's proposed pipeline construction. Organic material loading could occur temporarily if organic-rich topsoil were disturbed during construction and lost to waterways, or if sheet flow erosion caused loss of organic material from adjacent floodplains. Organic matter loading from these sources would not likely be sufficiently persistent in time or space to negatively affect waterbodies in the project area.

HDD and direct bore pipe installations have the potential to increase BOD or COD if an inadvertent release to waterways occurs. These installation methods use drilling fluid that consists of water, bentonite, and a small amount of additives used to improve performance and reduce the risk of an inadvertent release (Section 2.5.2). Common additives include Xanthan gum, plant or mineral fibers, and polysaccharide (sugar) gum, some of which could have high BOD. In the event of an inadvertent release with a high

BOD additive, high concentrations of suspended sediment, in conjunction with elevated bacterial oxygen consumption, could lead to fish mortality. Elevated BOD from an inadvertent release would be transient in nature and unlikely to be highly concentrated unless a release resulted in a discharge to a small stream with limited flushing capacity. In the event of a release to a small stream, macroinvertebrates would be the most likely affected community, since smaller streams may not support a large or sensitive fish community.

5.7.7.7 Per- & Poly-fluoroalkyl Substances

Per- and polyfluoroalkyl substances (PFAS) are a wide class of chemicals of emerging concern that are very persistent in the environment. They are used in many industrial processes; for example, nonstick pans are lined with a PFAS (polytetrafluoroethylene/PTFE), commercially branded as Teflon.

Enbridge's water quality monitoring effort included analyses for 40 PFAS; most compounds were not present in any sampled stream. The DNR summed individual PFAS compound results to obtain the total concentration from all fluorinated compounds, shown in Figure 5.7-22. Due to the extremely small concentrations involved, many analytical samples provided by Enbridge are approximate numbers.

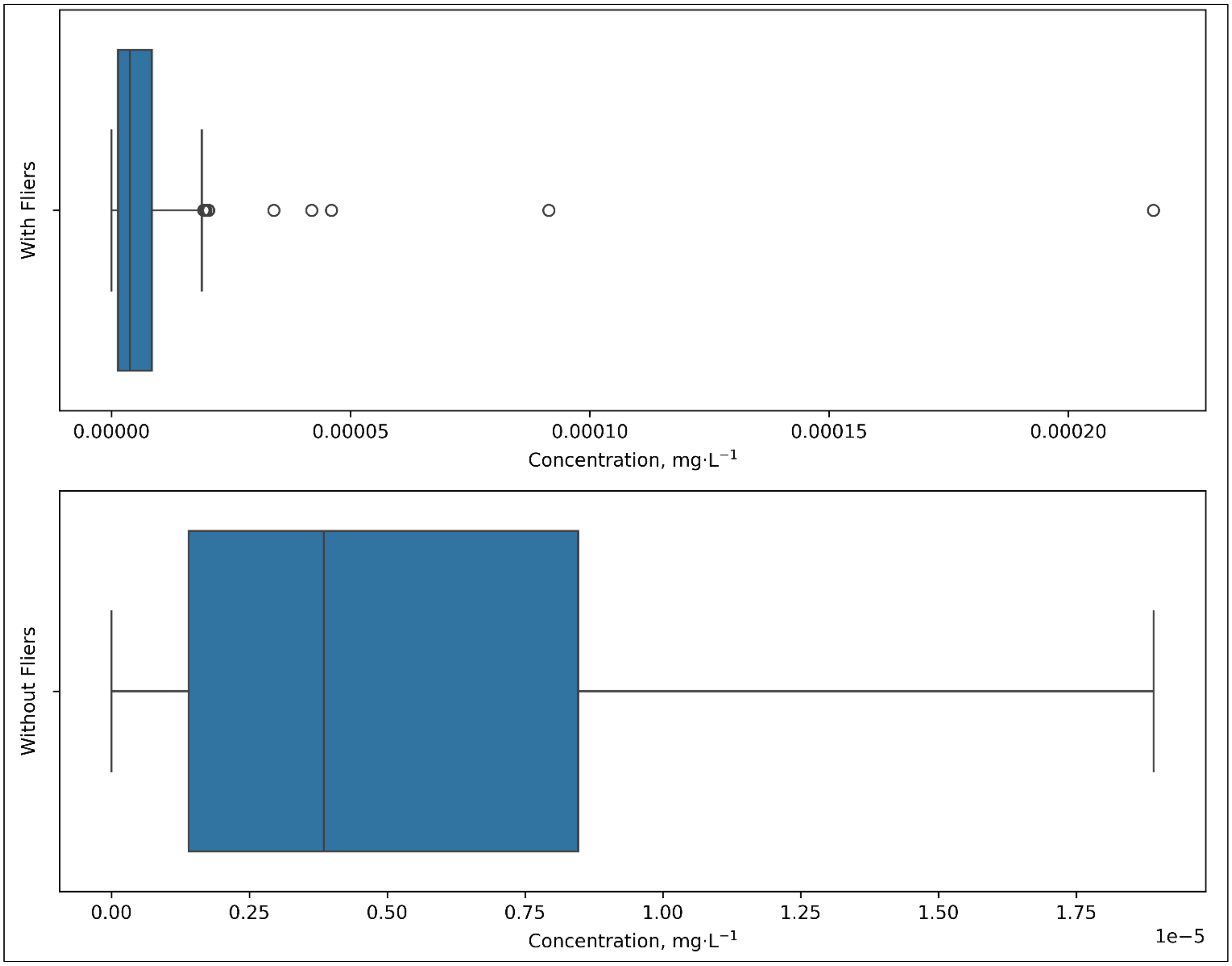


Figure 5.7-22 Total detected PFAS at Enbridge-sampled stream crossings.

Concentrations of individual PFAS were on the order of millionths of a milligram per liter of water. When summed together, most streams' concentrations of all PFAS were below 10 nanograms per liter (0.00001 milligrams per liter). One hundred twenty-one stream samples had detectable amounts of PFAS (levels greater than 0). Very few outlier samples exceeded the EPA's drinking water standards for individual compounds, typically four to 10 ppt depending on the compound (U.S. EPA, 2024, 1, table 1, col. 3).

Effects to PFAS concentrations in waterways crossed by Enbridge's proposed Line 5 relocation project would depend on the presence and use of PFAS in construction materials and methods. Enbridge has not disclosed specific anticipated construction materials, making it difficult to assess the risk of additional PFAS contamination to waterways in the project area. Standard construction equipment does not carry substantial loads of PFAS and would not be likely to contribute substantially to PFAS loading in affected waterways.

5.7.8 Effects on River & Stream Ecology

5.7.8.1 Community Types & Gradients

The Bad River Watershed and its sub-watersheds contain a highly diverse assemblage of fish species (Table 5.7-6). Fish have defined temperature tolerances within which they can survive, grow, and reproduce. Outside those tolerances, they can fail to reproduce, grow slowly or not at all, or die at extreme temperatures. By temperature regime, the Bad River fish assemblages subdivide into warm, cool-warm transition, cool-cold transition, and cold-water fish communities. The flowing water natural communities in the region can also be classified similarly by temperature, physical attributes, and the types of biological communities they support. Natural communities divide into four temperature classes and (generally) two size classes. As with the fisheries-based classification, temperature classes range from cold to warm streams, with cool-cold and cool-warm transition waters in-between. In addition, there are generally two categories of stream, headwater and mainstem streams, for each category. Large rivers and macroinvertebrate streams bracket the outside of the size distribution. Figure 5.7-23 depicts the distribution of these communities in the region and Figure 5.7-24 shows the number of each thermal guild class and natural community type by stream reach. By far the most prevalent type is cold-water (with a count of 500 in the watershed, and roughly 600 on a thermal basis). Table 5.7-7 shows how many of each natural community type would be crossed by Enbridge's proposed Line 5 relocation route and route alternatives. Table 5.7-8 shows the number of each flowing water natural community crossed by trenching and HDD along Enbridge's proposed relocation route.

Cold-water streams support cold-water fishes and may have some cool-water fishes as well, but warm-water fishes are completely absent. Cold-water headwaters typically support smaller/younger fish; for example, trout could only be present under a size of roughly five inches. Cold mainstems have a larger diversity of sizes and ages of fish with the same distribution of species as headwaters. Cool-cold and cool-warm streams both favor cool-water species and vary by the presence or absence of cold and warmwater species. Cool-warm streams have more common occurrences of warmwater species, whereas cool-cold streams have more common occurrences of cold-water species. The majority of mainstems in the Bad River watershed, including the main stems of the White and Bad rivers, are cool-warm and host a highly diverse set of fish species. Transitional temperature headwaters have a higher prevalence of species adapted to headwaters than do mainstem streams. Warmwater streams entirely lack cold-water species and instead have a high abundance of warmwater species. Variations by size follow a similar pattern as cold-water streams. Macroinvertebrate streams generally have intermittent flows and support only macroinvertebrate species (and occasionally a few fish). At the other extreme, large rivers contain a very high diversity of fish and tend to be somewhat warmer on average. 'Large River' denotes a size that is no longer wadable. In the project area, large river species usually include mainstem species, large-river specialists, and species that live in Lake Superior.

Table 5.7-6 Fish species reported from the Bad River watershed.

Alewife	Golden shiner	Rainbow trout
American brook lamprey	Greater redhorse	Redbelly dace
Atlantic salmon	Green sunfish	Redside dace
Banded darter	Hornyhead chub	Rock bass
Black bullhead	Iowa darter	Rosyface shiner
Black crappie	Johnny darter	Round whitefish
Blackchin shiner	Lake chub	Sand shiner
Blacknose shiner	Lake sturgeon	Sauger
Blackside darter	Lake trout	Sea lamprey
Bluegill	Largemouth bass	Shorthead redhorse
Bluntnose darter	Largescale stoneroller	Silver lamprey
Bluntnose minnow	Least darter	Silver redhorse
Brassy minnow	Logperch	Slenderhead darter
Brook stickleback	Longnose dace	Slimy sculpin
Brook trout	Longnose sucker	Smallmouth bass
Brown bullhead	Mimic shiner	Southern brook lamprey
Brown trout	Mottled sculpin	Splake
Burbot	Mud darter	Spoonhead sculpin
Central mudminnow	Muskellunge	Spottail shiner
Central stoneroller	Ninespine stickleback	Stonecat
Chestnut lamprey	Northern longear Sunfish	Tadpole madtom
Chinook salmon	Northern brook lamprey	Threespine stickleback
Coho salmon	Northern hog sucker	Tiger trout
Common carp	Northern pike	Troutperch
Common shiner	Northern redbelly dace	Walleye
Creek chub	Orangethroat darter	Warmouth
Emerald shiner	Pearl dace	Western blacknose dace
Fantail darter	Pink salmon	White perch
Fathead minnow	Pumpkinseed	White sucker
Finescale dace	Rainbow darter	Yellow bullhead
Golden redhorse	Rainbow smelt	Yellow perch

Source: DNR Fisheries Management Database

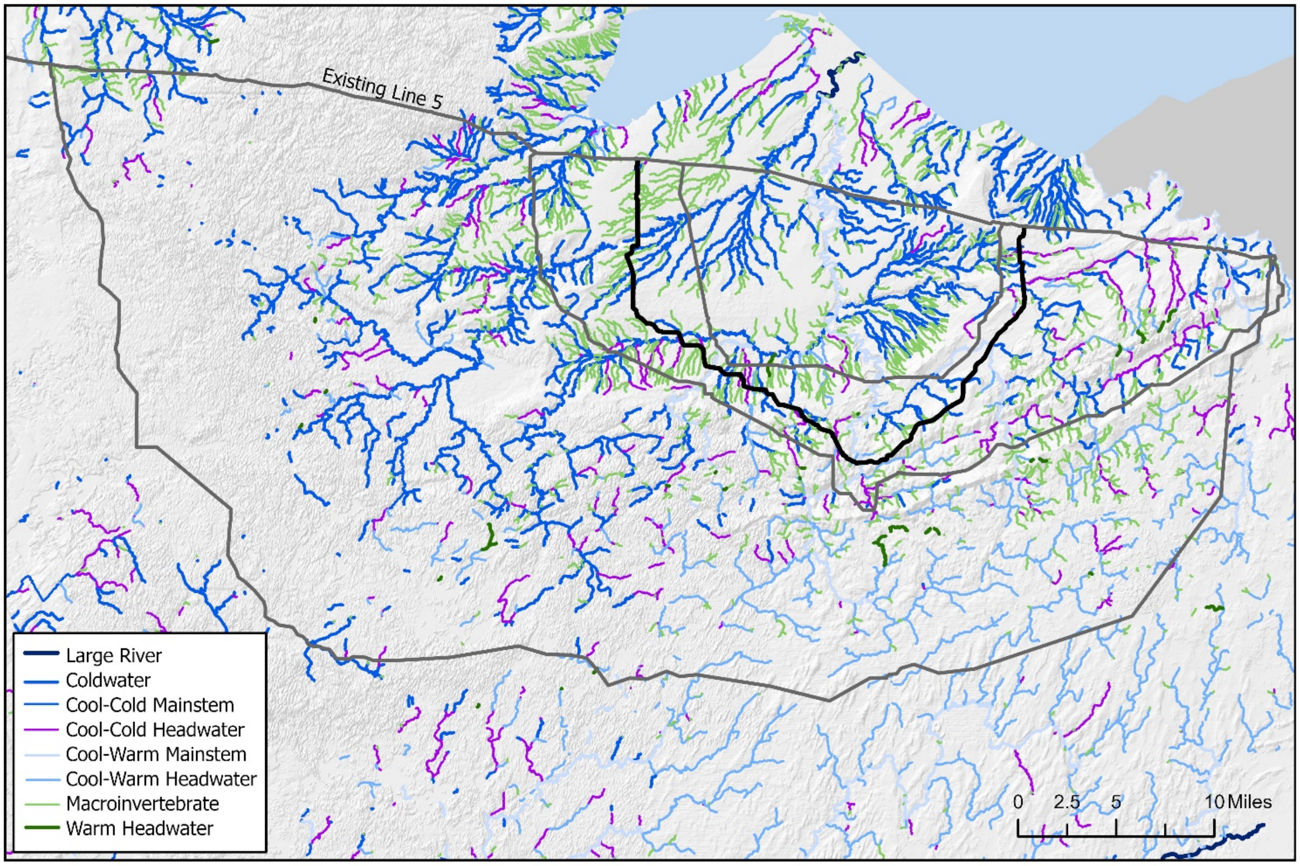


Figure 5.7-23 Flowing water natural communities in the vicinity of Enbridge's proposed Line 5 relocation route and route alternatives.

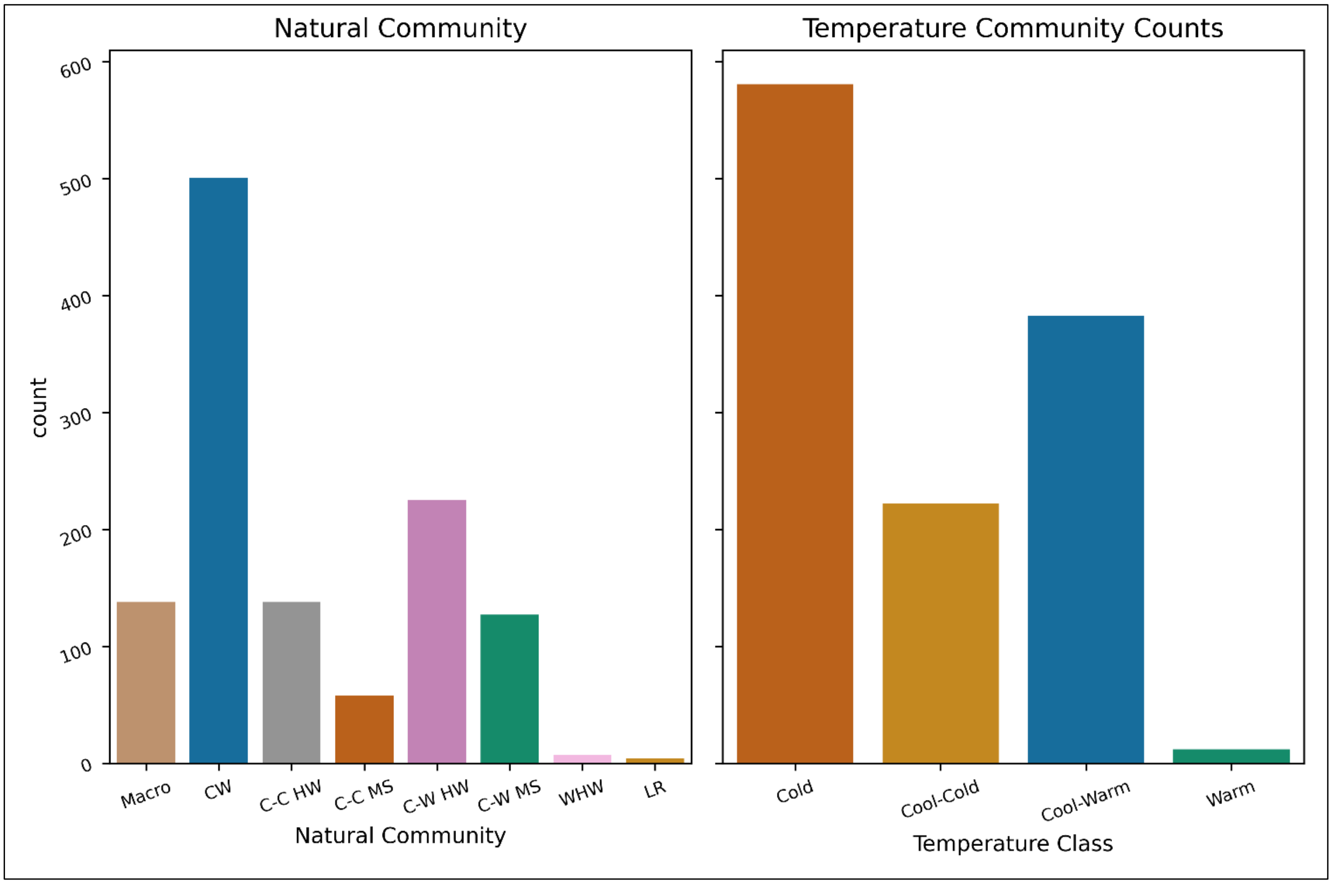


Figure 5.7-24 Natural community types in the Bad River watershed by natural community classification and thermal regime.

Macro = macroinvertebrate-only streams, CW = cold-water, C-C HW = cool-cold headwater, C-C MS = cool-cold mainstem, C-W HW = cool-warm headwater, C-W MS = cool-warm mainstem, WHW = warm headwater, LR = large river

Table 5.7-7 Count of flowing-water natural community types crossed by Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed (count)	RA-01 (count)	RA-02 (count)	RA-03 (count)
Length of pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Flowing-water natural community type				
Macroinvertebrate	22	0	42	4
Cold-water stream	17	13	14	5
Cool-cold headwater	7	0	11	7
Cool-cold mainstem	2	0	0	0
Cool-warm headwater	3	0	3	19
Cool-warm mainstem	3	0	4	2
Warm headwater	0	0	0	1

Table 5.7-8 Count of flowing water natural community types crossed by proposed Line 5 ROW.

Community type	Trenching	HDD or direct bore
Macroinvertebrate	22	0
Cold-water	13	4
Cool-cold headwater	3	4
Cool-cold mainstem	0	2
Cool-warm headwater	3	0
Cool-warm mainstem	1	2
Warm headwater	0	0

Flowing water natural communities vary in the project area by stream type, thermal regime, and proximity to Lake Superior. Lake Superior acts as a reservoir of biodiversity for the stream system. Physical barriers in the morphology of the stream system (for example, Copper Falls) serve as filters which subset that biodiversity. The Copper Falls complex in particular serves as an impassable barrier which divides the system between inland and lake-subset regimes. Thermal regime is also a critical determinant of community makeup. The thermal suitability of waterways depends on the time of year for most streams; many species will inhabit a wider range of habitats during less stressful, cooler months, and retreat to cold habitat where necessary during the warmest months of the year, typically July through September. Stream type is also a determinant of occupancy for fish species. Depending on life stage, species have different habitat requirements and tolerances. Generally, smaller streams with low flow will suit a smaller subset of species due to the more stressful conditions in these streams. These streams often have less food availability due to their physical size and can experience large fluctuations in water level and discharge depending on their water source. Headwater streams drain into larger perennial streams. Perennial streams are generally more suitable for adult fish, assuming other characteristics meet their survival requirements (mostly temperature, dissolved oxygen).

Rivers in the project area tend towards cooler and more variable flows farther upstream, but groundwater connections give rise to an alternative headwater habitat template, the groundwater-fed perennial stream. This class is headwater-sized but is fed year-round by groundwater. Water temperatures in groundwater-fed headwaters are cold, and the streams provide very consistent year-round baseflow. Many streams are also fed by wetland discharge, which provides a consistent baseflow year-round, with added water quality benefits due to organic matter processing and sediment settling. Groundwater-fed headwater streams provide critical habitats for the cold-water fish community at various life stages. Headwater reaches with groundwater inputs provide high quality spawning habitat for adults, crucial nursery habitat for juveniles, and thermal refuge for all ages, imperative for persisting through warmer summer months. Larger, downstream river segments provide more productive foraging opportunities during spring and summer and important overwinter habitat for adults. Groundwater-fed headwater streams are key to the dominance of the cold-water fish community in the Bad River watershed.

Surface waters with a high degree of ecological integrity receive special designations. Many of the state's highest quality waters have been designated in Chapter NR 102, Wis. Adm. Code, as Outstanding Resource Waters (ORWs) or Exceptional Resource Waters (ERWs). These waters provide outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality, are not significantly impacted by human activities, and warrant additional protection from the effects of pollution. ORW and ERW designations help the state meet CWA obligations to prevent any lowering of water quality. Similarly, Areas of Special Natural Resources Interest (ASNRI) are recognized by the state or federal government as possessing special ecological, cultural, aesthetic, educational, recreational, or scientific qualities. Certain areas, surface waters and wetlands are designated ASNRI by statute in s.

30.01(1am), Wis. Stat. ASNRI for the purposes of Wisconsin's Water Quality Standards for Wetlands are listed in s. NR 103.04, Wis, Adm. Code, which specifies that wetlands in ASNRI include those wetlands both within the boundary of designated ASNRI and those wetlands which are in proximity to or have a direct hydrologic connection to such designated areas. Enbridge's proposed Line 5 relocation route and route alternatives would cross ORWs, ERWs, ASNRI, and wetlands in ASNRI (Table 5.7-1, Table 5.7-2, Table 5.7-3, and Table 5.7-4). Table 5.7-9 provides a count of streams with special designations that would be crossed by Enbridge's proposed relocation route and route alternatives. Table 5.7-10 provides a breakdown of trenched and HDD crossings of these specially designated waters for Enbridge's proposed relocation route.

Table 5.7-9 Count of classified resource waters crossed by Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed (count)	RA-01 (count)	RA-02 (count)	RA-03 (count)
Length of pipeline	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Stream classification				
ASNRI[1]	16	14	21	18
ORW[2]	5	5	5	2
ERW[3]	4	3	5	2

[1]Area of special natural resources interest
[2]Outstanding resource water
[3]Exceptional resource water

Table 5.7-10 Count of classified streams crossed by trenching and HDD along Enbridge's proposed Line 5 relocation route.

Stream classification	Trenching	HDD or direct bore
ASNRI[1]	9	7
ORW[2]	2	3
ERW[3]	1	3

[1]Area of special natural resources interest
[2]Outstanding resource water
[3]Exceptional resource water

5.7.8.2 Effects on Fish

Effects to fish are likely to be proportional to their presence at or downstream of crossing locations and the sensitivity of each species to effects. The project's main effects categories are sediment and temperature, which both directly and indirectly affect various other environmental variables. Brook trout is an excellent focal species for characterizing effects because its preferred habitat intersects with most stream crossing types for the project, and because brook trout are highly sensitive to disturbance. Other species like largemouth and smallmouth bass, walleye, northern pike, and muskellunge are all less prevalent and are more tolerant to anticipated effects in the most commonly crossed stream types along Enbridge's proposed ROW. Table 5.7-11 shows the number of modeled highly suitable stream reaches crossed by Enbridge's proposed relocation route and route alternatives for species with more than one highly suitable reach (this scenario is noted in each individual section when relevant). Table 5.7-12 provides the breakdown of trenched crossings and HDD crossings along Enbridge's proposed route for the same group of species.

Table 5.7-11 Count of modeled highly suitable habitat reaches crossed by Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed route	RA-01	RA-02	RA-03
Length of pipeline	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Habitat type				
Brook trout habitat ≥ 80% suitability[1]	10	6	17	14
Largemouth bass habitat ≥ 30% suitability[2]	-	1	-	7
Walleye habitat ≥ 30% suitability[2]	1	1	1	1

[1] FishViz habitat suitability model (Stewart et al., 2016)
[2] ELOHA habitat suitability model (Diebel et al., 2015)

Table 5.7-12 Count of modeled highly suitable stream reaches crossed by trenching or HDD along Enbridge's proposed Line 5 relocation route.

Habitat type	trenching through streambed	HDD or direct bore beneath streambed
Brook trout habitat ≥ 80% suitability[1]	8	2
Largemouth bass habitat ≥ 30% suitability[2]	0	0
Walleye habitat ≥ 30% suitability[2]	0	1

[1] FishViz habitat suitability model (Stewart et al., 2016)
[2] ELOHA habitat suitability model (Diebel et al., 2015)

5.7.8.3 Brook Trout

Brook trout are a cold-water species of commercial and cultural value for the Bad River and surrounding watersheds. Brook trout are native to the region and inhabit many interior waterbodies throughout the area and the nearshore environment of Lake Superior. Brook trout are the only type of stream trout native to Wisconsin. Given their environmental needs, their presence and success in the Bad River watershed indicates strong groundwater-surface water connections, relatively undisturbed and unembedded gravel and sand-substrate streams, well-oxygenated, cold water, and at least periodically stable spring rainfall sequences which allow population success. Many of these habitat criteria overlap with those for high-quality surface water resources, and as such brook trout presence can be indicative of broader trends in overall resource quality.

Brook trout have a relatively complex set of environmental requirements for survival, including some critical bounds on temperature. As a cold-blooded species, their physiology fails below and above certain temperature limits (DNR, 2019a). Brook trout tend to prefer cooler waters within their survival range; their optimal temperature is between 50° F and 57.2° F.As a cold-blooded species, their physiology fails below and above certain temperature limits. Brook trout tend to prefer cooler waters within their survival range; their optimal temperature is between 50° F and 57.2° F. The species and other related species (e.g., lake trout, brown trout, etc.) can physiologically adapt to some amount of temperature shift depending on their environmental conditions and continue to survive and reproduce. Maximum summer water temperatures tend to define the success of the species in a stream system. Without cool/cold refugia during the most stressful periods of the year, the species cannot persist. For example, brook trout can only tolerate one day of a maximum daily mean temperature at 77.5° F. Brook trout can also tolerate some short spans at higher temperatures, but chronic overexposure to warm conditions greatly inhibits success.

Brook trout also depend on well-oxygenated waters to succeed; adult brook trout do best when in water with more than eight ppm of dissolved oxygen, corresponding to a relatively cold water temperature. Brook trout eggs have even more stringent oxygen requirements, needing 11 ppm of dissolved oxygen in the water column to ensure survival. Dissolved oxygen is depleted both by temperature and by algal consumption (see discussion of eutrophication in section Brook trout also depend on well-oxygenated waters to succeed; adult brook trout do best when in water with more than eight ppm of dissolved oxygen, corresponding to a relatively cold water temperature. Brook trout eggs have even more stringent oxygen requirements, needing 11 ppm of dissolved oxygen in the water column to ensure survival (DNR, 2019a). Dissolved oxygen is depleted both by temperature and by algal consumption (see discussion of eutrophication in section 5.7.7.4), meaning that waters must have low excess nutrients to allow brook trout survival.

Brook trout reproduction interfaces directly with groundwater conditions; the most-preferred spawning sites tend to be on gravel substrate and are connected hydrologically with groundwater. Connection with groundwater (upwelling or downwelling) provides triple benefits: thermal stability, baseflow stability, and oxygen stability. Baseflow stability is especially important during the most extreme times of the year, summer and winter. In the winter, groundwater-fed streams could remain ice-free despite extremely cold surface temperatures, while during the summer these streams remain around the optimal survival range for trout and continue flowing despite very dry conditions. Adults and juveniles often use groundwater-fed streams as thermal refugia during the summer. In the winter, groundwater-fed streams could remain ice-free despite extremely cold surface temperatures, while during the summer these streams remain around the optimal survival range for trout and continue flowing despite very dry conditions (DNR, 2019a). Adults and juveniles often use groundwater-fed streams as thermal refugia during the summer.

Mature brook trout are territorial; they prefer areas of relatively slow water with good food sources, which are a limit on the survival and reproduction of the species at adult and juvenile stages Brook trout juvenile survival is also strongly baseflow-dependent. If spring-summer flooding pushes fry into larger streams too early, they die, reducing the overall population success of a year and contributing to year failure. Mature brook trout are territorial; they prefer areas of relatively slow water with good food sources, which are a limit on the survival and reproduction of the species at adult and juvenile stages Brook trout juvenile survival is also strongly baseflow-dependent. If spring-summer flooding pushes fry into larger streams too early, they die, reducing the overall population success of a year and contributing to year failure (DNR, 2019a).

To summarize, brook trout success requires a series of connected habitats which provide cold, well-oxygenated water, sufficient food (invertebrates for juveniles, smaller fish for adults), and easy connection to a diverse set of habitats to weather inclement temperature and flow conditions during the winter and summer (DNR, 2019a). Their presence is an indicator of high regional water quality, with low hydrologic disturbance, low sediment load, and high dissolved oxygen.

Brook trout distributions are relatively well-understood, since they are a highly valued game fish. Distributions are sampled routinely with state fisheries data at survey points and are modeled to fill gaps in suitability in several data products. FishViz, a decision support tool developed by the USGS models the current prevalence of brook trout and makes predictions about the prevalence of the species into the 2080s.

FishVIz only models a subset of all stream crossings identified in Enbridge's application materials (Section 5.7.5). ELOHA, a decision support tool characterizing the effects of hydraulic alteration on fish populations, also models the prevalence of brook trout for a larger set of streams than FishViz. FishViz is typically more optimistic in its estimates than ELOHA. Figure 5.7-25 depicts the distribution of FishViz-modeled brook trout occurrences (given in probability of presence, essentially a modeled % chance) at Enbridge's proposed waterway crossings. Maps of FishViz- and ELOHA-modeled outputs for the project area are shown in Figure 5.7-26 and Figure 5.7-27, respectively. Some streams are also recognized as trout streams under s. NR 1.02, Wis. Adm. Code, and these are jointly considered as highly suitable areas for brook trout (Figure 5.7-28; Table 5.7-13).

Figure 5.7-25 shows most crossings are predicted to have above 50 percent suitability based on the FishViz model. Four crossings are relatively unsuitable (< 40%) for brook trout with another cluster of 11 crossings between 40 percent and 50 percent. Scores can be interpreted directly as probabilities, such that a probability of 0.67 would indicate that the model predicts a 70 percent chance of species being present in a given reach based on the input data.

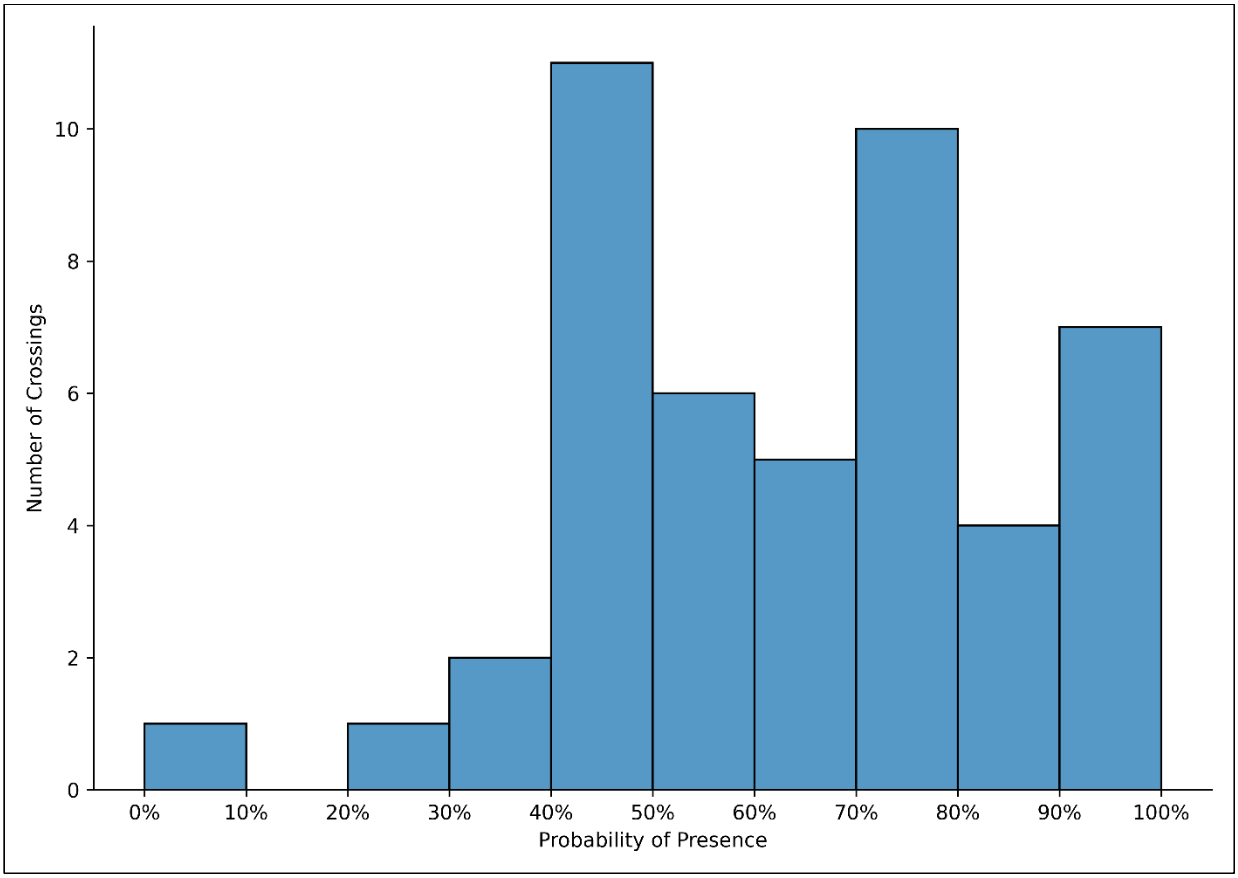


Figure 5.7-25 Distribution of FishViz-modeled brook trout occurrences at Enbridge's proposed waterway crossings.
Source: DNR

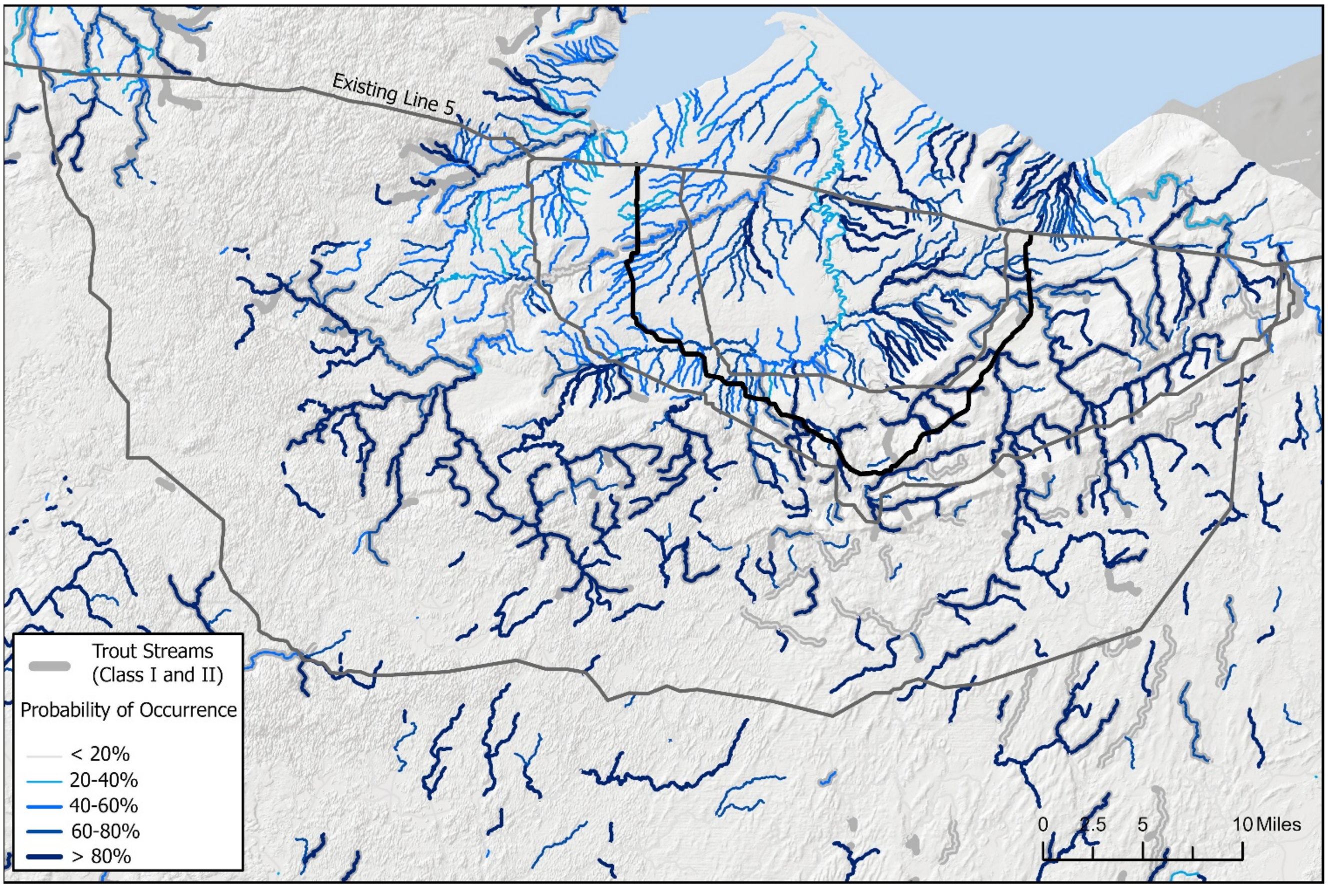


Figure 5.7-26 FishViz-modeled probabilities of brook trout presence around Enbridge's proposed Line 5 relocation route and route alternatives.

Bold black lines indicate the Enbridge's proposed Line 5 relocation route and route alternatives.
Source: (Stewart et al., 2016)

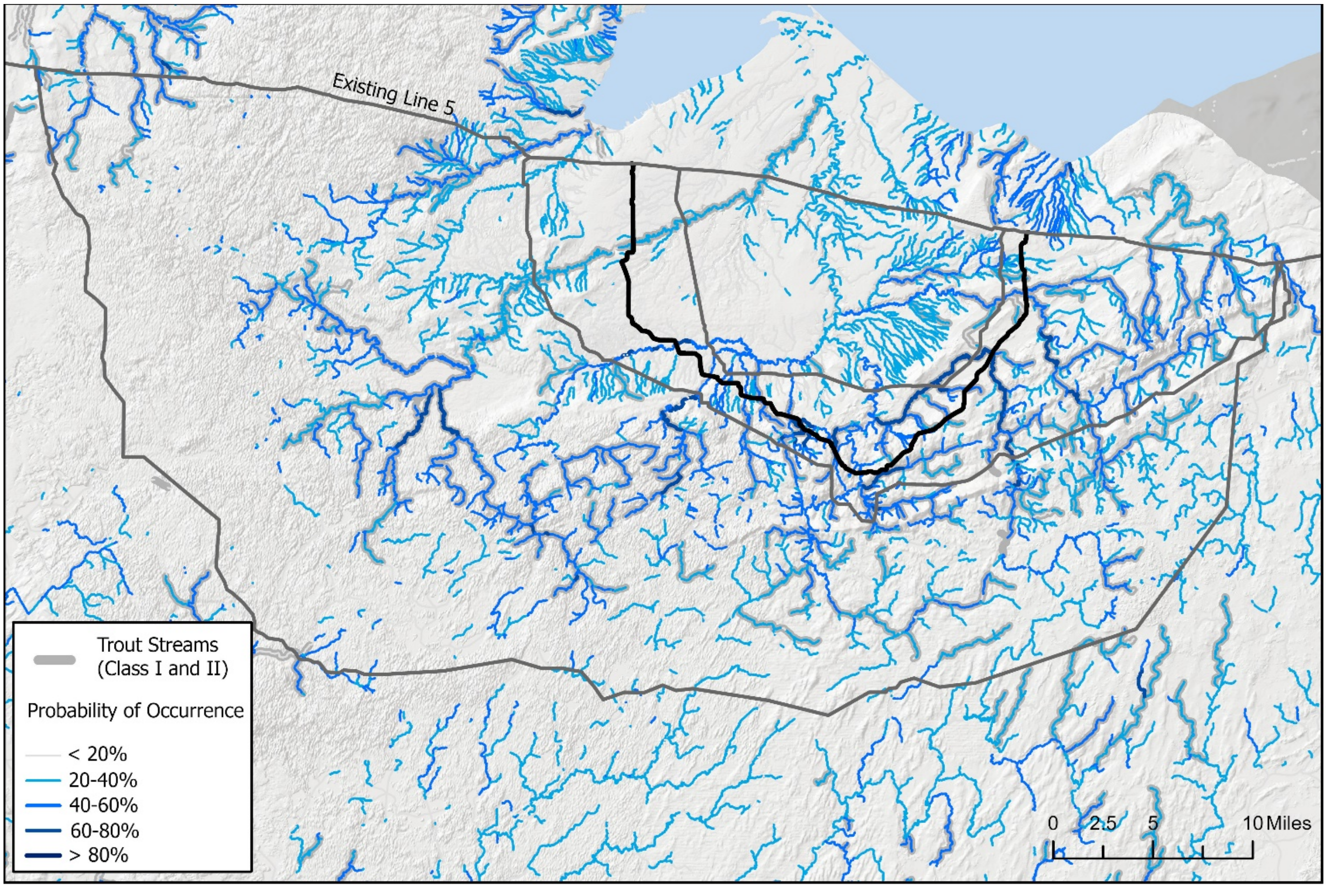


Figure 5.7-27 ELOHA-modeled probabilities of brook trout presence around Enbridge's proposed Line 5 relocation route and route alternatives.

Bold black lines indicate Enbridge's proposed Line 5 relocation route and route alternatives.
Source: DNR

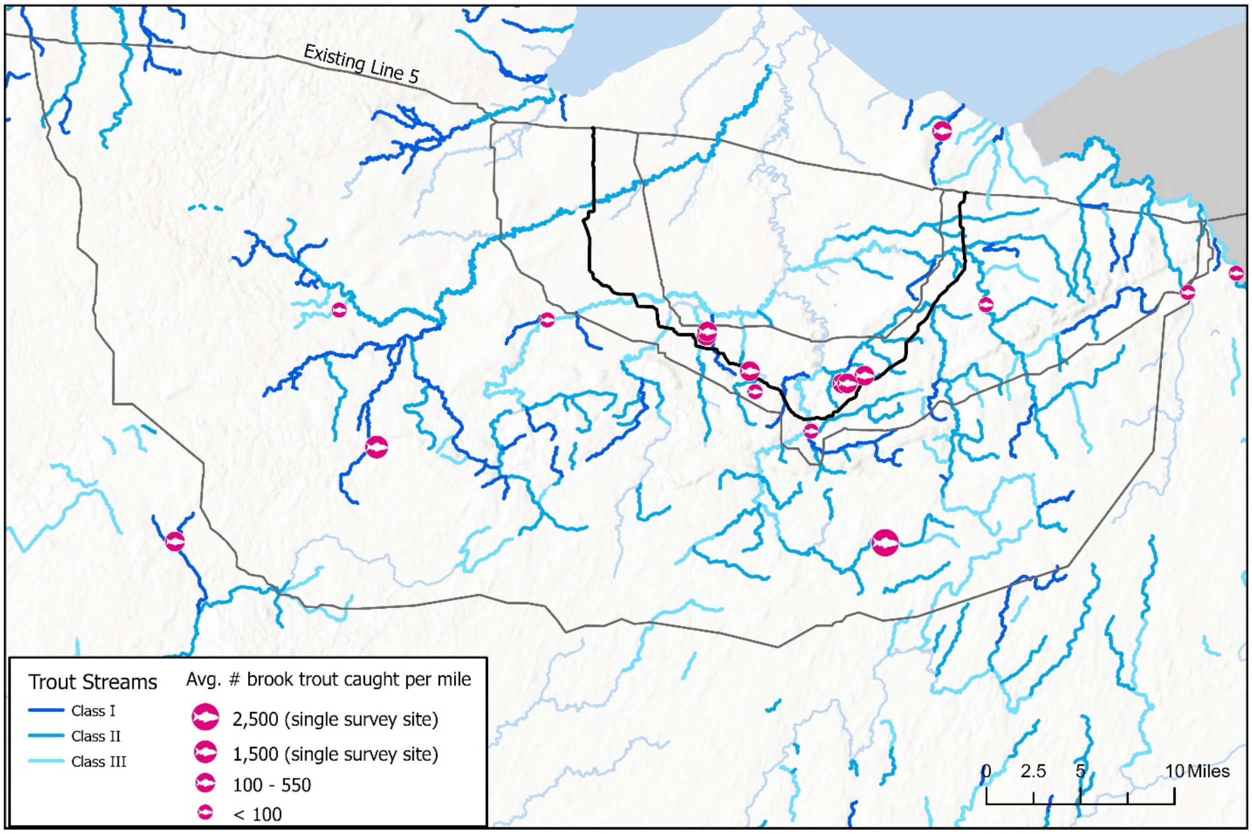


Figure 5.7-28 Classified trout streams and average number of brook trout caught per mile from fish population surveys conducted between 2000 and 2023.

Note: Unit of fish caught is catch per unit effort (CPE) which describes the rate at which fish are caught per mile of stream surveyed. Averages are across surveys which may have different objectives, but all investigate either population baselines or brook trout specifically.

Source: DNR

Table 5.7-13 Count of Class I and Class II trout streams crossed by Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed route	RA-01	RA-02	RA-03
Length of pipeline (miles)	41.1 mi.	31. 4 mi.	58.0 mi.	101.5 mi.
Trout stream classification				
Class I	2	1	4	2
Class II	9	6	11	5

Brook trout are a cold-water species and are most sensitive to increases in water temperature during periods of summer low flow. They are unable to survive even brief exposure to temperatures above 77° F, even after periods of acclimation (Raleigh, 1982). Clearing of the tree canopy at proposed crossings and warming associated with pipeline operations (Section 5.7.7.1) could create localized areas exceeding this threshold, resulting in brook trout avoidance of the area during high-temperature, low-flow periods. It is unlikely that baseflow conditions low enough to induce substantial heating would be suitable for brook trout movement but may create an obstacle in the event that trout traverse the area to go between thermal refugia.

If a benthic upwelling zone is located around the pipeline, elevated pipeline temperatures could make the area unsuitable for brook trout spawning. The presence of potential brook trout spawning habitat at Enbridge's proposed waterbody crossings was not assessed during Enbridge's site surveys, so it is unclear how common or likely this scenario would be along Enbridge's proposed ROW. Trout streams at greatest risk of temperature alteration would be those that are marginal habitats and relatively small. Smaller streams with less flow would be more likely to have higher levels of heating, since warmer water upwelling from underground sources would not be diluted as much when it reaches the streambed. Lower volumes of water would also heat faster due to solar radiation, compounding the effect if tree clearing occurs. Marginal habitats (typically cool-cold or cool-warm transition) are the most sensitive habitats to temperature alteration because they are close to the limits of success for trout species. Ultimately, the greatest risk of pipeline effects lies in the extremes of pipeline operation temperatures and stream temperatures, which are poorly covered by Enbridge's modeling and other analytical materials, making it challenging to characterize the nature or prevalence of risk at these extremes.

Brook trout are sight feeders and depend on clear water to feed. This makes them sensitive to elevated turbidity and suspended sediment. Elevated turbidity and suspended sediment levels would be anticipated as part of the project's environmental footprint, including some release of sediment from dammed crossings of river sand streams which could release a pulse of suspended sediment during times of the year when water is relatively clear. Sedimentation could also affect trout spawning habitat. In the short-term, habitat would be affected through direct disruption during the egg incubation phase. Direct sedimentation of viable brook trout eggs or fry can reduce survival (up to 25%) (Argent and Flebbe, 1999). Timing restrictions would be included as waterway permit conditions to avoid this type of effect. In the long-term, sedimentation could increase embeddedness of fine materials in gravel/cobble substrates, thereby decreasing the quality and quantity of available spawning habitat. Trout redds, which are typically positioned in porous, groundwater-interactive benthic material like gravel, would be vulnerable to sedimentation from pipeline construction activities, which would make the spawning areas less suitable overall because of the additional fine material. Sedimentation would limit the amount of habitat available to fish larvae when there is a sufficiently large downstream deposit, and elevated suspended solids would temporarily disturb fish below crossings. Compromising quality gravel/cobble spawning substrates via sedimentation could result in long-term reductions in juvenile brook trout production (Nuhfer, 2004). Trout and other fish typically engage in avoidance behaviors before being harmed by elevated suspended solids levels, so it would be likely that a zone between 30 and 500 feet downstream of each crossing would have reduced fish populations for the duration of in-stream construction.

Extremely high levels of total suspended solids (like those from an inadvertent release) would also be harmful to brook trout, causing gill abrasion, stress response, and difficulty breathing (Newcombe, 2003). HDD sites could also cause stress due to this mechanism but would be unlikely to increase mortality substantially unless extremely prolonged or if they occurred under low-flow conditions. To reduce the amount of sediment entering a waterbody, Enbridge would implement the erosion and sediment control measures specified in its EPP (Appendix D). Pipelines would be installed at stream crossings as quickly as possible to allow suspended sediment levels to return to preconstruction levels upon completion of in-stream work. Risks related to HDD inadvertent releases would be limited through careful monitoring of drilling fluid returns coming from the drill path or shaker tank, scrutinizing drilling fluid pressures, and visually inspecting the drill path, locating start and end points outside of the floodplain and outside of adjacent wetland complexes, implementing erosion and sediment control practices at start and end points to protect the adjacent resources, and having a plan and appropriate equipment in place to contain and remove any drilling fluid released.

The anticipated effects of petroleum spills on brook trout and other fisheries are addressed in Chapter 6.

5.7.8.4 Walleye

Walleye are a popular sportfish and are culturally significant to the Ojibwe people residing in the area (Section 4.2.1.11). The mouth of the Bad River and the Kakagon Slough provide two of the largest walleye spawning areas on the Wisconsin shores of Lake Superior. Since they are not deep, cold-water fish, like trout, walleye remain closer to shore, and thus Wisconsin walleye are likely to stay near Wisconsin shores. Walleye are an apex-predator species adapted to living in a variety of habitats (Bozek, Haxton, and Raabe, 2011). They typically spawn immediately after spring thaws begin, and do so in large riffles with rocky substrates that protect newly spawned larvae (Bozek, Baccante, and Lester, 2011; Bozek, Haxton, and Raabe, 2011). Gravel and water movement are both important for sheltering and oxygenating eggs. Eggs take 10 to 21 days to mature. Walleye young depend on correct flow conditions to reach nurseries after hatching, and feed on zooplankton, then macroinvertebrates, and finally fish as they mature (Bozek, Baccante, and Lester, 2011). Adult walleye succeed best in larger river systems and their temperature optimum is 71° F (Bozek, Baccante, and Lester, 2011; Bozek, Haxton, and Raabe, 2011), but they tolerate higher temperatures relatively well, especially after heat adaptation. Walleye are very tolerant of low oxygen conditions, and can survive at concentrations down to around three ppm (Bozek, Haxton, and Raabe, 2011). Their main competitive niche is low-light/high-turbidity predation, at which they have an advantage due to a well-developed reflective layer in their eyes that allows them to see and forage in conditions other predators cannot (Bozek, Baccante, and Lester, 2011; Bozek, Haxton, and Raabe, 2011).

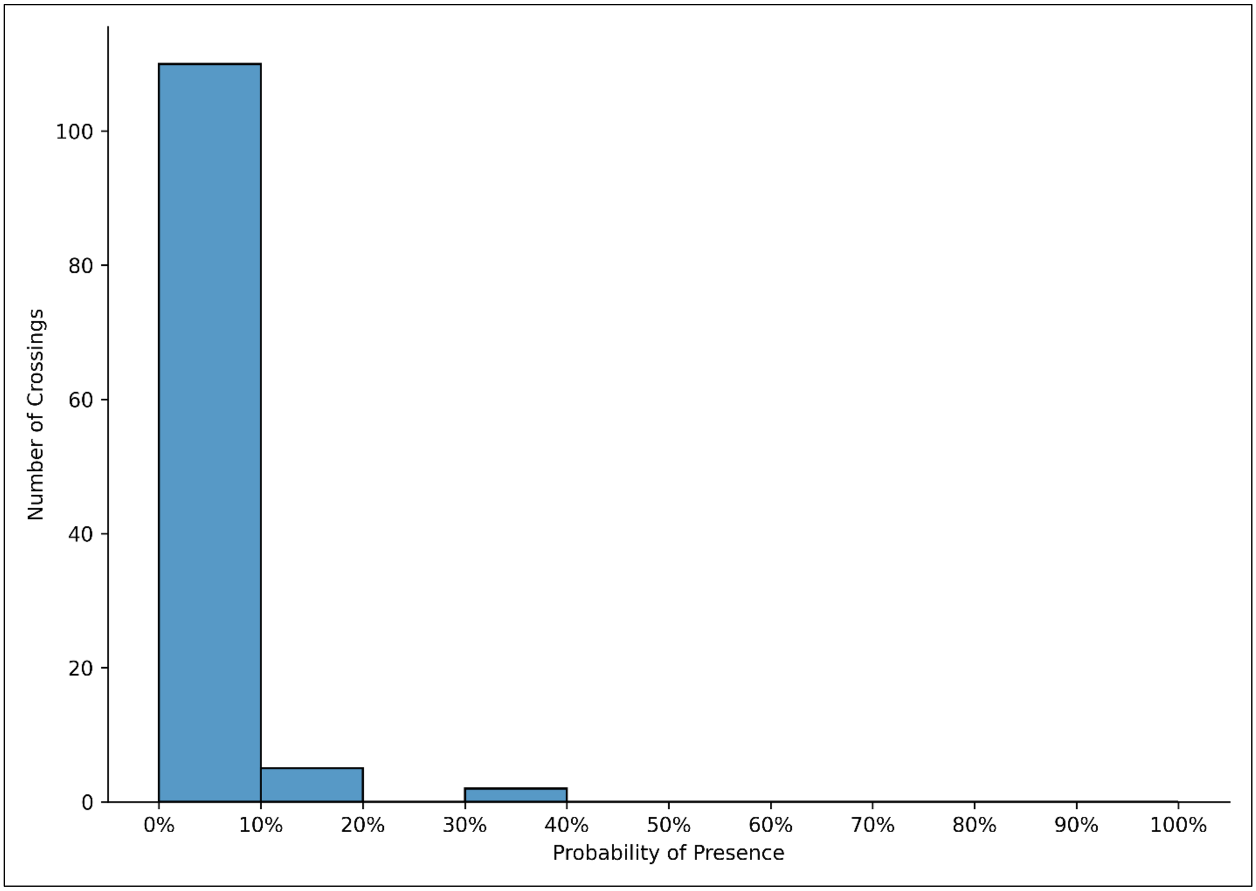


Figure 5.7-29 Distribution of ELOHA-modeled walleye occurrences at Enbridge's proposed waterway crossings.
Source: DNR

Walleye are mostly concentrated in large rivers in the project area. Figure 5.7-29 shows the distribution among intersected crossings by ELOHA, showing relatively low probability of presence for most crossings, which is logical given that most project crossings are smaller, headwater streams. Of those remaining, probability of presence is not above 50 percent, but select crossings do approach that level. Figure 5.7-30 shows the spatial distribution of suitability in the watershed, showing strong preference for large rivers by walleye in the area. Walleye do not show up in most DNR-sampled streams since most preferred walleye habitat in the area is in reaches of the Bad and White rivers within the Bad River Reservation, which are not sampled by the DNR.

Because of their limitation to larger rivers, the major anticipated effects on walleye would be from any inadvertent release or liquid petroleum spill occurring on a large river. The effects of sedimentation from an inadvertent release of drilling fluids from HDD or direct boring operations would be like those from sedimentation associated with trenched construction–drilling fluids and sediments could cover walleye spawning habitat, decreasing the survival and recruitment of subsequent spawning years if severe enough. Otherwise, effects on walleye would likely be limited and reduced in comparison to more sensitive species like brook trout. Risks related to HDD inadvertent releases would be limited through monitoring of drilling fluid pressures and the drill path, locating start and end points outside of the floodplain and outside of adjacent wetland complexes, implementing erosion and sediment control practices at start and end points to protect the adjacent resources, and having a plan and appropriate equipment in place to contain and remove any drilling fluid released.

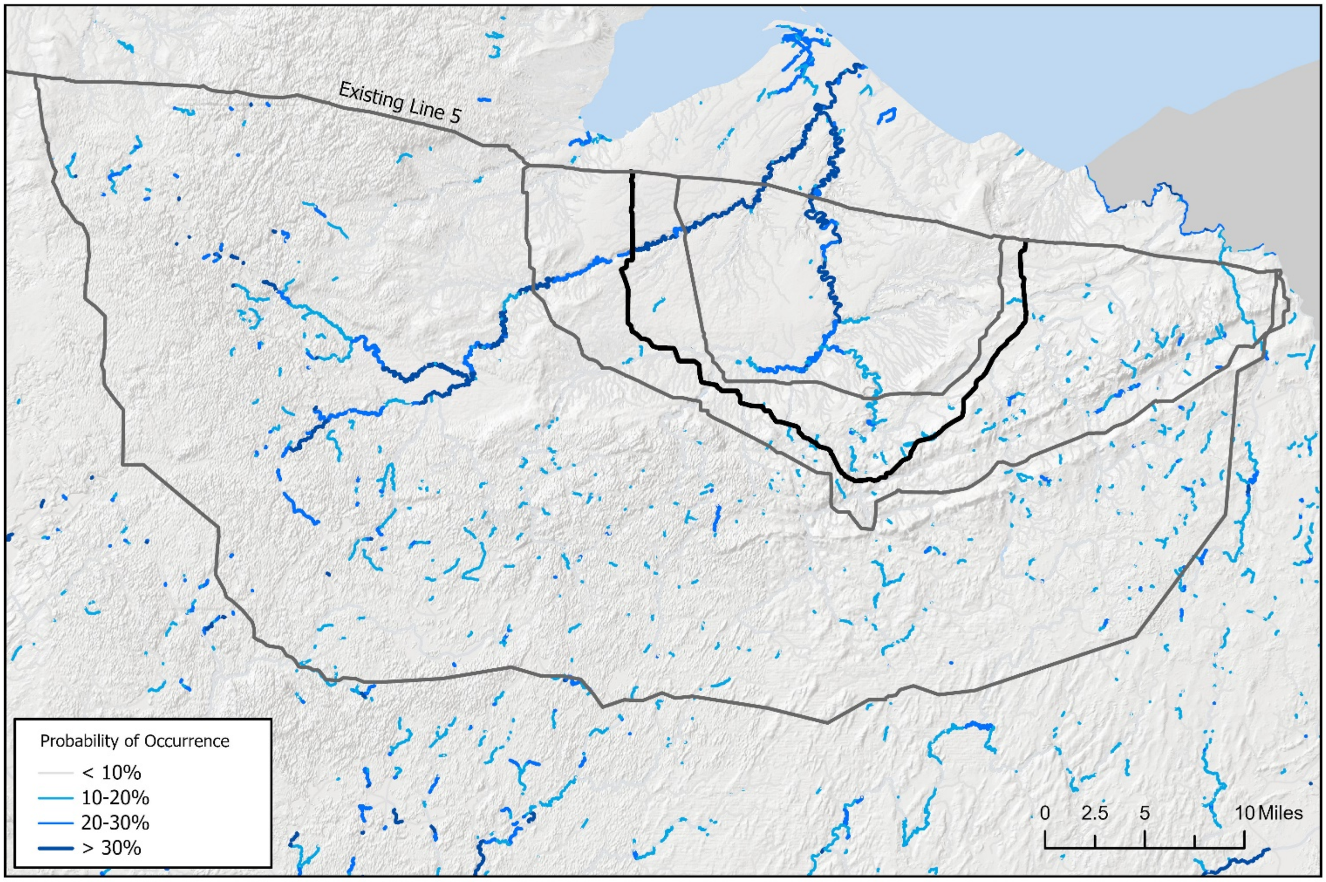


Figure 5.7-30 Modeled probability of walleye presence around Enbridge's proposed Line 5 relocation route and route alternatives.

Bold black lines indicate Enbridge's proposed Line 5 relocation route and route alternatives.
Source: DNR

The anticipated effects of petroleum spills on walleye and other fisheries are addressed in Chapter 6.

5.7.8.5 Northern Pike

Northern pike are cool-water, apex predators that live in shallow, slow-moving waters well-covered by vegetation (Harvey, 2009). They typically live in lakes or the backwaters and sloughs of large rivers (Harvey, 2009), including the Bad and White rivers and inland lakes beyond natural stream barriers. Northern pike depend on vegetated cover for all portions of their life cycle, from spawning (which occurs just after ice-off in the spring) to adulthood; pike are long-lived (up to 30 years; (Harvey, 2009). Optimal growth rates occur between 71° F and 73° F for juveniles and between 66° F and 71° F for adults, and they can survive a wide range of both dissolved oxygen concentrations and temperatures. Northern pike can tolerate temperatures up to around 84° F and dissolved oxygen concentrations as low as 0.3 ppm, although they engage in avoidance behaviors at around 4 ppm (Harvey, 2009). Pike consume large quantities of other organisms, moving from zooplankton as larvae to macroinvertebrates as juveniles, and finally fish as adults (Harvey, 2009); pike eat opportunistically and have no preferred prey (Harvey, 2009).

DNR stream samples from the proposed project area generally do not show northern pike occurrences. FishViz model outputs indicate that most streams crossed by Enbridge's proposed Line 5 relocation route are poorly suitable for northern pike; most of the proposed stream crossings have between a 10 percent and 20 percent probability of presence (Figure 5.7-31). This is reasonable given the typical profile of these streams and the species' environmental preferences. Figure 5.7-32 shows the distribution of northern pike probability of presence.

Because of their limited prevalence in the direct project area, northern pike would be unlikely to be present at any trenched crossings proposed for Enbridge's Line 5 relocation. Major effects on northern pike would be from an inadvertent release from an HDD operation or a petroleum spill. Materials discharged from an inadvertent release would inhibit breathing and induce avoidance responses, as well as reduce feeding for the duration of elevated turbidity (Newcombe, 2003). Because of their reliance on vegetated, slow-water habitats, northern pike would be vulnerable to the effects of a petroleum spill.

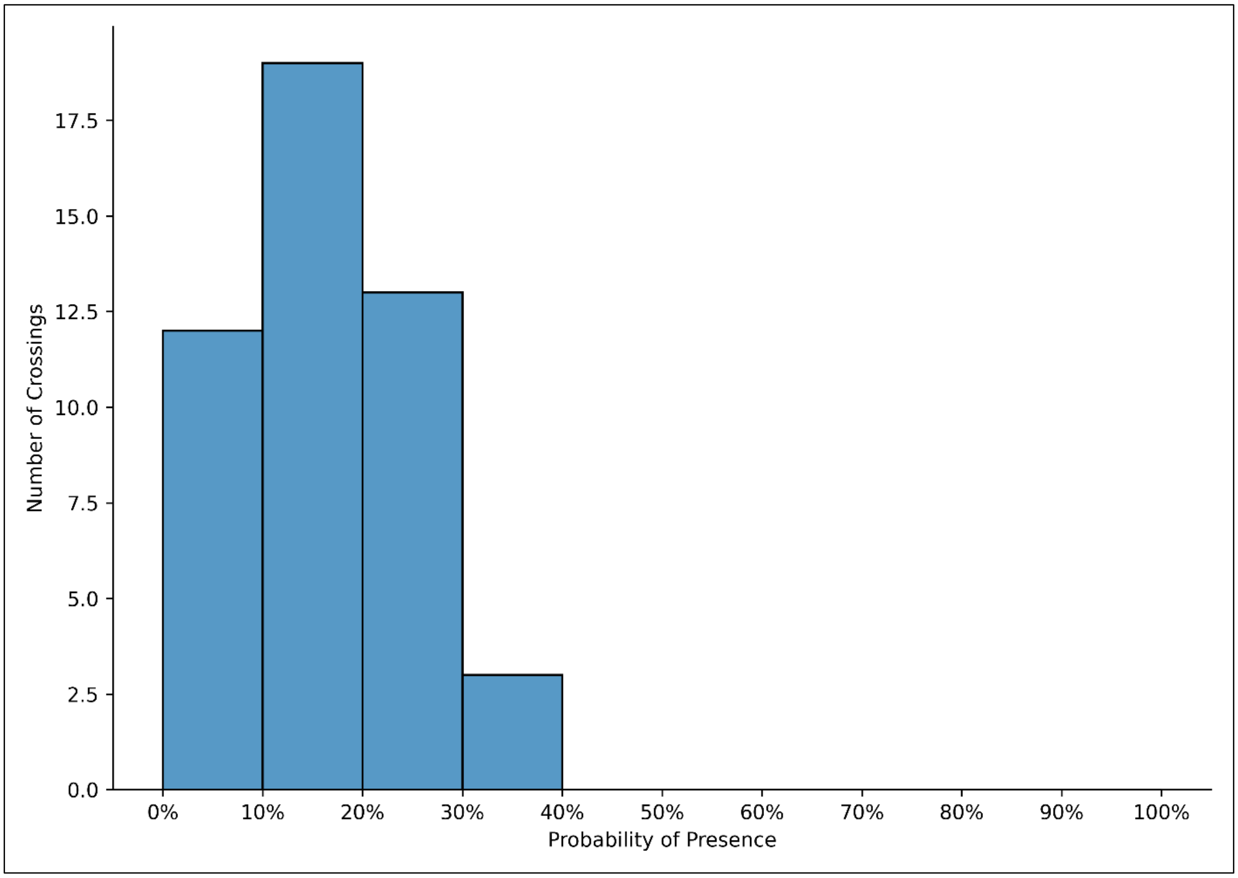


Figure 5.7-31 Distribution of FishViz-modeled northern pike occurrences at Enbridge's proposed waterbody crossings.
Source: DNR

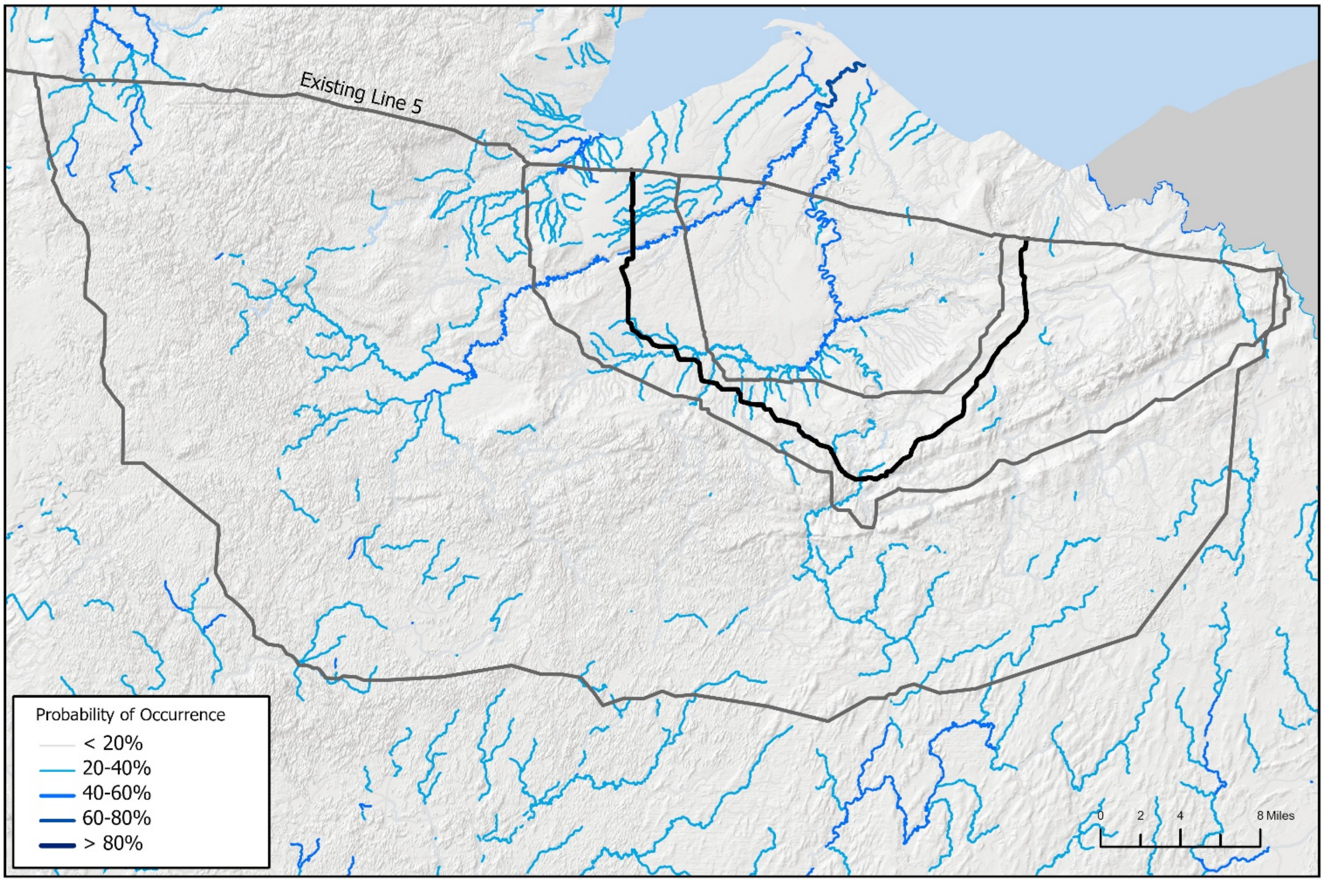


Figure 5.7-32 Modeled probability of northern pike presence around Enbridge's proposed Line 5 relocation route and route alternatives.
Bold black lines indicate Enbridge's proposed Line 5 relocation route and route alternatives.
Source: DNR

5.7.8.6 Muskellunge

Muskellunge share several characteristics with northern pike (Section 5.7.8.5). Muskellunge usually prefer shallower, slower waters, and spawn in backwaters or river pools with the same habitat features and organic/mucky substrate. Spawning occurs between mid-April and mid-May and eggs take eight to 14 days to hatch. Hatching success is controlled by water temperature and in some areas water remains too cold after spawning for successful hatching depending on year, controlling the population. Muskellunge are apex predators and typically occupy home ranges from which they do not deviate strongly except for during spawning. They prefer water between 33° F and 78° F but can tolerate up to 90° F for brief stints, and can tolerate low dissolved oxygen concentrations. Muskellunge hunt by sight and their feeding is inhibited by turbid water. Adults can be long-lived (up to 30 years in some cases)(Becker, 1983).

Muskellunge are naturally rare and highly dispersed throughout their range; probabilities of presence for muskellunge are correspondingly low even in places with a good habitat fit (Figure 5.7-33). Much like for northern pike, many of the streams crossed by Enbridge's proposed Line 5 relocation route are unsuitable for muskellunge, excepting some larger river areas like the Bad and White rivers (Figure 5.7-34). Muskellunge are additionally denoted by recognized muskellunge waters, which include mostly lakes in the project area with the exception of the Bad River below Copper Falls.

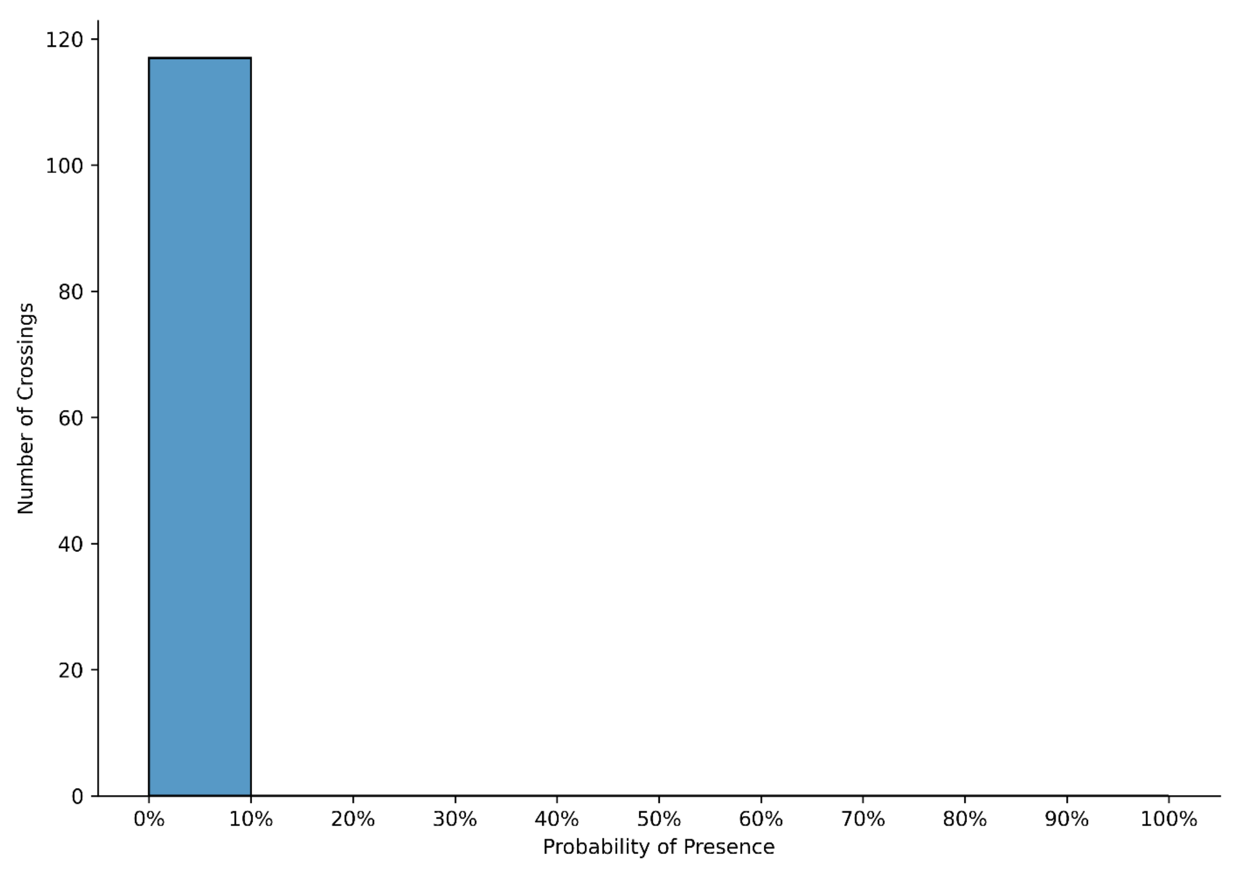


Figure 5.7-33 Distribution of ELOHA-modeled muskellunge occurrences at Enbridge's proposed waterway crossings.
Source: DNR

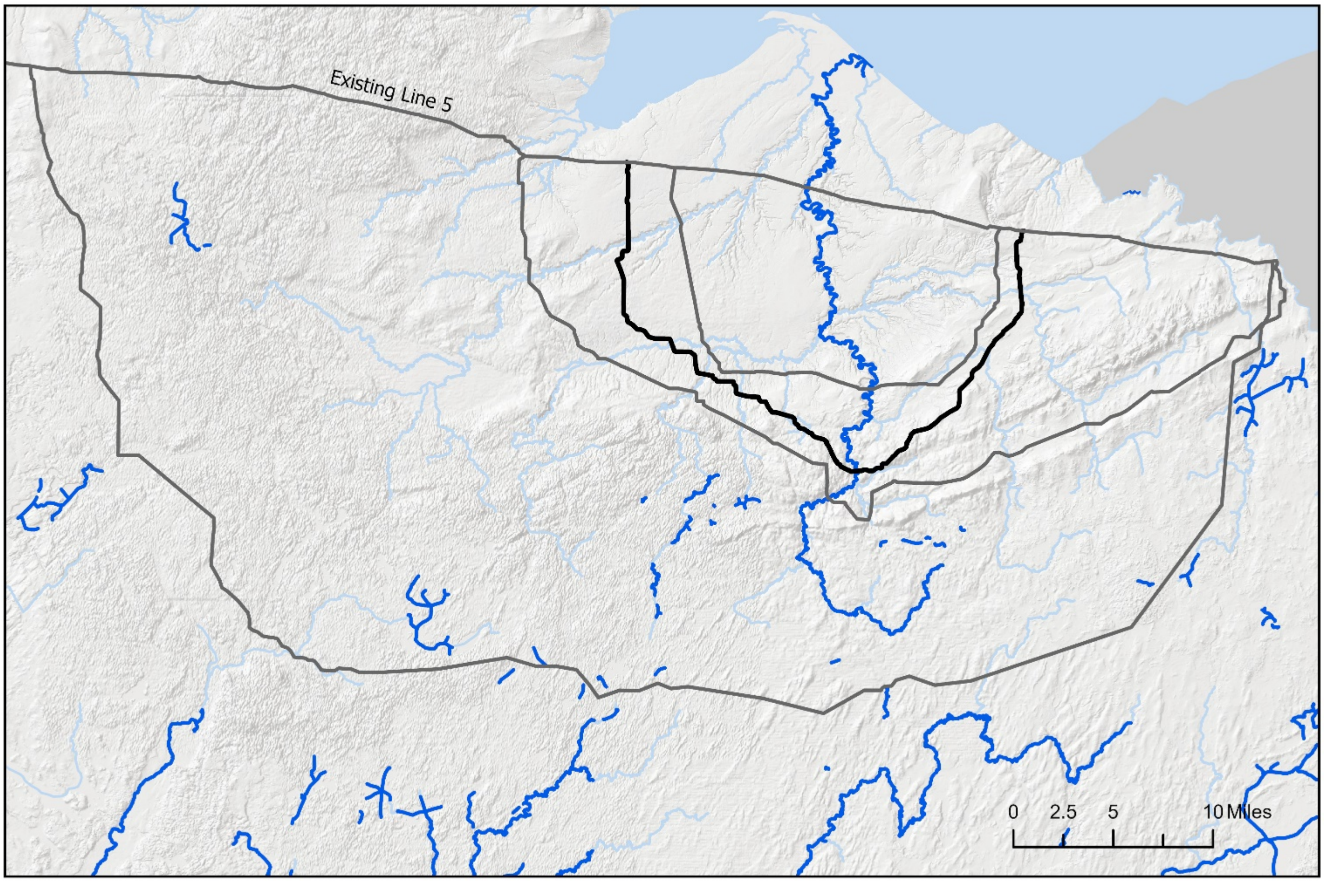


Figure 5.7-34 Designated muskellunge waters.
Bold black lines represent Enbridge's proposed Line 5 relocation route and route alternatives. Blue lines represent designated muskellunge waters.
Source: DNR

Due to their environmental requirements and relatively rare presence throughout the area of direct construction, muskellunge would be unlikely to experience direct effects from construction, with the exception of any inadvertent release from HDD operations or a petroleum spill. An inadvertent release would inhibit feeding behavior in muskellunge for the duration of elevated turbidity levels and could induce avoidance behavior or a more acute stress response depending on the severity of the inadvertent release. Muskellunge would likely lose habitat along major rivers in the event of a petroleum spill, since they rely on slow, vegetated waters which retain oil for longer periods.

5.7.8.7 Lake Sturgeon

Lake sturgeon are a species of special concern, a species of greatest conservation need (DNR, 2024), and are culturally significant to the Ojibwe people residing in the area (Section 4.2.1.11). They are very long-lived species that can live to be over 100 years old (males mature at ages 12 to 15 and females between 18 and 27). Lake sturgeon spawn between mid-April and early June depending on the conditions; spawning requires water temperatures between 50° F and 59° F. They often spawn on gravel and cobble substrates on the outer bends of large rivers, especially in areas with higher velocities and steeper gradients. Eggs take eight to 14 days to hatch; larvae rely on interstitial spaces in gravel for shelter and disperse nightly downstream after 13 to 19 days of growth. Juvenile fish shelter in deep pools in rivers over the winter, and adults reside in the deep waters of large lakes (Peterson, Vecsei, and Jennings, 2007). Lake sturgeon are omnivorous bottom feeders as adults, using their barbels to find prey, typically crustaceans and benthic macroinvertebrates. Because lake sturgeon grow slowly and reproduce slowly, they are highly vulnerable to fishing and overexploitation. Older individuals are thought to be very important for population success (Becker, 1983; Peterson, Vecsei, and Jennings, 2007).

Lake sturgeon have been the subject of a decades-long restoration/rehabilitation campaign to expand their numbers and success throughout Wisconsin (DNR, n.d.-a). Prior literature identifying suitable habitat indicates that the lower Bad River and the Apostle Islands are both good spawning habitats for lake sturgeon (Becker, 1983). In particular, the falls of the lower Bad River match the species' spawning template well. Mattes and Nelson (2001) found evidence of adult and larval lake sturgeon successfully using and spawning in the upper reaches of the White River. The DNR has identified specific lake sturgeon waters (Figure 5.7-35). Their suitability was not modeled in either FishViz or ELOHA.

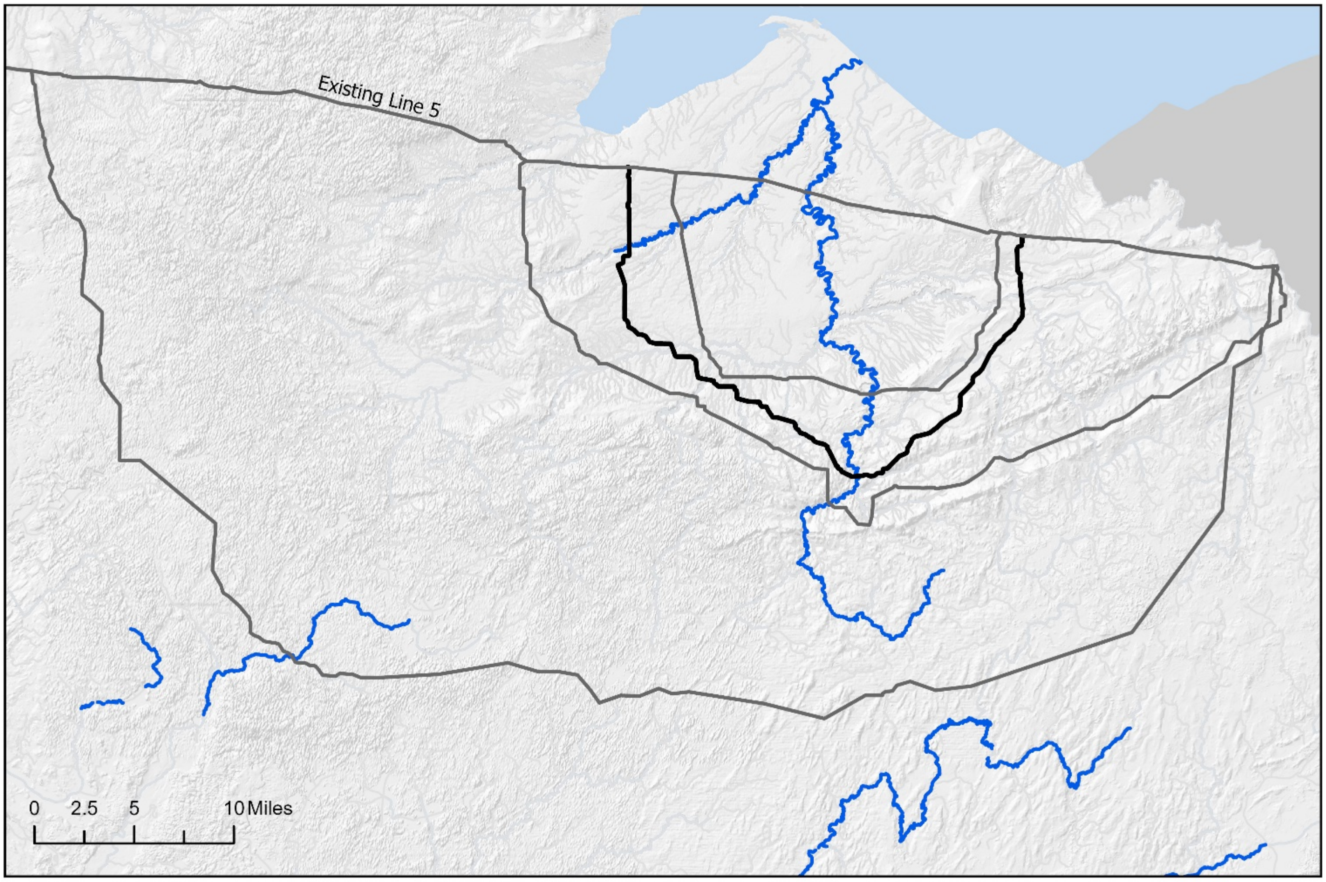


Figure 5.7-35 Designated lake sturgeon waters.
Bold black lines indicate Enbridge's proposed Line 5 relocation route and route alternatives. Blue lines indicate sturgeon waters.
Source: DNR

The species' preference for larger rivers and large lakes means that they would be unlikely to be directly affected by trenched crossings from the proposed project. To reduce the amount of sediment entering a waterbody, Enbridge would implement the erosion and sediment control measures specified in its EPP (Appendix D). Pipelines would be installed at stream crossings as quickly as possible to allow suspended sediment levels to return to preconstruction levels upon completion of instream work.

The major anticipated effects to lake sturgeon would be from inadvertent releases from HDD operations or a petroleum spill. Inadvertent release risk is attenuated by distance from preferred spawning habitat, which would allow some dilution of drilling fluid with additional water. However, depending on the conditions in which an inadvertent release occurs, spawning habitat could still undergo sedimentation, reducing suitability for lake sturgeon. In the event of a petroleum spill, any oil which settles at the bottom of rivers would harm lake sturgeon due to their feeding patterns. Prey availability would be reduced, making it harder for the species to find food, and the species would likely be exposed to any settled oil more directly due to its feeding position, increasing mortality risk (Chapter 6).

5.7.8.8 Largemouth Bass

Largemouth bass are an introduced gamefish to the project area (T. G. Brown, Pollard, and Grant, 2009) and prefer shallow, clear, moderately vegetated water as habitat (Becker, 1983; T. G. Brown, Pollard, and Grant, 2009). Largemouth bass are apex predators and are warmwater fish preferring water temperatures between 81 and 86° F (Becker, 1983). Notably, they cannot grow below water temperatures of around 50° F, meaning that colder average water temperatures impose a hard limit on their ability to disperse. Largemouth bass spawn in reedy shallows and males care for young by forming a nest that they guard until three to four weeks after hatching (Becker, 1983; T. G. Brown, Pollard, and Grant, 2009). Largemouth typically progress over their development from eating macroinvertebrates to fish of progressively larger sizes. Largemouth bass are highly adaptable to different habitats but prefer lakes (T. G. Brown, Pollard, and Grant, 2009). They live in the backwaters and pools of large rivers with slow water and muddy or silty bottoms (Becker, 1983; T. G. Brown, Pollard, and Grant, 2009).

Largemouth bass probability of presence was modeled by ELOHA (Figure 5.7-36). Probabilities are generally low along Enbridge's proposed Line 5 relocation route, likely due to the preponderance of colder water temperatures and smaller, faster, more turbid waters than the species' preference. Largemouth bass have higher probabilities of presence further downstream of the proposed crossings in larger river segments with the area of highest suitability being the Beartrap Creek system (Figure 5.7-37).

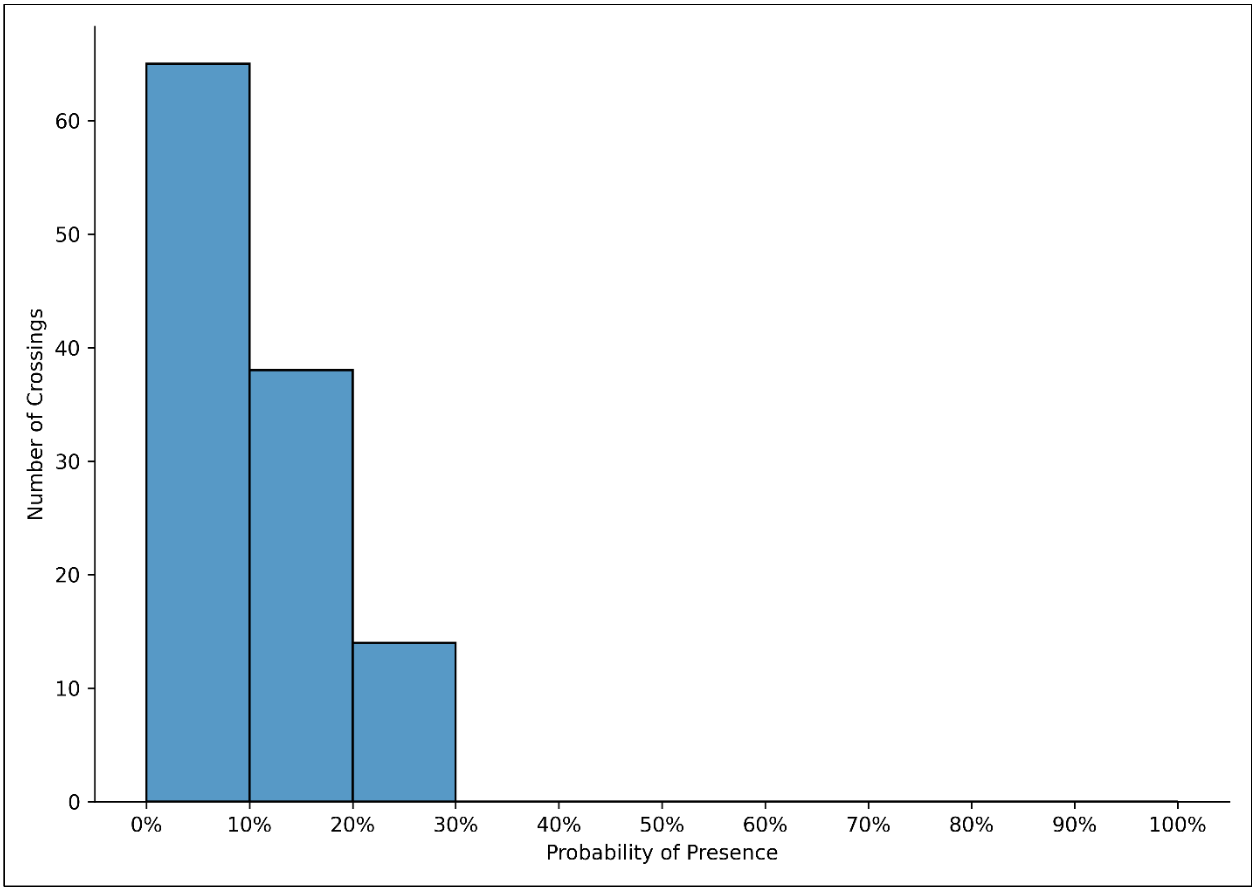


Figure 5.7-36 Distribution of ELOHA-modeled probabilities of largemouth bass presence among Enbridge's proposed waterway crossings.
Source: DNR

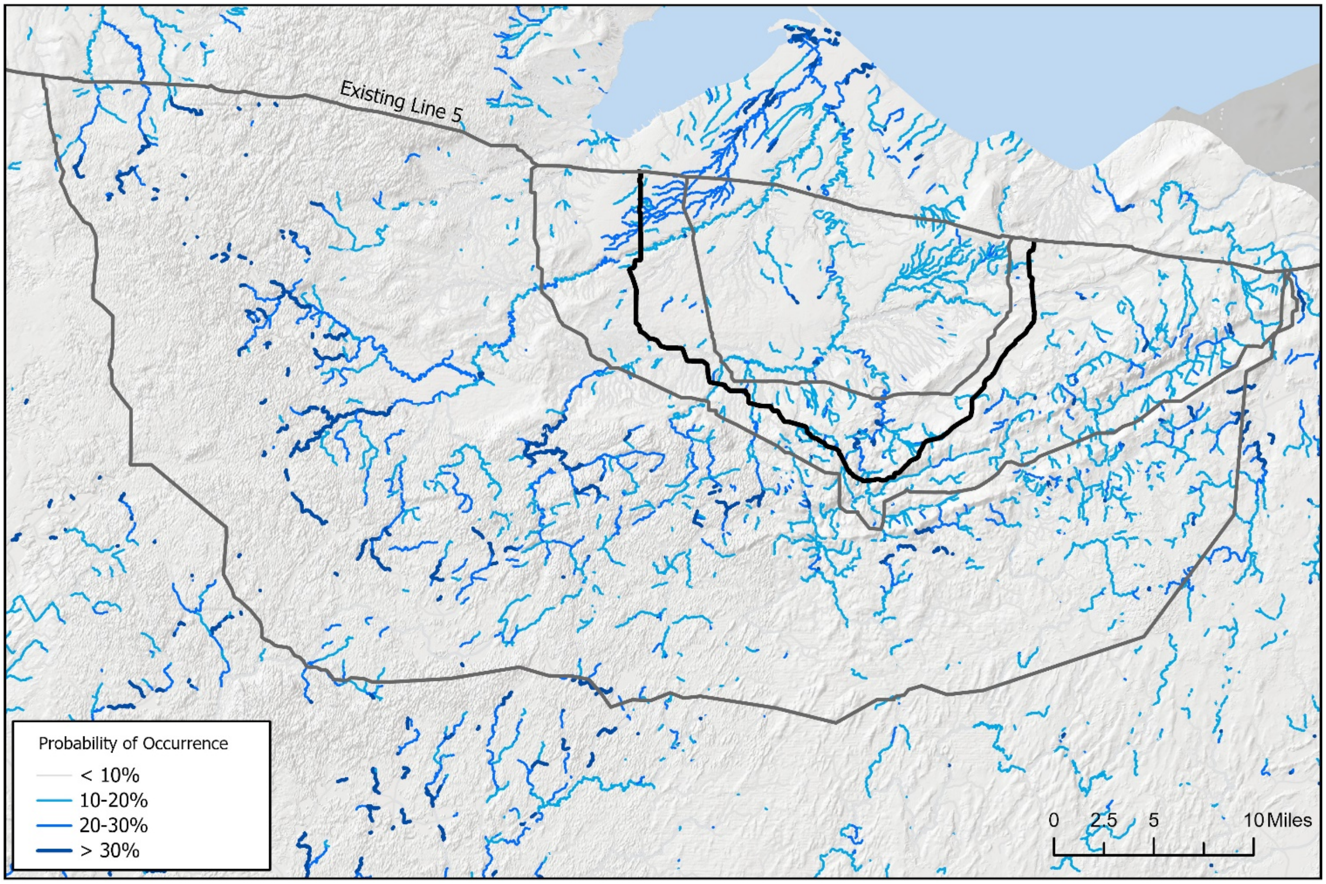


Figure 5.7-37 Fish-Viz-modeled probability of largemouth bass presence around Enbridge's proposed Line 5 relocation route and route alternatives.
Bold black lines indicate Enbridge's proposed Line 5 relocation route and route alternatives.
Data Source: Stewart et al. (2016)

Due to their environmental tolerance profile and distributional characteristics, largemouth bass are unlikely to be present at most or all of the project area's main crossings, which would limit direct effects to this species. To reduce the amount of sediment entering a waterbody, Enbridge would implement the erosion and sediment control measures specified in its EPP (Appendix D). Pipelines would be installed at stream crossings as quickly as possible to allow suspended sediment levels to return to preconstruction levels upon completion of instream work.

The main anticipated threat to largemouth bass habitat suitability would be from increased turbidity during an inadvertent release from an HDD operation or a liquid petroleum spill. Increased turbidity from an inadvertent release would inhibit feeding for the species, decreasing success for the duration of elevated turbidity. A petroleum spill would have potentially negative effects for the species, but the response of largemouth bass to oil exposure is poorly researched, as with most fish species. Generally, the main effect would be increased stress and reduced success of spawning due to contamination of slow-water sediments with submerged oil.

5.7.8.9 Smallmouth Bass

Smallmouth bass are predatory fish which live in lakes and medium-large rivers, preferring temperatures between 70° F and 80° F. They are close cousins with largemouth bass in terms of behavior and are similarly adaptable to a wide range of environmental conditions. Smallmouth bass are often found in the downstream areas of trout waters, where colder headwaters are occupied by brook trout and as the temperature warms and the river widens smallmouth bass predominate. Smallmouth bass need clean gravel beds to spawn, and they form nests and provide parental care from the time of spawning through the early juvenile stage. Typically spawning takes two to nine days and care is provided for another two to nine days. Smallmouth bass progress from eating large zooplankton (*Daphnia* spp.) as hatchlings, to aquatic macroinvertebrates as juveniles, and finally progressively larger fish and crustaceans as they mature (Becker, 1983).

Smallmouth bass prefer lakes but can also be found in rivers and streams; they are crepuscular and seek shelter under cover or in deeper water during the day. In streams, they prefer areas with backwaters with structure (i.e., large boulders, stumps, and rock ledges) because these areas provide slow water which minimizes their energy use over the course of the day (Becker, 1983).

Smallmouth bass probability of presence was modeled in FishViz (Figure 5.7-38). Most streams crossed by Enbridge's proposed Line 5 relocation route have very low probability of smallmouth bass presence, with only a small subset reaching above 50 percent probability of presence. These areas are generally larger streams and rivers and downstream waters (Figure 5.7-39) which corresponds with Becker's (1983) account of smallmouth bass habitat preferences.

Because smallmouth bass prefer larger waterbodies, their preferred habitat zones will generally be crossed by HDD, which would limit the direct effects of pipeline construction. An inadvertent release would have the anticipated effect of sedimentation on spawning habitat, limiting success of spawning efforts in the affected area until it was cleared of additional sediment. A petroleum spill would affect the species through direct toxicity and by reducing the suitability of affected areas for spawning by limiting food supplies and increasing toxicity stress to both young and adult smallmouth bass (Chapter 6).

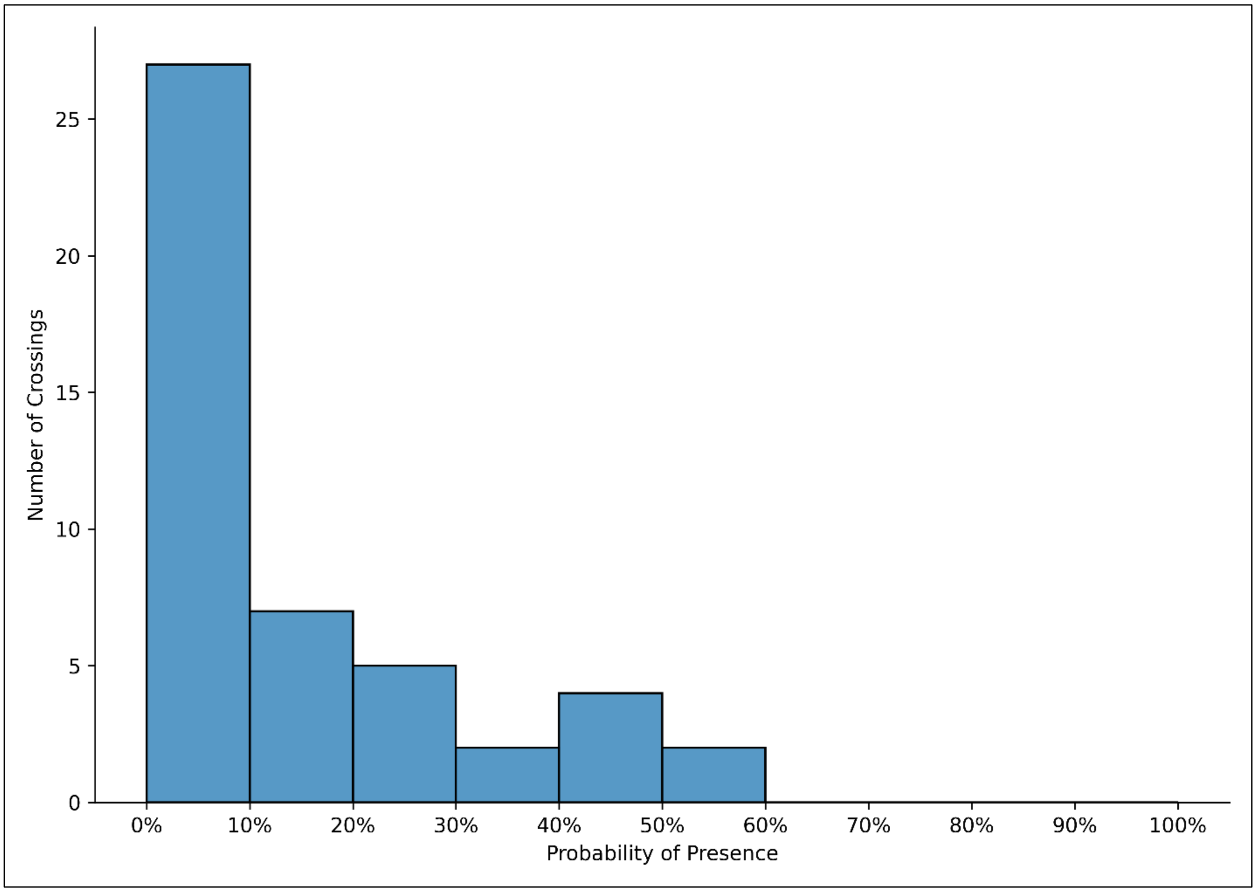


Figure 5.7-38 FishViz-modeled probabilities of smallmouth bass presence among Enbridge's proposed waterway crossings.
Source: DNR

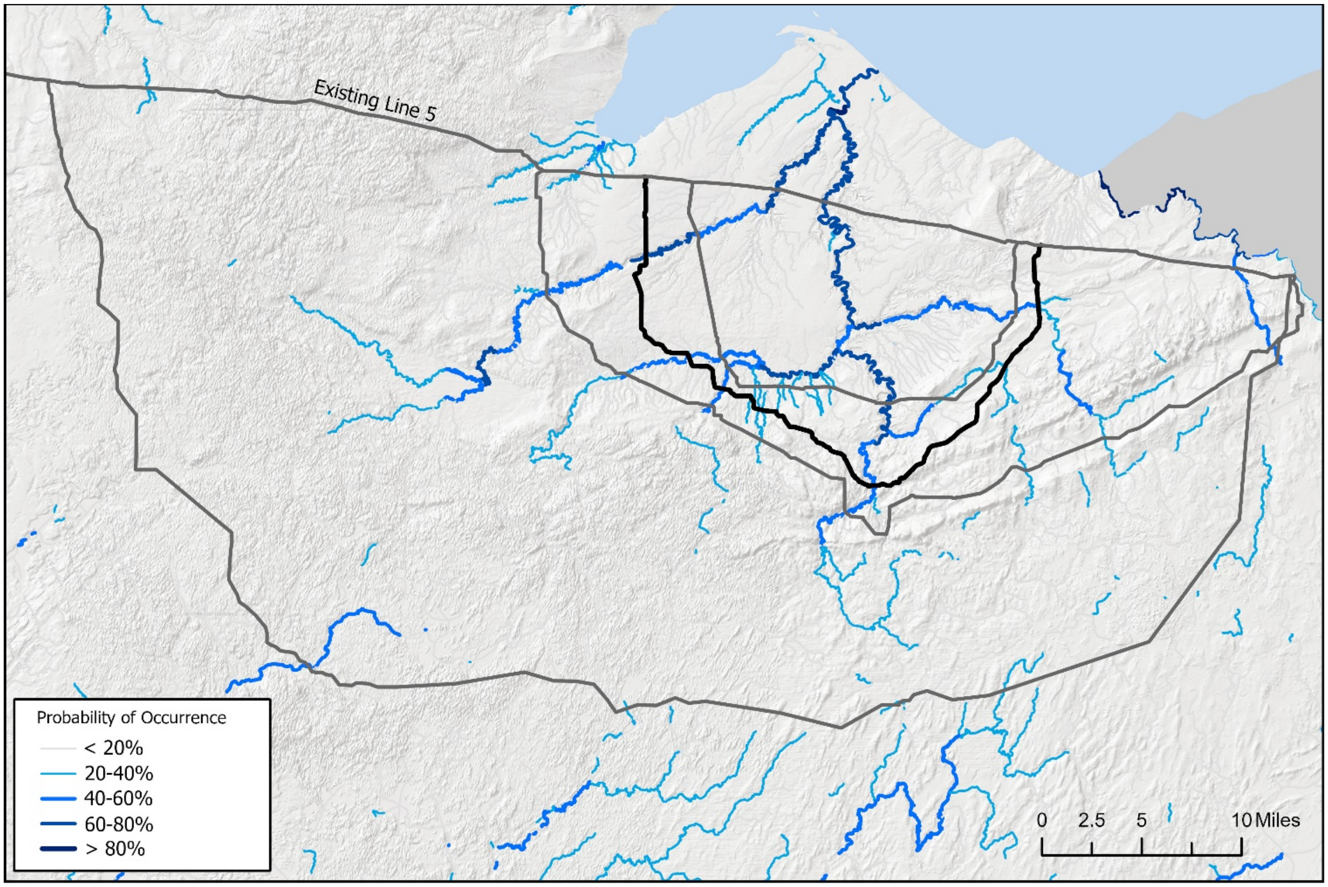


Figure 5.7-39 FishViz-modeled probabilities of smallmouth bass presence around Enbridge's proposed Line 5 relocation route and route alternatives.

Bold black lines indicate Enbridge's proposed Line 5 relocation route and route alternatives.
Data Source: Stewart et al. (2016)

5.7.8.10 Effects on Macroinvertebrates

Macroinvertebrates are strong indicators of water quality and an important part of the stream ecosystem. Because macroinvertebrates typically live in one location throughout their aquatic life stages, they are sensitive to the conditions of a waterbody. Their presence/absence can be informative as an indicator of water quality and any changes to it over time thanks to monitoring.

Macroinvertebrate data are not generally available for waterbody crossings along Enbridge's proposed Line 5 relocation route. However, the DNR has collected samples for the macroinvertebrate index of biotic integrity (IBI) to measure the quality of stream habitat throughout the state, including locations near the proposed ROW. Enbridge has also pledged to collect macroinvertebrate samples before and after construction. The macroinvertebrate IBI estimates the overall pollution tolerance of the community in a sampled area, weighted by the relative abundance of each taxonomic group (family, genus, etc.) (Lillie, Szczytko, and Miller, 2003). Higher scores generally indicate macroinvertebrate populations which are sensitive to pollution, disturbance, and degraded water quality. Macroinvertebrate IBI scores divide into wadable stream macroinvertebrate IBI (Hilsenhoff, 1987; 1988) and nonwadeable river macroinvertebrate IBI (Weigel and Dimick, 2011), because different communities of macroinvertebrates prefer large and small streams.

Figure 5.7-40 shows the distribution of wadable macroinvertebrate IBI samples in the state;10,365 individual samples were aggregated to 4,659 sites for this analysis. Sampling has been relatively dispersed throughout the state and encompasses all stream impact levels, from very heavily impaired urban streams (for example, some reaches of streams in the Milwaukee area) to extremely high-quality, low-impairment streams. This figure also displays the distribution of macroinvertebrate IBI samples in the area around Enbridge's proposed Line 5 relocation route.

The mean macroinvertebrate IBI value around Enbridge's proposed project area is 8.3, which is much higher than the state's mean score of 5.50. Most of the high-scoring sites are around MP 19 to MP 40. The western portion of the ROW, which runs through agriculture-dominated areas, has on average lower IBI scores. This region includes many sites in the top 25 percent of sites in the state for macroinvertebrate IBIs, and several in the top 10 percent. One site close to the proposed Line 5 crossing (UNT Tyler Forks) is rated in the top 15 percent, and the macroinvertebrate IBI near the proposed HDD at the Brunsweiler River (500 feet downstream) scores 12th-best in the state among all samples collected.

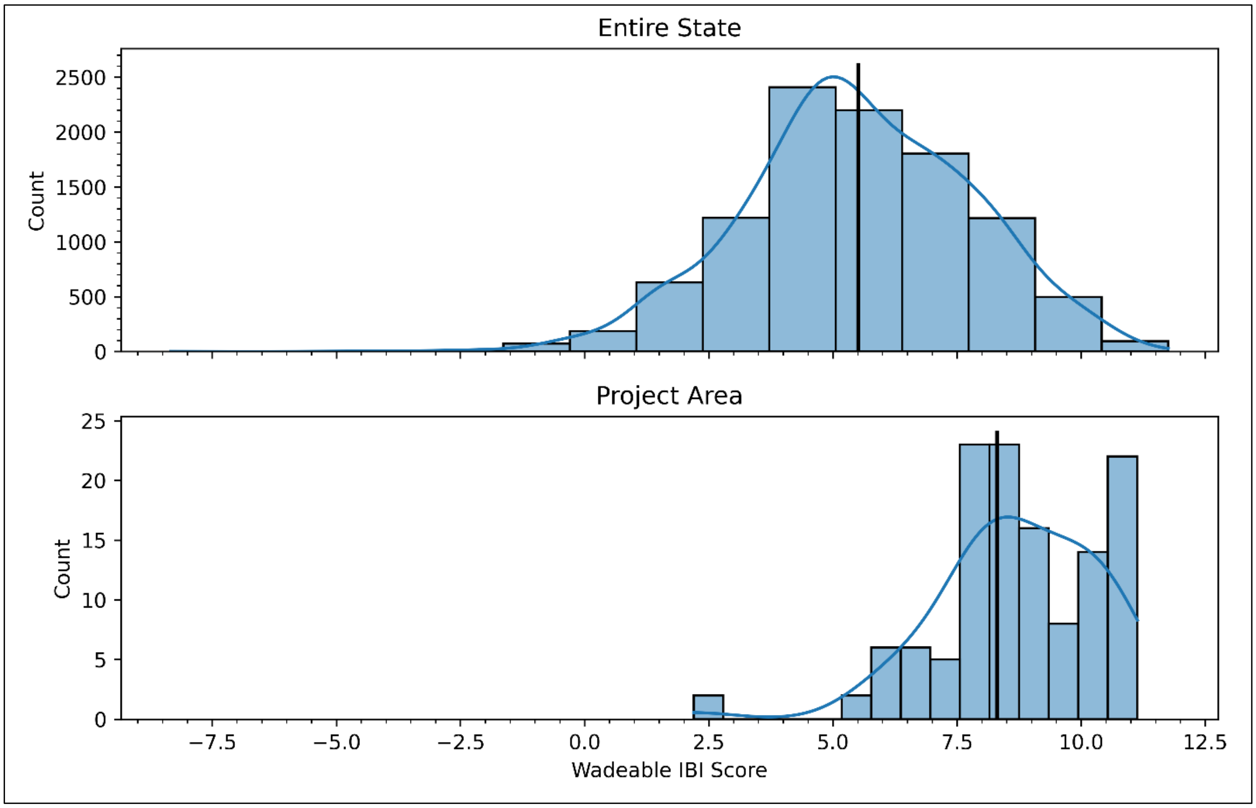


Figure 5.7-40 Macroinvertebrate IBI scores for Wisconsin (top) and in the area of Enbridge's proposed project area (Bottom).
Data Source: DNR

The crossing at the Brunsweiler River is the closest macroinvertebrate IBI sample point to the existing Line 5. Other values are approximations of what conditions at proposed waterbody crossings could be like, depending on the particular conditions encountered at the crossing itself. In particular, macroinvertebrate IBI scores will be most similar in riffles near the project area, since macroinvertebrate IBI samples are collected from riffles. Generally, the high values for Enbridge's proposed project area correspond to good water quality on a regional level and demonstrate widespread favorable conditions along the proposed route.

Literature regarding the effects of pipeline waterbody crossings is divided between the determination of temporary effects and longer lasting effects (Lévesque and Dubé, 2007). Many studies of pipeline crossing effects are sponsored directly by oil pipeline organizations and are localized to Canadian provinces and streams. Research in the United States, and reviews across larger geographic areas and timescales, is not readily available, making it difficult to relate the outcomes found in previous studies to the specific conditions along Enbridge's proposed relocation route. In general, much of the initial effect would depend on the type of substrate at a crossing, how the substrate is disturbed, and the amount of sediment released. Recovery would depend on how sediment clears from the system, and how riparian and in-stream characteristics would be changed due to the waterbody crossing methods. Effects from manipulation of riparian cover would be direct and indirect. Some riparian and in-stream changes would be permanent or permanently maintained to ensure the integrity of the pipeline and to prevent petroleum spills.

Macroinvertebrates, due to their dependence on micro-scale habitat during development, are uniquely susceptible to disturbances from construction activities. Their sole mechanism for escape is to release from their present location and 'drift' downstream to other suitable areas. Macroinvertebrates would be directly affected by initial substrate disturbance and sedimentation, as well as temperature effects from the pipeline. Trenched crossing techniques would lead to up to 100 percent mortality of streambed macroinvertebrates in the trench and any area which is drained for the duration of construction, due to the severity of macroinvertebrate habitat disturbance. Pipeline construction would also influence the habitability of near-downstream areas due to increased suspended solids loads and changes to flow dynamics from stream diversion. These factors would create an extended direct effect footprint downstream of each crossing. In areas with blasting, vibrations through the subsurface could also cause mass release of macroinvertebrates from disturbance upstream or downstream of the crossing point, which would increase the footprint of total macroinvertebrate loss.

Sedimentation of habitat downstream of trench crossings would lead to increased mortality for a minimum of 40 to 60 feet below each crossing. Areas affected by sedimentation would limit habitability for macroinvertebrates (at least those which favor coarse sediment) for a longer period, since the interstitial spaces these species depend on would be blocked. Temporary changes to stream substrate could be sufficient to modify the community structure over the short term (weeks to one year) according to Anderson, Fraikin, and Chandler (1998). Depending on the frequency of spates and sediment-clearing flows, it is possible that sediment would linger in accumulations for longer than a year, but this would depend on the weather in the years following construction, as do many effects (Armitage and Gunn, 1996). Backfilling sediment layers around the pipeline in the hyporheic zone would alter macroinvertebrate habitat and potentially cause a community shift due to the mixing of soil layers.

To reduce the amount of sediment entering a waterbody during trench construction, Enbridge would implement the erosion and sediment control measures specified in its EPP (Appendix D). Pipelines would be installed at stream crossings as quickly as possible to allow suspended sediment levels to return to preconstruction levels upon completion of instream work.

The effects of sedimentation from an inadvertent release of drilling fluids from HDD or direct boring operations would be like those from sedimentation associated with trenched construction. Risks related to HDD inadvertent releases may be limited through monitoring of drilling fluid pressures and the drill path, locating start and end points outside of the floodplain and outside of adjacent wetland complexes, implementing erosion and sediment control practices at start and end points to protect the adjacent resources, and having a plan and appropriate equipment in place to contain and remove any drilling fluid released.

Clearing of riparian tree cover would affect vegetation inputs to the local area around each proposed crossing. Some macroinvertebrates depend on subsidies of large wood for microhabitat and food, while others rely on detritus inputs from surrounding forested areas which would be cut down. Emergence success in the vicinity of the crossing would depend on riparian vegetation as well. Loss of riparian forested areas especially could alter macroinvertebrate community composition in the waterbodies at the proposed pipeline crossings.

Macroinvertebrates, which depend on very small-scale variations of flow, temperature, and dissolved oxygen, would be affected by temperature increases associated with both canopy removal and pipeline temperature. Since macroinvertebrates depend on temperature as an important cue for reproductive behavior and growth (Hawkins et al., 1997; Gustafson, 2008), large changes in local average water temperature would accelerate their growth and development in the vicinity of the pipeline, potentially mistiming their reproductive cycle to be out of step with typical seasonal cues and causing greater vulnerability to local population failure. Warmwater-tolerant species would be more prevalent, especially in the late summer and early fall when temperature and flow conditions are at their most limiting for sensitive species. For species operating at the margins of their tolerance level, elevated temperature would be likely to extirpate them, leading to a permanently altered community as a result of warming conditions. Generally, research finds that macroinvertebrate body size decreases with increased warming due to additional oxygen limitation (Horne and Hirst, 2015). Some species of macroinvertebrates burrow into the hyporheic zone when streambeds run dry, and these species would also be affected by elevated groundwater temperatures around the pipeline as they burrow. Groundwater temperature would be higher closer to the pipeline, which could amplify the effects of elevated temperature discussed above, depending on the temperature tolerance of each species.

The disturbance regime (frequency, timing, and duration of disturbances) for macroinvertebrates is important context for recovery potential. Disturbance regimes vary by the type of stream considered. The most stable streams would be those which have stable baseflow from groundwater and a relatively low probability of high-flow events, especially those which move coarse bank substrates or scour bedrock. These kinds of streams would typically have more stable flows and temperatures during periods of low flow, allowing larger standing crops of macroinvertebrates than streams which run dry for periods of the year. Streams in the project region would typically see their greatest disturbances during spring snowmelt and storms, which are generally the highest flows. The stable baseflows of summer and fall would aid in the establishment of a larger standing community of macroinvertebrates, so disturbance during these times would likely be more impactful overall than disturbances during typical times of year like during spring snowmelt. There could be a great diversity of responses to disturbance even between streams which are relatively close to each other (Armitage and Gunn, 1996).

Recovery potential would also depend on the dynamics of surrounding macroinvertebrate communities. Depending on the ability of these communities to redisperse to the crossing point, colonization by certain species could be delayed. Competition dynamics could then more permanently modify community structure after the disturbance. It is generally likely, however, that recolonization would proceed quickly since populations in neighboring habitat would be able to colonize disturbed areas from relatively nearby upstream.

Macroinvertebrates would also be directly and indirectly harmed in the case of a liquid petroleum spill. Fresh benthic oil would cause acute toxicity, mostly from the most volatile fractions of the hydrocarbon mixture (polycyclic aromatic hydrocarbons/PAHs). Oil aggregation with organic matter and leaf packs would limit macroinvertebrate habitat. Emergence patterns would likely be inhibited in contaminated locations as well, especially in backwaters, wetlands, and areas of slow flow where oil will linger for a longer period. A subset of species would likely recolonize after cleanup, with lingering effects on community structure. These types of effects are discussed in Chapter 6.

5.7.8.11 Effects on Mussels

Mussels play key roles in river and stream ecosystems, where they are considered "ecosystem engineers" because they modify aquatic habitat making it more suitable for themselves and other organisms. Mussels capture organic matter from the water column when they siphon, processing it to build body and shell, excreting nutrients that are immediately available to plant life, and depositing the remaining organic material to the sediment making it available for other invertebrates and fish to consume. During this feeding process, the mussels remove phytoplankton and bacteria and fungi that are attached to non-living organic particles. Undesirable particles and chemicals are bound in the mussels' pseudofeces and deposited on the substrate. Mussel shells provide a surface for algae and insect larvae to attach to. Because mussels firmly anchor themselves to the stream bed, they could stabilize the stream bottom, thus minimizing the scouring effects of floods and waves. Mussels are also an important food source for terrestrial and aquatic animals, including muskrats, raccoons, and several species of fish.

Mussels are susceptible to disturbances from construction activities. They have limited ability to escape and would be directly affected by initial substrate disturbance and sedimentation, as well as temperature effects from the pipeline. Increases in suspended solids and sedimentation could impact mussels by altering habitat, decreasing food availability, physically interfering with filter feeding and respiration, and impeding various aspects of the mussel–host relationships (Watters, 2000; Osterling, Arvidsson, and Greenberg, 2010). The effects of deposited fine sediments on recruitment failure are well known, but effects of suspended fine sediments (total suspended solids) on adult mussels have not been studied to the same degree (Lummer, Auerswald, and Geist, 2016). Goldsmith et al. (2021) described the effects of total suspended solids as follows. Clearance rates (a measure of feeding) are negatively impacted by total suspended solids concentrations greater than eight ppm, and respiratory stress occurred at ~600 ppm. Declines in fertilization success and glochidia (mussel larvae) development occurred at total suspended solids values of 15 ppm, and reproductive failure occurred at 20 ppm. Effects on host fish attachment and glochidia encystment occurred at total suspended solids concentrations of 1,250 to 5,000 ppm. Mussels are sensitive to smothering and mortality at depths as low as 0.6 to 2.5 cm of substrate. Trenched crossing techniques would influence the habitability of near-downstream areas due to increased suspended solids loads and changes to flow dynamics from stream diversion. Effects of sedimentation can occur significant distances downstream from a disturbance site, particularly when fine sediment (i.e., clay) is involved (Watters, 2000).

The effects of sedimentation from an inadvertent release of drilling fluids from HDD or direct boring operations would be like those from sedimentation associated with trenched construction. Risks related to HDD inadvertent releases would be limited through monitoring of drilling fluid pressures and the drill path, locating start and end points outside of the floodplain and outside of adjacent wetland complexes, implementing erosion and sediment control practices at start and end points to protect the adjacent resources, and having a plan and appropriate equipment in place to contain and remove any drilling fluid released.

In 2024, EnviroScience conducted surveys for freshwater mussels, using DNR-approved protocols, at 13 of Enbridge's proposed Line 5 waterway crossings in Ashland, Bayfield, and Iron counties (Appendix Y). The majority of the surveyed crossing sites had minimal to no flow, and stream bottoms compositions were high in unconsolidated sand and silt, which are generally not conducive to mussel colonization. The surveys found no evidence of current or historical mussel communities at any of the surveyed sites. The surveyors reasonably concluded: "It is unlikely the proposed construction activities at these sites will impact any mussel community within these stream reaches." To reduce the amount of sediment entering a waterbody, Enbridge would implement the erosion and sediment control measures specified in its EPP (Appendix D). Pipelines would be installed at stream crossings as quickly as possible to allow suspended sediment levels to return to preconstruction levels upon completion of instream work.

The anticipated effects of petroleum spills on mussels are addressed in Chapter 6.

5.7.9 Cumulative Effects on Waterways

5.7.9.1 Effects of Climate Change

As discussed in Section 7.3.3 and Section 7.3.4, climate change is modifying regional precipitation patterns in northern Wisconsin and throughout the Ceded Territories, increasing the magnitude of extreme precipitation events. These extreme precipitation events will, over time, also become a larger fraction of the annual precipitation budget, leading to fewer small or low-energy storms between larger events. The project area is predicted to get roughly 10 rain events per decade with three or more inches of rainfall. A three-inch, 24-hour rainfall event corresponds roughly to a five-year rainfall return interval using current probability distributions (National Weather Service, n.d.), i.e., two to five events per decade on average (Figure 5.7-41).

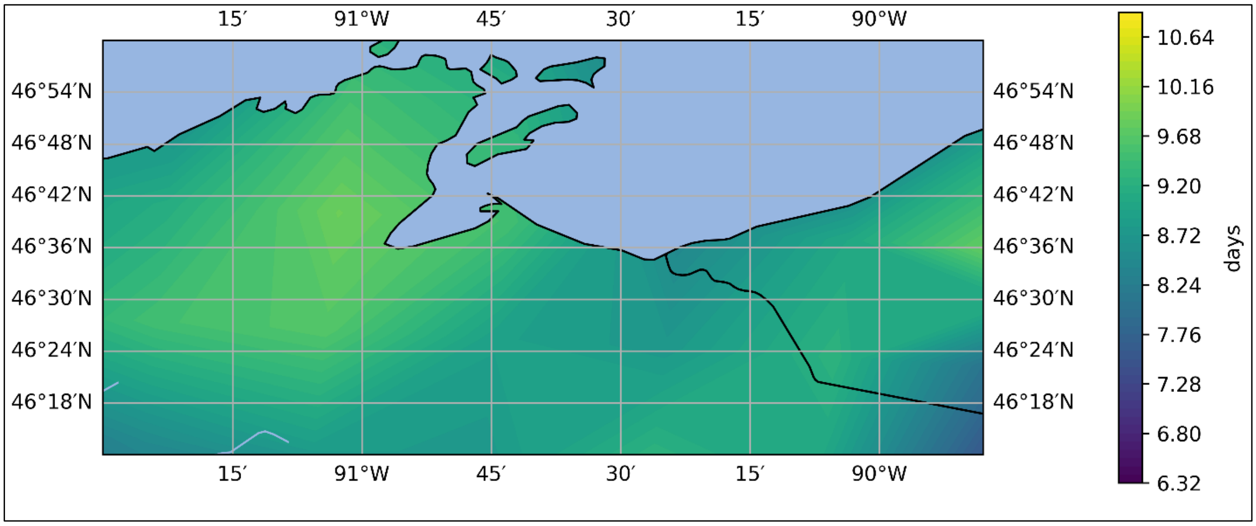


Figure 5.7-41 Projected days with > 3" of rainfall per decade in 2080.
Source: WICCI

Higher-energy storms occurring more regularly will lead to elevated erosion and flood risks. The Bad River watershed is understood to have flash-flood hydrology (F. A. Fitzpatrick et al., 2016) and erosive geology, as described in section 5.6. Landscape features in the region are sensitive to current patterns of precipitation and will likely be more so in a future with more intense storms. Elevated landscape erosion potential would lead to a greater risk of pipeline exposure, especially at locations currently identified as geohazards. However, additional erosion could occur at currently low-risk sites due to unpredictable patterns in erosion (see for example section 5.6.7.2).

One elevated risk area for the pipeline under increased precipitation is at stream crossings. More intense precipitation entails greater erosive power, especially for streambeds. Generally, streambeds subject to greater erosive power erode more, leading to downcutting (section 5.6.7.5) when sediment supply does not balance the added erosion. Accelerated incision would pose a serious threat to pipeline safety. Enbridge has not proposed in-stream stabilization in any of its current plans. In-stream stabilization would be difficult to implement without extreme disturbance to benthic habitat.

Increased erosion risk also affects spill response time. Spill response relies on road infrastructure being intact to transport heavy equipment and large numbers of personnel to control points, and those control points being safely accessible to set up and manage equipment upon arrival. Road infrastructure in the project region is vulnerable to washouts (F. A. Fitzpatrick et al., 2023). Washouts during floods have had severe consequences for emergency response with other energy infrastructure in the region. During the July 2016 flood, dam operation emergency response was severely affected by flooding and road washouts. For example, emergency dispatch crews sent to the White River hydro plant at 1:00 a.m. during the night of the flood were unable to reach the plant for eight hours, whereas their quoted response time was three hours. Other regional dams came within one foot of overtopping and subsequent failure, and were at substantial risk of doing so, as roads leading to and from affected dams washed out just after the operator reached the control area. Communication lines were also cut by the event (Hydro Review, 2018). These issues are likely to occur in some measure with any future major flooding event in the watershed and could substantially affect response times to petroleum spills. Cut communication lines could limit the ability of pipeline operators to monitor pipeline integrity and apply automated management techniques to limit flow or report issues. Damaged infrastructure could compound communication failures by greatly slowing crew response time to flooding and requiring manual pipeline control from pumping or valve stations. High-velocity floodwaters would also create unsafe conditions for installation of oil control mechanisms, reducing their effectiveness and slowing response time as well. Greater floodwater extent would also increase the areal coverage of a petroleum oil spill, delivering oil to upland areas not typically inundated, and increase wetland coverage, as well as increasing delivery to Lake Superior (Section 6.4.4.1).

Because the pipeline is intended to operate indefinitely (a reasonable expectation of its service life is roughly the lifetime of the current pipeline, 50 to 100 years) the pipeline will foreseeably experience a rare extreme rain event with the capacity to substantially alter surrounding geology and destabilize streams and slopes. NOAA's current 50-year, 24-hour return interval storm for Ashland County is 6.15 inches (National Weather Service, n.d.), but the magnitude of the 50-year, 24-hour return storm is projected to increase as more intense rainstorms become common with further climate warming (WICCI, 2021). Increased extreme precipitation will incur greater risk of pipeline exposure over time.

Greater storm intensity could also create a greater pipeline maintenance burden, with additional effects on streams during maintenance activities. For example, destabilizing flows could cause pipeline exposure concerns and spur preventative maintenance activities by Enbridge. Maintenance activities, including regrading, application of erosion armoring, or recontouring for greater stream stability, can all create ongoing disturbance to waterways along the proposed ROW (Section 5.6.7.2).

Greater storm intensity also increases the risk of elevated sediment loss or erosion during the construction of the pipeline. Stormwater regulations cover flows and precipitation events under normal conditions, less than or equal to around a two-year recurrence interval. Extreme flooding events during construction could cause major erosion from unstable landforms and would result in more consequential erosion to trenched riparian areas than in a stabilized scenario.

5.7.9.2 Effects of Historic Land Use

A critical piece of the baseline conditions for streams is their historic land-use context and alterations. Streams in the Midwest in general have been affected by several centuries of pervasive land-use change, with long-lasting consequences for how streams behave (F. A. Fitzpatrick, Knox, and Whitman, 1999). Deforestation and conversion to agriculture are the primary causes of many changes to current streams. Deforestation reduces the amount of ground cover and weakens the structural integrity of the soil, allowing erosion at lower energy levels. Deforestation also increases the amount of water going to runoff, increasing flow volumes by reducing the proportion of rainfall converted to groundwater or evaporated/transpired from the land surface (Allan, Castillo, and Capps, 2021). Reduced tree cover also decreases surface roughness, which increases the velocity of water moving across the land surface and to stream channels.

Small-medium streams respond to deforestation by downcutting, eroding more quickly due to the greater volume of high-energy flow (Leopold, 1973; F. A. Fitzpatrick, Knox, and Whitman, 1999). Downcutting is evident in regional streams subjected to agricultural land-use change between the 1850s and the 1920s, and which are still presently incised due to pervasive land cover change. Sediment load also increases in upland/headwater sections of these streams, both due to increased erosive power and additional upland inputs of sediment from the loss of stabilizing vegetation (F. A. Fitzpatrick, Knox, and Whitman, 1999). Flooding is typically more energetic under cleared conditions than in forested conditions as well, since delivery to the stream network is much more efficient, especially in urban or agricultural (tile-drained) contexts. Higher stream power also tends to simplify channel morphology, reducing the amount of habitat for macroinvertebrates, fish, and amphibians through removal (Walsh et al., 2005). Many streams are less stable than before clearing, and are still adjusting their form to more energetic and more frequent high flows with changes to their shape and substrate characteristics.

Sediment from deforested streams is lost from headwaters and transported downriver to flat, slow-moving river sections. Many large rivers that today are highly turbid were in the past relatively clear due to their forested surroundings and relatively stable configurations. Post-agricultural streams are, however, still in the process of adapting to the changes in land use that occurred over the past few centuries, and the process of recovery will potentially take centuries more, depending on the ways in which development influences the watershed into the future. For example, continued loss of beaver from the area will decrease the sediment capture potential of the stream network, leading to higher total suspended solids and bulk sediment export, as well as more highly competent streams that continue their pattern of headcutting and downcutting. Loss of forested land has also increased the input of water directly into streams due to rainfall, which is a primary driver of downcutting in midwestern streams. Some streams have bankfull flows 2.5 times greater than predevelopment (F. A. Fitzpatrick, Knox, and Whitman, 1999). The greater the bankfull flow, the greater the erosion power, and the greater the vulnerability to flooding.

Deforestation/logging and agricultural land use both affect flood peaks. Agricultural land raises flood peaks by speeding delivery of water from upland areas to streams, often through the installation of tile drains which quickly remove shallow subsurface water. Flood peaks from logging also increase due to aforementioned reductions in interception capacity, as well as reduced evapotranspiration and increased velocity from lower surface roughness. The Bad River watershed is generally highly prone to flash floods due to its geology (Section 5.5 and Section 5.7.3), which is exacerbated by these trends. Raised flood peaks affect streams by increasing the stress to aquatic organisms and creating more potential to modify stream configurations over time by delivering more energy more quickly to streams. Again, this trend makes streams more dynamic and unstable over time, since smaller rainstorms result in more powerful floods and greater erosion. Larger flood peaks are exacerbated by climate change, which will increase the number of high-intensity precipitation events over the 21st Century and beyond, compounding the risk of destabilization from land use alteration. Flood risks compound to fish populations as well; streams with larger or more frequent flash floods are less hospitable for spawning. More frequent flash floods can destabilize regional populations of fish because fry are sensitive to intense flows. For brook trout specifically, fry are vulnerable to flooding while small, as floods can wash them to main channels which are poorly suited for their survival. Increased flood frequency will likely create greater instability in trout and other headwater-spawning fish populations over the course of the 21st Century. Macroinvertebrates are also sensitive to high flows and typically experience high mortality during floods and scour events.

5.7.9.3 Shifts in Fish Community Type over Time

Climate change affects stream communities by modifying the disturbance and temperature regimes, changing which species are best-suited for a particular stream environment. The disturbance regime and its ecological effect is challenging to capture from climate models, but the temperature regime is somewhat easier to model and is captured by past suitability modeling, particularly in the FishViz decision support tool.

FishViz examines the shifts in community and species distribution due to climate change in the upper Midwest. Its spatial outputs cover Minnesota, Wisconsin, Michigan, northern Ohio, and New York. Its spatial outputs are based on NHD streams, which do not have complete coverage of all streams in the Bad River watershed, much like other regional decision support tools. FishViz covers a subset of 13 fish species which are representative of different community types, specifically presenting coverage of cold-water, cool-water, and warmwater guilds with representative species for each.

FishViz tends to overestimate the presence of species in streams (Stewart et al., 2016, 4, Table 1) and due to the specification of its prediction model may have different prediction values than those in other tools like ELOHA. It is also based on NHDPlusV1 data with 1:100k hydrography scale, which tends naturally to subset the data towards larger, more perennial streams, which would modify the observed patterns of suitability somewhat. The tool covers three time periods: the late 20th Century, mid-21st Century (~2050) and late 21st Century (~2080), providing trend predictions for fish suitability across time. This allows description of how climate change will affect fish communities in the Bad River region, and the crossings, due to climate change.

Figure 5.7-42 shows that cold-water species (a - d) are generally set to decline in abundance, with some rebound upwards or easing of decline depending on the species. For example, brook trout's mean occurrence (orange line) shifts from less than 0.6 to less than 0.4, a 20 percent shift in median suitability scores over the course of 80 years. The primary decline in species suitability is driven by temperature; for example, the most important predictors of brook trout presence are all temperature derivatives or correlates (Stewart et al., 2016, Appendix 1, sheet 4), especially thermal tolerance ranges, a pattern mirrored by other cold-water species. However, suitability loss is mitigated somewhat by increases in precipitation, baseflow, and groundwater recharge, which work to improve the suitability of habitat for cold-water fish specifically (Lyons, Stewart, and Mitro, 2010). Improved hydrologic conditions could explain the changes of the extrema over time. For example, brook trout suitability is projected to have more variability in the middle 21st Century than the late 21st Century; while maximum suitability is diminished, climatic conditions may make some presently marginal habitat more suitable. The net effect is habitat that is overall less suitable but less extreme in its suitability variation.

Cool-water species (e – I, in Figure 5.7-42) show species-specific patterns of increase and decrease over the 21st Century. For example, northern pike will have modestly decreased stream suitability over the 21st Century, while brook stickleback are predicted to experience large losses in suitability overall. By contrast, the northern hog sucker is predicted to have a small increase in mean suitability. As intermediaries between cold-water and warmwater guilds, cool-water species will tend to split in prevalence based on their individual tolerances to environmental shifts towards warmer temperatures.
Warmwater species (j-m, in Figure 5.7-42) show universal increases in suitability over the 21st Century. Most responses are modest, except for the green sunfish (k), which is predicted to greatly increase suitability over the course of the 21st Century.

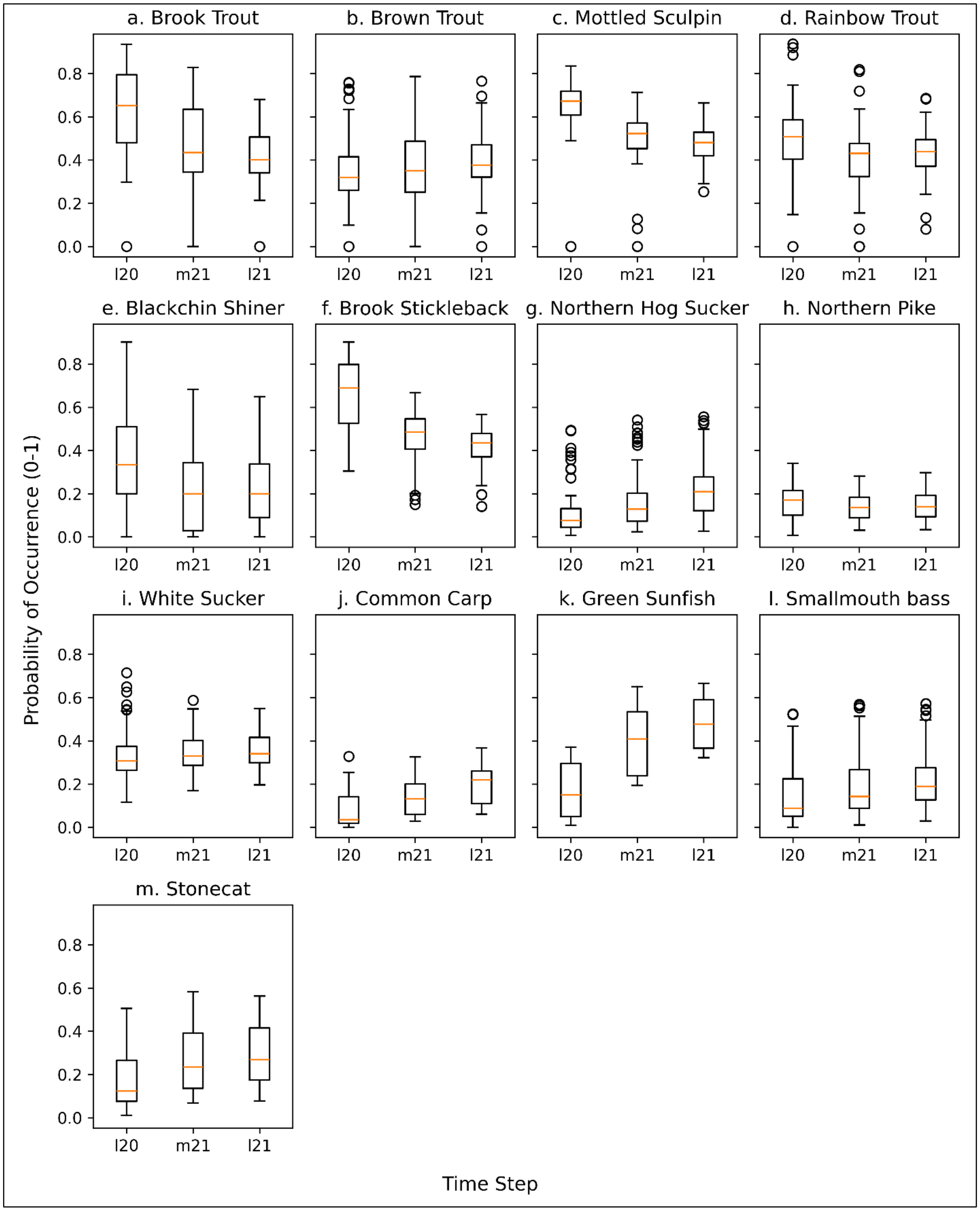


Figure 5.7-42 Per-species predicted shift in prevalence at waterway crossing sites along Enbridge's proposed Line 5 relocation route over the 21st Century.
Data Source: Stewart et al. (2016)

Streams not represented by FishViz in the proposed project domain will tend to be smaller and have more ephemeral flow regimes. These streams will be more directly affected by increases in water temperature because these streams receive a larger proportion of precipitation flow and tend to be shallower, allowing faster increases in temperature. Fish in these streams tend to be the most stress-tolerant subset of all species in the area (typically termed pioneer species). Pioneer species tend to tolerate shifts in environmental conditions better than their specialist peers and will likely have more modest direct suitability shifts from climate change. However, these species could still suffer from habitat loss at the edges of their network if marginal streams lose baseflow in the summer. Generalist and pioneer species could also expand their population as other species decline in response to climate-related stresses, since the absence of sensitive species will open a competitive niche for pioneer/generalist fish to fill.

Fishviz characterizes the loss of suitability that is already baked into the next 50 years of development. Brook trout loss will likely be motivated largely by losses in marginal habitats, in particular streams which warm sufficiently that they no longer are tolerable by brook trout during periods of summer stress. Greater secondary stress and isolation could also stem from climate change, since greater oscillation between low and high flows will lead to periods of flushing (which harm vulnerable fry) and very low flows, which cause great stress for larger fish with less tolerance for elevated temperature. The movement of the upper extremum of brook trout suitability in particular by the 2080s signifies that the most suitable habitat will likely be degraded, and less suitable crossings will expand in scope, limiting the reach of the brook trout population. The trend is regional as well; streams in the Bad River and associated watersheds are predicted to have a near-universal loss in trout suitability in favor of warm-water species over the next 60 years. Especially climate-vulnerable streams include Tyler Forks, which would lose suitability along all of its reaches near the proposed project to its confluence with the Bad River at Copper Falls, and the Marengo River near the proposed project, which would experience wholesale loss of suitability. The reaches of Billy Creek and Trout Brook nearest to the pipeline crossing would also greatly decrease in trout suitability by 2080.

Pipeline construction would increase habitat vulnerability through changes in riparian cover and temperature as described in previous sections. Marginal habitat would typically be more sensitive to additional disturbance; in the event that any high-risk areas require maintenance, this could add to patterns of disturbance over time and continue to decrease the stability of the fish and macroinvertebrate communities in these stream reaches.

Additional modeling work conducted by Selbig (2015) corroborates the trend in cold-water suitability described by FishViz outputs and provides more detailed analysis. The study, which considered three trout streams in Vilas County (two of which are currently Class I or II trout streams), examined the potential effects of climate change on stream temperatures using a network-aware, coupled groundwater-surface water flow model and downscaled climate predictions. Summer stream temperatures were predicted to increase by between 0.9° F and 5.7° F. Additionally, the variability in temperature effects would lead to some streams exceeding lethal limits for trout survivability more than 50 percent of the time. Two trout streams in the study were also predicted to lose self-sustaining populations of trout due to heat stress. Selbig (2015) concluded that small increases in temperature can lead to large changes in fish community type, a finding shared by Lyons, Stewart, and Mitro (2010). Selbig (2015) identified the most vulnerable streams as those that are currently low-diversity and only occupied by brook trout. These streams would lose trout populations if warmed, but the trout would have very few replacements from warmwater fish species, leading to an overall loss in diversity. Several small headwaters streams of this type would be crossed by Enbridge’s proposed ROW.

5.7.10 Sites with Elevated Risk Profiles

Some proposed stream crossings would be affected by a confluence of factors which, taken together, indicate high risk for adverse effects. These are, typically, areas that have a high risk of erosion or temperature increases coupled with high sensitivity due to their current fish and macroinvertebrate community composition. The following sections, while not complete, illustrate how factors can add together to create additional concern about the effects to a particular area.

5.7.10.1 Unnamed Tributary to Silver Creek (sasd1015p)

An example of a site with a high-risk profile is an unnamed tributary of Silver Creek (sasd1015p). According to Enbridge's fieldwork, the proposed crossing location has a substrate of gravel, silt/clay, cobble, and boulders (depending on the exact site sampled). DNR staff visited the site in October 2023 and found sand, silt, and gravel substrates near the proposed crossing point. These substrates, with the exception of clay, would be conducive to groundwater-surface water exchange through the interstitial spaces, and regional groundwater model outputs suggest that the stream is groundwater-fed at the crossing site (Leaf et al., 2015). The site is also a location where DNR fisheries staff found brook trout in August 2023, and the site is a tributary of a Class II trout water, suggesting that the area could be used as a thermal refuge for fish. The site is modeled as highly suitable for brook trout by FishViz. Beyond the gravel habitat, the area is also shaded, as is the upland stream network behind it. Its tributary streams are also modeled as highly suitable for brook trout, and trout were observed there during DNR fisheries surveys conducted in July 2023. Since the channel at this location is wide and shallow (12 feet wide, 0.7 feet deep at time of sampling), the area would be likely to experience increased heating due to riparian clearing. This would potentially be exacerbated by construction grading activities, since grading would allow wider exposure angles to the sun. The site is also at high erosion risk (Section 5.7.10.6). Convenience sampling of substrate revealed macroinvertebrates (specifically caddisflies) inhabiting the site. These factors all increase the risk that the area would be subject to higher temperature effects from pipeline operation, including effects on fish movement, spawning, and shelter, and macroinvertebrate community structure.

5.7.10.2 Camp Four Creek

Camp Four Creek (sasw005) would be another area with high-risk potential for temperature effects. Beyond the beaver dam present at the site (established between first survey and subsequent sampling), the stream is a Class II trout stream indicating a high degree of suitability for cold-water fisheries communities. The stream is a tributary of the Tyler Forks, which is an outstanding resource water designated as a Class I trout stream in 1980. Camp Four Creek receives baseflow from groundwater according to regional groundwater models (Leaf et al., 2015) and is modeled as highly suitable for trout on FishViz (Stewart et al., 2016). Temperatures in the stream were around 59° F around 800 feet downstream at a wooded road. The proposed crossing itself provides an example of how canopy clearing and slower flows can affect the temperature of water. Enbridge's sampling at this location in late August and early September 2023 showed that temperatures in the beaver wetland complex were between 64° F and 67° F, whereas the downstream temperatures were between 59° F and 62° F. This stream crossing is also a candidate for blasting, meaning that the pipeline would likely be buried at a shallower depth, causing greater heating effects to hyporheic water in the area.

5.7.10.3 Trout Brook & Billy Creek

One high risk area is the group of tributaries between Trout Brook and Billy Creek. This area is high risk because of the large contributing areas to each of the streams in the region, the large cleared footprint at this location, and the potential exposure time. This part of the watershed is recognized as having high-quality trout waters and scores well on catch per unit effort for brook trout.

All but one of the streams (a ditch) are considered moderately to highly functional streams, and crossing survey data indicate that four of the seven streams (sasc026e, sasc025i, sasc025i_x, and sas1004e) are connected to wetlands in some capacity. Site sasb1004e in particular is indicated as groundwater-fed and wetland-connected, making it a potential contributor to lower thermal stress in downstream waterbodies.

The potential exposure time at this location would be extended by the presence of two HDD crossings in close proximity, which would require continuous access for the duration of drilling. The HDDs at this intersection are the HDDs for Trout Brook and Billy Creek, which are estimated to take 25 and 41 12-hour shifts, respectively (Enbridge 2023b, Table 2, page 15). If Enbridge operates one 12-hour shift per day, this would require a total of 66 days of disturbance or 33 days if two 12-hour shifts were run per day. This would lead to a relatively large amount of bare-earth time, tending towards longer modeled estimates of sediment discharge for the region. The stream crossings in this zone are in an erosion-prone layer underlying more erosion-resistant sediment.

All affected streams would run the risk of headcutting due to their location in highly erodible areas. Disturbances could lead to stream channels migrating uphill in response to flooding events if improperly stabilized. In the case of sas1004e, this would lead to accelerated drainage of its adjoining wetland, for example. Pipeline crossings of these tributaries would also carry the risk of exposure during high-flow or flash-flood events, due to the erodibility of the streambeds in question.

Steep slopes are prevalent in the area, including on the banks of Billy Creek and its upstream tributaries. Public comments from local residents indicate evidence of erosion-sensitive soil features, including mass failure of landscape features under heavy rain.

Billy Creek is a sensitive receptor for sediment inputs. The stream is perennial and fed by groundwater sources, and sustains a Class I trout fishery, meaning that its conditions are conducive to a self-sustaining population of Brook trout. Additionally, the streams formed by the confluence of all crossing points in this region were found to have brook trout populations by DNR fisheries biologist sampling, indicating that brook trout communities use these direct downstream reaches, in at least some years, as refuge during the summer months (samples were collected in July), providing important habitat during the period of maximal physiological stress for trout and other cold-water species.

Enbridge's geohazard assessment does not include any stream crossings from this area of the company's proposed Line 5 relocation route, likely because Enbridge's assessment focuses specifically on risks to pipeline exposure. However, effects from sediment releases on downstream organisms suggests this area as a location of concern.

5.7.10.4 Crossings Close to the Bad River Reservation

An additional area of concern includes two of Enbridge's proposed waterway crossings near the boundary of the Bad River Reservation. The two crossings are within two kilometers of the reservation boundary along the run of their respective rivers. Depending on the flow conditions encountered before, during, and after construction, the waterbodies at these crossings could experience sediment inputs resulting from construction.

DNR staff visited this region in October 2023. This site is situated in a predominantly sand-silt substrate. The stream itself has a predominantly sandy bottom. There is no detailed soil survey data for the stream's floodplain, only for surrounding uplands. The stream is situated within a gully which has a high proportion of steep slopes (greater than 20%) which contribute to erosion risk. There is some evidence to suggest that the slope substrate is also sandy. DNR staff observed *Equisetum hymenale* (scouring rush), which prefers sandy soils, growing on the lower slopes surrounding the stream crossing (Figure 5.7-43), indicating that sand is a large component of the topsoil in this region.

Figure 5.7-43 *Equisetum hymenale* at the site visit location.
Photo: Andrew J. Brown, DNR

Soil texture grabs also indicated a sandy texture overlain by organic matter, and including a smaller proportion of clay. These characteristics were also found at other locations with demonstrated high erosion potential. In particular, these characteristics are similar to those at a site of a groundwater sapping event on the Bad River Reservation at Potato River Road (Section 5.6.5). The Potato River Road site experienced an extreme headcutting event during the 2016 flooding, which led to the loss of the roadbed and long-distance travel of a neighboring stream gully up-grade (Figure 5.6-2; Figure 5.6-24). Soils at Potato River Road were also very sandy (SSURGO Data indicate 85 percent sand in this surficial map unit) and overlain by a thin layer of organic material. Communities of *E. hymenale* were also observed at this site.

Both of these sites can be considered as part of the transition zone (Figure 5.6-18), which confers elevated risk of catastrophic erosion in large storm events and higher erosion risk during normal flooding events. When sampled in 2023, sasc1006b's downstream fish community was dominated by pioneer, generalist, and headwater species, mainly creek chub (*Semotilus atromaculatus*), western blacknose dace (*Rhinicthys atratulus*), and common shiner (*Luxilus Cornutus*). These species indicate a cool-warm typology with high disturbance close to headwaters and are generally tolerant of disturbances to their environment.

5.7.10.5 Tyler Forks Tributaries

Tributaries of the Tyler Forks (unnamed tributaries of Scott Taylor Creek) southwest of Copper Falls State Park are at elevated erosion risk. These crossings all share a similar geologic profile, with very high proportions (80% to 90%) of silt sediments. According to Enbridge's survey materials, many of these streams have coarse dominant substrates in the stream channel itself (gravel, boulders, etc.). These areas also exhibit steep slopes and signs of erosive activity. Sediment dynamics around these tributaries could also be disturbed due to logging.

Brook trout catch per unit effort values downstream of this set of tributaries (recorded as unnamed tributaries of the Tyler Forks) were 200 and 150 for different branches, indicating well-oxygenated and cool waters during the warm months of the year. This region of Enbridge's proposed Line 5 relocation route and its waterbody crossings are also generally well-forested, which improves water temperature conditions for cool-water species. Fish surveys on the northern branch of tributaries, in particular, found only brook trout, whereas surveys of the southern branch also found western blacknose dace and creek chub, both of which are pioneer species.

5.7.10.6 Unnamed Tributary to Silver Creek

Three contributing areas traverse one unnamed tributary of Silver Creek within 800 meters of one another. Contributing areas 150, 147, and 149 are highly ranked for predicted total erosion yield (Appendix Q). Contributing area 150, in particular, is one of the highest-risk locations along Enbridge's entire Line 5 relocation route, since it is a trenched crossing set inside of two steep adjoining slopes.

DNR staff visited contributing area 150 in October 2023 and found evidence of early instar stoneflies and caddisflies from a small convenience sample. The streambed itself in this location is a mixture of sand and gravel, with enough stability to harbor macroinvertebrates, and has a history of flooding and jumping its banks, resulting in periodic disturbance of the floodplain and multiple banks. The stream is near a gravel pit and its neighboring soil consists of layers of sand and clay.

This tributary is rated highly as brook trout habitat by FishViz and summer 2023 sampling by DNR fisheries staff found high proportions of brook trout, and presence of creek chub, western blacknose dace, and mottled sculpin, indicating a pioneer/headwater community and a likely thermal refuge for brook trout during the summer months. This would indicate elevated sensitivity to potential effects from water quality alterations, especially thermal impacts.

Because three of Enbridge's construction sites cross this stream (two upstream are pipeline pullback areas for a nearby HDD site), this crossing and downstream areas would be affected by all three crossing points, cumulatively. Added sediment deposition could break up connectivity between sections of the stream (if there is a blockage like a deadfall, which acts as a filter). The additional sediment deposition could also lead to embedded gravel deposits, removing macroinvertebrate habitat from this reach. All three sites would be destabilized from clearing and seeding at roughly the same time and would experience a roughly similar profile of added erosion loss as a consequence of line clearing and construction, with the caveat that the pipeline pullback zone, where the two upstream crossings would occur, would have fewer in-stream effects since these locations would not be trenched during pullback operations.

5.7.11 Wild Rice Waters

Wild rice waters are ecologically and culturally important resources in northern Wisconsin (Section 4.2.1.10). These waters are especially sensitive to changes in water level or sediment bed level, which can inhibit the growth of wild rice when altered. Figure 4.2-3 shows wild rice waters in the region of Enbridge's proposed Line 5 relocation route and route alternatives. The primary wild rice waters with potential to be affected by Enbridge's proposed Line 5 relocation are those in the Kakagon and Bad River sloughs on the Bad River Reservation.

Enbridge's and the DNR's sediment transport modeling indicate sedimentation from proposed Line 5 construction activities would be unlikely to reach the Kakagon and Bad River sloughs. Any sediment that would arrive there would be very small in proportion to the volume of water transported by the contributing rivers. It would also be the smallest fraction of sediment which settles out most slowly, making it less likely to cause any significant sedimentation if it would reach these wild rice waters.

An inadvertent release of drilling fluids from an HDD or direct bore operation would pose a greater risk of sedimentation on wild rice waters due to the larger volume of sediment released. Sedimentation from an inadvertent release would be limited by the distance between the sloughs and the proposed ROW alignment, which would allow dilution of the inadvertent release flow and the settling out of a portion of the sediment release prior to reaching wild rice waters.

If Enbridge chose an alternative route, effects would vary slightly from the proposed route. RA-01 would have similar potential to affect wild rice waters as the proposed route. RA-02 would have the potential to affect wild rice waters on the White River near the White River flowage dam. This wild rice water would be vulnerable to an HDD inadvertent release. It is positioned on a slower-flowing body of water which is impounded by a dam. The dam would promote additional sedimentation in the event of an inadvertent release and potentially reduce the water level in wild rice beds, depending on the exact position of those beds in relation to the inadvertent release plume. RA-03 passes near Chippewa Lake in the Chequamegon-Nicolet National Forest, which could be susceptible to the effects of construction-related sedimentation or an HDD inadvertent release (if HDD were used to traverse the area). Sediment at or near the lake and its associated stream would be more likely to settle out due to the slower flows in lake areas.

Wild rice waters would be vulnerable to petroleum spills. Section 6.4.4.8 discusses the anticipated effects of petroleum spills on wild rice.

5.7.12 Inland Lakes

There are 19 named lakes within the Lake Superior Coastal Plain in the Superior Coastal Plan Ecological Landscape (Section 5.9.1.1). There are another 864 unnamed lakes, which are typically on the order of a few acres each. The total area of mapped lakes in the ecological landscape is 2,798 acres (DNR, 2015b). In the North Central Forest Ecological Landscape (Section 5.9.1.2), there are many lakes of diverse types. There are 1,734 named lakes within the region and another 11,468 unnamed lakes (DNR, 2015c). The Northwest Sands Ecological Landscape (Section 5.9.1.3) has a concentration of glacial kettle lakes that provide high-quality habitat for aquatic organisms. Groundwater-fed, soft-water seepage lakes are common in the region. Lakes account for approximately 4.8 percent of the landcover in the region (DNR, 2015d). None of the inland lakes are within one half mile of Enbridge's proposed Line 5 relocation route, RA-01, or RA-02. There are more than 20 named lakes within one half mile of RA-03. Given this, significant direct, indirect, or cumulative effects from Enbridge's proposed project on inland lakes would be unlikely.

5.8 Wetlands

Wetlands are places on the landscape where water is close to, at, or above the soil for at least part of the year. Wetlands provide important functions such as purifiers for lakes, rivers, and groundwater, flood water control, and they provide storage for floodwaters (DNR, n.d.-b). Wetlands are an important resource for many of Wisconsin's fish and wildlife species, from providing nesting and nursery habitats to providing important food sources (DNR, n.d.-b). It is estimated that between one-quarter and one-third of all rare species in Wisconsin are found in wetlands (Luthin and Thompson, 2010). Wetlands are also playgrounds for birders, hikers, hunters and paddlers, and a storehouse for carbon, a component of GHGs fueling climate change (DNR, n.d.-c). Wisconsin has over five million acres of wetlands, which cover 15 percent of the state. Wetlands occupy approximately 12 percent the Superior Coastal Plain Ecological Landscape and approximately 23 percent of the North Central Forest Ecological Landscape. They are abundant in the vicinity of Enbridge's proposed Line 5 relocation project. This section reviews the current conditions and anticipated effects to wetlands from Enbridge's proposed Line 5 relocation.

5.8.1 State Wetland Permitting

As described in Section 1.4.3.10, the DNR is responsible for regulating the discharge of dredge and fill material into wetlands under s. 281.36, Wis. Stat., and ch. NR 103, Wis. Adm. Code. As currently proposed, Enbridge's Line 5 relocation project would require an Individual Permit for the temporary wetland fill, permanent wetland fill, and forested wetland conversion.

Under s. 281.36 (3n) (b), Wis. Stat., the DNR must consider all of the following factors when it assesses project effects on wetland functional values:

- The direct impacts of the proposed project to wetland functional values.
- The cumulative impacts attributable to the proposed project that may occur to wetland functional values based on past impacts or reasonably anticipated impacts caused by similar projects in the area affected by the project.
- Potential secondary impacts of the project to wetland functional values.
- The impact on functional values resulting from the mitigation that is required.
- The net positive or negative environmental impact of the proposed project.

Under s. 281.36 (3n) (c), Wis. Stat., the DNR must make a finding that the proposed project causing a discharge is in compliance with water quality standards and that a wetland individual permit may be issued if the DNR determines that all of the following apply:

- The proposed project represents the least environmentally damaging practicable alternative taking into consideration practicable alternatives that avoid wetland impacts.
- All practicable measures to minimize adverse impacts to wetland functional values will be taken.

- The proposed project will not result in significant adverse impact to wetland functional values, in significant adverse impact to water quality, or in other significant adverse environmental consequences.

5.8.2 Wetland Functional Values

Wetlands are dynamic ecosystems that provide different functions depending on the type of wetland and its location in the landscape. The same wetland could provide different functions from year to year and season to season. There are many different types of wetlands, typically characterized by the type of vegetation and soils, and their hydrological characteristics (DNR, n.d.-d).

Wetland functional values are those physical, biological, and chemical functions a wetland performs and the benefits or values that society derives from them. Wisconsin's Water Quality Standards for Wetlands established wetland functional values for the purposes of protecting, preserving, restoring and enhancing the quality of waters of the state (s. NR 103.03(1), Wis. Adm. Code). Standardized assessment methods are used to evaluate the extent to which a specific wetland may perform any given function. The presence or absence of specific characteristics is used to determine the importance of each functional value for a particular site (DNR, n.d.-d). Functional values specific to Enbridge's proposed Line 5 relocation project area are described below and discussed in greater detail throughout Sections 5.8.3 and 5.8.4.

5.8.2.1 Floristic Composition and Integrity

Floral diversity and integrity provide an important gauge for assessing the condition of wetlands and several of the wetland functional values below. Wetlands can support an abundance and variety of plants. These plants contribute to the earth's biodiversity and provide food and shelter for many animal species at critical times during their life cycles. Many of the rare and endangered plant species in Wisconsin are found in wetlands.

The importance of floral diversity in a particular wetland is usually related to two factors. First, the more valuable wetlands usually support a greater variety of native plants (high diversity) than sites with little variety or large numbers of non–native species. Wetlands with a diversity of plant species can in turn support a diversity of insects, diversity of wildlife habitat and use, and can protect sites from colonization of invasive species (Luthin and Thompson, 2010). Second, wetland communities that are regionally scarce are considered particularly valuable (DNR, n.d.-d).

5.8.2.2 Habitat for Fish, Wildlife, & Aquatic Organisms

Wetlands play a critical role in biological support. Aquatic life support functions can vary by wetland, but even small wetlands can support aquatic species. Many animals spend their entire lives in wetlands; for others, wetlands are critical habitat for feeding, breeding, resting, nesting, escape cover, or travel corridors. For many amphibians, seasonally flooded wetlands could be their only viable habitat. Wetlands with connections to surface waters provide critical fish-support functions (Bernthal and Trochlell, 1998). Wetlands provide spawning grounds for northern pike, nurseries for fish and ducklings, critical habitat for shorebirds and songbirds, and lifelong habitat for some frogs and turtles. Wetlands support game species (e.g., waterfowl, raccoon, beaver, deer, and pheasants) as well as non-game species (e.g., migratory songbirds, small mammals, raptors, amphibians, and reptiles) that are important components of the food web. Wetlands also provide essential habitat for smaller aquatic organisms in the food web, including crustaceans, mollusks, insects, and plankton.

Some of the most valuable wetlands for fish and wildlife provide diverse plant cover and open water within large, undeveloped tracts of land. This function could be considered particularly important if the habitat is regionally scarce, such as the last remaining wetland in an urban setting (DNR, n.d.-d).

See s. NR 103.03(1)(e) and (f), Wis. Adm. Code.

5.8.2.3 Storm & Flood Protection

Due to dense deep-rooted vegetation and their location within the landscape, wetlands are important for retaining storm water from rushing toward rivers and lakes. Wetlands slow storm water runoff from rain and melting snow and can provide storage areas for floods, thus minimizing harm to downstream areas. Preservation of wetlands can limit the need for grey infrastructure projects to control flood and storm water, such as dikes, levees, concrete-lined channels, and detention basins.

Wetlands located in the mid- or lower reaches of a watershed contribute most substantially to flood control since they lie in the path of more water than their upstream counterparts. When several wetland basins perform this function within a watershed, the effect could be a staggered, moderated discharge, reducing flood peaks. Flood protection could be especially important in cities, where pavement contributes to runoff, and in areas with steep slopes or other land features that tend to increase storm water amounts and velocity (Section 5.6.1). These functional values can provide economic benefits to downstream property owners and taxpayers (DNR, n.d.-d).

When surface water flows into a wetland, the combination of a flatter or more depressional topography, as well as the presence of dense, emergent vegetation, can slow or entirely retain surface water runoff and moderate water level fluctuation extremes. Larger wetlands can have a significant effect upon flood storage, while smaller wetlands could cumulatively reduce peak flooding (Bernthal and Trochlell, 1998). Flood protection is a particularly important function in the Lake Superior Clay Plain watersheds (Section 5.7.3). The impermeable clays impede penetration of water, which can result in increased runoff during and after precipitation events and following snow melt.

See s. NR 103.03(1)(a), Wis. Adm. Code.

5.8.2.4 Water Quality Protection

Wetland plants and soils have the capacity to store and filter pollutants ranging from sediment to pesticides to animal wastes. Calm wetland waters, with their flat surface and flow characteristics, allow particles of toxins and nutrients to settle out of the water column. Plants take up certain nutrients from the water. Other substances can be stored or transformed to a less toxic state within wetlands. The filtering and storage capacity of wetlands protects water quality within lakes, rivers, streams, groundwater, and drinking water.

Larger wetlands and those that contain dense vegetation are most effective in protecting water quality. If surrounding land uses contribute to soil runoff or introduce manure or other pollutants into a watershed, the value of this function could be especially high.

Wetlands that filter or store sediments or nutrients for extended periods could undergo fundamental changes. Sediments can eventually fill in wetlands and nutrients can eventually modify the vegetation. Such changes could result in the loss of the water quality protection function over time (DNR, n.d.-d).

See s. NR 103.03(1)(c), Wis. Adm. Code.

5.8.2.5 Shoreline Protection

Shoreland wetlands act as buffers between land and water. They protect against erosion by absorbing the force of waves and currents and by anchoring sediments. Roots of wetland plants bind lakeshores and streambanks, providing further protection. A wetland that reduces erosion can also reduce sedimentation to nearby waterways, which can support the water quality and clarity downstream (DNR, n.d.-d). Benefits include the protection of habitat and structures, as well as land that might otherwise be lost to erosion. This function is especially important in waterways where boat traffic, water current, and/or wind cause substantial water movement that could otherwise damage the shore.

Trout streams and other high-quality waterways often depend on shoreland wetlands to protect their characteristically clear, cold waters. Without this wetland buffer, the shoreline becomes undercut and collapses. When this happens, streams often become wider, shallower, and more turbid; water temperatures rise, and habitat quality deteriorates.

See s. NR 103.03(1)(d), Wis. Adm. Code.

5.8.2.6 Hydrologic Functions

Wetlands may interact with groundwater on a local or regional scale: some wetlands recharge groundwater while other wetlands act as groundwater discharge areas. Some wetlands could also be isolated from the groundwater. Wetlands can retain water during wet periods and then distribute the water to maintain water levels in aquifers and surface waters during dry periods. Wetlands cumulatively perform important watershed functions (Bernthal and Trochlell, 1998).

Groundwater recharge is the process by which water moves into the groundwater system. Although recharge usually occurs at higher elevations, some wetlands can provide a valuable service of replenishing groundwater supplies. The filtering capacity of wetland plants and substrates could also help protect groundwater quality.

Groundwater discharge is the process by which groundwater is discharged to the land surface or to surface water. Groundwater discharge is a more common wetland function and can be important for stabilizing stream flows, especially during dry months. Groundwater discharge through wetlands can enhance the aquatic life communities in downstream areas. It also can contribute toward high-quality water in lakes, rivers, and streams. In some cases, groundwater discharge sites are obvious, through visible springs or by the presence of certain plant species (DNR, n.d.-d).

See s. NR 103.03(1)(b), Wis. Adm. Code.

5.8.2.7 Recreational, Cultural, Educational, Scientific, & Natural Scenic Beauty

Wetlands are places to study, hike in, snowshoe through, or just enjoy. They provide peaceful open spaces in landscapes and have rich potential for hunters and anglers, scientists, and students. Wetlands provide exceptional educational and scientific research opportunities because of their unique combination of terrestrial and aquatic life and physical and chemical processes. Many species of endangered and threatened plants and animals are found in wetlands. Wetlands located within or near urban settings and those frequently visited by the public are especially valuable for the social and educational opportunities they offer (Bernthal and Trochlell, 1998). Open water, diverse vegetation, and lack of pollution also contribute to the value of specific wetlands for recreational and educational purposes and general quality of life (DNR, n.d.-d). Recreational activities in wetlands, such as hunting, hiking, and fishing, are economically important.

See s. NR 103.03(1)(g), Wis. Adm. Code.

5.8.3 Wetlands & Ecological Landscapes within the Project Area

Wetlands are abundant within the ecological landscapes that would be crossed by Enbridge's proposed Line 5 relocation route and route alternatives. Of the approximately 41 miles of pipeline proposed to be installed, 22 miles of pipeline would be located within the North Central Forest Ecological Landscape (Section 5.9.1.2) and 19 miles would be installed within the Superior Coastal Plain Ecological Landscape (Section 5.9.1.1). The existing Ino Pump Station is located within the Northwest Sands Ecological Landscape (Section 5.9.1.3), where work would be limited to minor modifications within the existing station. Further discussion on wetlands and ecological landscapes will be limited to the North Central Forest and Superior Coastal Plain regions.

5.8.3.1 Superior Coastal Plain Ecological Landscape

The Superior Coastal Plain Ecological Landscape has a wetland land cover of approximately 12 percent. Wetlands within the Superior Coastal Plain are characterized as approximately 61 percent forested, 34 percent shrub, and five percent emergent/wet meadow (a general category that includes marsh, sedge meadow, bog, and fen communities).

Wetlands of the Superior Coastal Plain are of exceptionally high importance due to their ecological and cultural values. Wetlands in this region have distinctive attributes that are not found anywhere else in the state, such as coastal peatlands, perched wetlands, and red-clay wetlands. These wetlands support rare plants, rare animals, and valuable biodiversity. Wetlands closer to larger cities have been subject to degradation from pollutants, development projects, and invasive species.

Due to historical logging, clearing of vegetation, and changes in land use over the past several centuries that have reduced forest cover and increased open land, many watersheds in this region are affected by large quantities of rain and snowmelt moving quickly over the landscape and reaching the waterways, which has in turn increased peak flows and springtime flooding (Section 5.7.3). Maintaining wetlands and mature upland forests is important to "slow the flow," especially during large precipitation events, which are increasing in frequency and intensity due to climate change. (WICCI, 2021)

The most characteristic wetland communities in the region are peatlands, including sedge-dominated open fens, bogs, and conifer swamps. Wild rice marshes are also extensive and well-developed (Section 5.7.11). Areas of heavily disturbed wetlands, such as abandoned agricultural fields, logging areas, or pastureland, are generally dominated by invasive reed canary grass or tall native shrubs, such as alders and willows (DNR, 2015c).

Soils within this region consist of deep, poorly drained reddish clays; organic soils within the peatlands tend to be underlain by impermeable tills.

5.8.3.2 North Central Forest Ecological Landscape

The North Central Forest Ecological Landscape has a wetland land cover of approximately 23 percent of the total land area. Wetlands within the North Central Forest Ecological Landscape are characterized as approximately 59 percent forested, 30 percent shrub, and 4 percent emergent/wet meadow (a general category that includes marsh, sedge meadow, bog, and fen communities). Wetlands of the North Central Forest are abundant, generally in good condition, and have high ecological values. Many of the wetlands in the North Central Forest are embedded within extensive forest cover and adjoin lakes and streams. The magnitude of disturbance by agricultural activities and other developments is lower here than in other areas of the state.

Forested wetlands within this region include acid conifer swamps dominated by black spruce and tamarack trees, ash-dominated hardwood swamps, and wet-mesic northern white cedar swamps (Section 5.9.2.8), which are more common in this landscape than anywhere else in the state. Alder thicket and shrub-carr wetlands (Section 5.9.2.6) are common wetland shrub communities. Peatlands, including open bogs, poor fens, muskegs, black spruce swamps, and tamarack swamps, are also common in this landscape. Herbaceous wetland communities, such as marshes, sedge meadows (Section 5.9.2.5), and fens, are widespread and serve as important habitats for sensitive plants and animals. Wild rice marshes (Section 5.7.11) are more abundant and widespread within this landscape (and the Northern Highland Ecological Landscape) than anywhere else in the state. Invasive species are more localized and less widespread in this region.

Soils within this region consist of sandy loam, sand, and silts. Organic soils generally consist of acid peat or nonacid muck and are poorly or very poorly drained. Large areas of compact and low-permeability soils have supported large wetland complexes within the region, contributing to high water quality. Areas of compact, silty soils with high water tables and gentle terrain promote the establishment of ephemeral ponds, which are common and widespread in the North Central Forest Ecological Landscape. Ephemeral ponds provide critical, secure breeding habitat for frogs, salamanders, and certain invertebrates (DNR, 2015d).

5.8.4 Wetland Identification & Quality

Wetlands along the proposed project route were identified through wetland delineations (reports not found in the appendices). Wetland delineations were conducted by Enbridge consultants August through October 2019 and May through July 2020 based on the criteria and methodology described in the USACE's *Corps of Engineers 1987 Wetlands Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*. Wetland delineations also included offsite evaluation of USGS topographic maps, NRCS soil survey data, DNR Wisconsin Wetland Inventory maps, USFWS National Wetland Inventory maps, USGS National Hydrography Dataset, Google Earth Historical Imagery, and Microsoft Aerial Imagery.

The wetland delineation survey corridors were approximately 300 to 500 feet wide along Enbridge's proposed Line 5 relocation route and included the proposed locations of the pipeline ROW, staging areas, temporary workspaces, and off-ROW access routes. The wetland delineation survey corridor was larger than the proposed project area and identified wetlands that would not be crossed or directly affected by the project.

Approximately one-half of the wetlands delineated in 2019 were delineated during the month of October (October 1 through October 19). Based on site photos, the DNR determined it was still field season at the time of the October delineations, however, it should be noted in the northern part of the state where the project is proposed, vegetation could be senesced or dead at this time of the year, and floristic conditions can be difficult to assess during this period.

Enbridge delineated approximately 612 acres of wetlands, identified as 762 wetland complexes, along the survey corridor in 2019 and 2020. Wetland classifications and plant community types are provided in Table 5.8-1 and are described in greater detail in the sections below.

Table 5.8-1 Summary of wetlands within the wetland delineation survey corridor.

Wetland classification [a]	Total acres	Total %	Eggers & Reed wetland plant community [b]	Acres by plant community
Palustrine Emergent (PEM)	138.5	22.6%	Fresh (Wet) Meadow	124.2
			Seasonally Flooded Basin	2.1
			Sedge Meadow	11.2
			Shallow/Deep Marsh	1.9
Palustrine Scrub-Shrub (PSS)	57.6	9.4%	Alder Thicket	26.5
			Open Bog	2.4
			Shrub-Carr	28.7
Palustrine Forested (PFO)	415.4	67.9%	Coniferous Bog	3.8
			Coniferous Swamp	4.2
			Floodplain Forest	32.0
			Hardwood Swamp	370.2
			Hardwood Swamp (Vernal Subtype)	5.2
Total:	**611.5**	**100%**		

[a] (Cowardin et al., 1979)
[b] (Eggers and Reed, 2015)

Approximately 101.1 acres, identified as 452 wetland complexes and 867 discrete wetlands, were delineated within the proposed project area, which encompasses the pipeline corridor, staging areas, temporary workspaces, valve sites, and off-ROW access routes. Of the 101.1 acres of wetlands, approximately 28.1 acres were identified as palustrine emergent, 10.2 acres were palustrine scrub-shrub, and 62.8 acres were palustrine forested. The most common wetland plant communities were hardwood swamp (58.9 acres), fresh (wet) meadow (24.7 acres), and shrub-carr (7.0 acres). Wetland classifications and plant community types within the proposed project area are provided in Table 5.8-2 and are described in greater detail in the sections that follow.

Table 5.8-2 Summary of wetlands within the proposed project area.

Wetland classification	Total acres	Total %	Eggers & Reed wetland plant community [a]	Acres by plant community
Palustrine emergent (PEM)	28.1	27.8%	Fresh (wet) meadow	24.7
			Seasonally flooded basin	0.2
			Sedge meadow	2.8
			Shallow marsh	0.4
Palustrine scrub-shrub (PSS)	10.2	10.1%	Alder thicket	3.0
			Open bog	0.2
			Shrub-carr	7.0
Palustrine forested (PFO)	62.8	62.1%	Coniferous bog	0.4
			Coniferous swamp	0.7
			Floodplain forest	2.7
			Hardwood swamp	58.6
			Hardwood swamp (Vernal subtype)	0.4
Total:	**101.1**	**100%**		**101.1**

[a](Eggers and Reed, 2015)

5.8.4.1 Wetland Classification

5.8.4.1.1 Palustrine Emergent Wetlands (PEM)

A palustrine emergent (PEM) wetland is defined as a nontidal wetland characterized by erect, rooted, hydrophytic herbaceous species. These wetland habitats are often dominated by perennial plants, where the vegetation is present for the majority of the growing season (Cowardin et al., 1979). Marshes are characterized by standing water and dominated by cattails (*Typha* spp.), bulrushes (particularly *Schoenoplectus acutus*, *S. tabernaemontani*, and *Bolboschoenus fluviatilis*), pickerel-weed (*Pontederia cordata*), lake sedges (*Carex lacustris*), and/or bur–reed (*Sparganium* spp.). Sedge or "wet" meadows often have saturated soils rather than standing water and the soils range from neutral to strongly acidic. Sedges, grasses, and reeds are dominant and may also have leatherleaf (*Chamaedaphne calyculata*), marsh cinquefoil (*Comarum palustre*), northern blue flag (*Iris versicolor*), and bog willow (*Salix pedicellaris*). Sphagnum mosses are either absent or they occur in scattered, discontinuous patches. (DNR, n.d.-e; DNR, n.d.-f).

Eggers and Reed (2015) list two subtypes of fresh (wet) meadow, a native subtype dominated by species such as Canada bluejoint grass (*Calamagrostis canadensis*), sedges (*Carex* spp., *Scirpus* spp.), and forbs, and a disturbed subtype dominated by non-native species such as reed canary grass (*Phalaris arundinacea*). Enbridge did not state which subtype was present in their wetland delineation reports. Given the types of wetlands that typically occur in this region and the lower levels of anthropogenic disturbance relative to southern Wisconsin and urban areas, the vast majority of the fresh (wet) meadows are most likely the native subtype. These would be classified as northern sedge meadows in the Wisconsin DNR Natural Heritage Inventory wetland classification (Section 5.9.2.5).

Typical vegetation observed within the delineated PEM wetlands include sedges (*Carex* spp., *Scirpus* spp.), Canada bluejoint grass (*Calamagrostis canadensis*), orange jewelweed (*Impatiens capensis*), asters (*Asteraceae* spp.), boneset (*Eupatorium perfoliatum*), rough bedstraw (*Galium asprellum*), marsh fern (*Thelypteris palustris*), arrow-leaved tearthumb (*Persicaria sagittata*), and sensitive fern (*Onoclea sensibilis*). Over one-quarter of the delineated wetlands within Enbridge's proposed project area are PEM wetlands; approximately ninety percent of the PEM wetlands are classified as fresh (wet) meadow communities (mostly native subtype).

5.8.4.1.2 Palustrine Scrub-shrub Wetlands (PSS)

A palustrine scrub-shrub (PSS) wetland is defined as a non-tidal wetland consisting of woody vegetation that is less than 20 feet tall, including shrubs, young trees, and stunted trees or shrubs (Cowardin et al., 1979). Scrub-shrub include bogs and alder thickets and are characterized by woody shrubs and small trees such as tag alder (*Alnus serrulate*), bog birch (*Betula pumila*), willow (*Salix spp.)*, and dogwood (*Cornus spp*.) (DNR, n.d.-e).

Typical vegetation observed within the delineated PSS include sedges (*Carex* spp.*)*, giant goldenrod *(Solidago gigantea)*, horsetail (*Equisetum* spp.), mannagrass (*Glyceria* spp.), red-osier dogwood (*Cornus sericea*), willows (*Salix* spp.), speckled alder (*Alnus incana*), quaking aspen (*Populus tremuloides*), American basswood (*Tilia americana*), yellow birch (*Betula alleghaniensis*), and maple trees (*Acer* spp.).

Widely scattered, small, ephemeral pools were observed in the delineated PSS wetlands and supported a variety of emergent hydrophytes. Approximately ten percent of the delineated wetlands within the proposed project area are PSS wetlands; apart from approximately 0.2 acres of open bogs, the PSS wetlands are classified as either alder ticket or shrub-carr communities.

5.8.4.1.3 Palustrine Forested Wetlands (PFO)

A palustrine forested (PFO) wetland is defined as a non-tidal wetland characterized by dominant woody vegetation that is greater than 20 feet tall, with an overstory of trees, an understory of small trees and shrubs, and an herbaceous layer (Cowardin et al., 1979). Forested wetlands include hardwood swamps, black spruce and tamarack swamps, cedar swamps, and forested floodplain complexes; these areas may contain tamarack (*Larix laricina*), white cedar (*Thuja occidentalis*), black spruce (*Picea mariana*), elm (*Ulmus* spp.), black ash (*Fraxinus nigra*), green ash (*Fraxinus pennsylvanica*), and silver maple (*Acer saccharinum*) (DNR, n.d.-e).

Palustrine forested wetlands crossed by the proposed route are primarily comprised of black ash (*Fraxinus nigra*) dominated depressions within the hardwood uplands; discrete aspen groves within shrub-carr; and isolated hardwoods and conifers in better drained areas adjacent to incised drainageways. Black ash (*Fraxinus nigra*) also occurs as a fringe or minor component to larger wetland complexes or as isolated, stunted specimens within some wetlands.

Typical vegetation observed within the delineated PFO wetlands include sedges (*Carex* spp.*)*, horsetail (*Equisetum* spp.), mannagrass (*Glyceria* spp.), Canada bluejoint (*Calamagrostis canadensis*), orange jewelweed (*Impatiens capensis*), woolgrass (*Scirpus cyperinus*), ostrich fern (*Matteuccia struthiopteris*), cinnamon fern (*Osmunda cinnamomea*), evergreen wood fern (*Dryopteris intermedia*), dogwood (*Cornus* spp.), winterberry (*Ilex verticillate*), dwarf red raspberry (*Rubus pubescens*), beaked hazelnut (*Corylus cornuta*), eastern hop-hornbeam (*Ostrya virginiana*), nanny-berry (*Viburnum lentago*), speckled alder (*Alnus incana*), quaking aspen (*Populus tremuloides*), American basswood (*Tilia americana*), yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), black ash (*Fraxinus nigra*), green ash (*Fraxinus pennsylvanica*), black spruce (*Picea mariana*), eastern white pine (*Pinus strobus*), northern white cedar (*Thuja occidentalis*), eastern hemlock (*Tsuga canadensis*), and American elm (*Ulmus americana*). Approximately two-thirds of the delineated wetlands that are in the proposed project area are PFO wetlands; most of these wetlands are classified as hardwood swamp communities (Section 5.9.2.7).

5.8.4.2 Wetland Natural Community Types within the Project Area

Natural communities are interactive assemblages of plants, animals, and other organisms, their physical environment, and the natural processes that affect them. They are defined by the assemblage of plant and animal species that live together in a particular area, at a particular time. The DNR's Natural Heritage Inventory tracks examples of all types of Wisconsin's natural communities that are deemed valuable because of their undisturbed condition, size, what occurs around them, or other reasons. Natural community types are discussed in Section 5.9.2. and Figure 5.9-4 depicts selected natural wetland communities along Enbridge's proposed Line 5 relocation route and route alternatives. Section 5.7.8.1 describes flowing water natural communities. Identifying a wetland by its natural community type, in addition to its classification, can provide a broader understanding of the value and condition of the wetland. Table 5.8-3 presents a crosswalk table that lists the Eggers and Reed (2015) classifications based on Enbridge's wetland delineations and the corresponding natural community wetland types used by the DNR (Section 5.9.2).

It should be noted most of Enbridge's proposed Line 5 relocation route would be on private land, apart from a 7.5-mile segment within the Iron County Forest. Neither private land nor county forests have been well surveyed for high-quality natural communities. By way of example, the DNR's Endangered Resources Review recorded only three high-quality natural communities within Enbridge's proposed project area or surrounding area (Boreal Forest, Ephemeral Pond, and Stream – slow, hard, cold; Section 5.9.2.12). Given most of the route has not been thoroughly surveyed for high-quality natural communities, it is likely that additional high-quality communities are present. As an additional example, wetland wirc013, as described in the Mashkiiziibii Natural Resources Department's field survey reports (Section 5.8.4.5), would likely qualify as a high-quality northern hardwood swamp natural community, but because it has not been documented by the DNR's Natural Heritage Conservation program, it was not captured in the Endangered Resources Review.

As stated previously, the "fresh (wet) meadow" communities identified by Enbridge and listed in this EIS should be considered "northern sedge meadow" using the DNR's natural community type. Enbridge appears to have labeled all non-sedge dominated, herbaceous wetlands as "fresh (wet) meadow" for the purposes of this assessment, therefore, it can be assumed the wetlands specifically listed in this EIS that have moderate or higher floristic condition metrics (e.g., FQI or mean C) are most-likely northern sedge meadow wetlands.

Table 5.8-3 Crosswalk from Eggers & Reed classification to DNR natural community types.

Wetland classification	Eggers & Reed [a]	DNR natural community type
PEM	Fresh (wet) meadow (disturbed subtype)	Ruderal wet meadow (non-native dominated)
	Sedge meadow (sedge mat type)	Boreal rich fen
		Great Lakes shore fen
		Poor fen
	Sedge Meadow OR Fresh (wet) meadow (native subtype)	Northern sedge meadow
	Shallow, Open Water Communities	Floating-leaved marsh
		Oligotrophic Marsh
		Submergent Marsh
PSS	Alder thicket	Alder thicket
	Open bog	Muskeg
		Open bog
		Patterned peatland
	Shrub-Carr	Ruderal shrub wetland (non-native dominated)
		Shrub-carr
PFO	Coniferous Bog	Black spruce swamp
		Northern tamarack swamp
	Coniferous swamp	Northern wet-mesic forest
		Southern tamarack swamp
		White pine-red maple swamp
	Floodplain forest	Floodplain forest
	Hardwood swamp	Forested seep
		Northern hardwood swamp
		Ruderal swamp (non-native dominated)
		Southern hardwood swamp
	Hardwood swamp (vernal pool subtype)	Ephemeral pond

[a] (Eggers and Reed, 2015)

Credit: Ryan O'Connor, DNR

Note: This crosswalk table is not exhaustive and has been updated with the intent to reflect potential wetland communities within the project area.

5.8.4.3 Wetland Rapid Assessment Methodology

During the 2019 and 2020 wetland delineations, Enbridge assessed each wetland complexes' functional values based on the DNR's Wetland Rapid Assessment Methodology (WRAM). The WRAM is a qualitative method developed to provide a standardized process for wetland professionals to evaluate the extent to which a specific wetland performs a given function (wetland functional values are introduced in Section 5.8.2). The full range of wetland functions and values are incorporated in a WRAM. The presence or absence of specific characteristics is used to determine the importance of each functional value for a site. The WRAM is intended as a rapid method for assessing wetland condition and functional values based upon observable characteristics and using best professional judgment to interpret those observations (DNR, 2014).

Per the DNR's WRAM guidance, rapid assessments should be completed during the growing season, which would typically end early to mid-October, at the latest. Approximately 50 percent of the wetlands Enbridge delineated and assessed in 2019 (approximately 338 wetland complexes) were completed between October 1 and October 19. In the northern part of the state where the project is proposed, vegetation may be senesced or dead at this time of year, therefore floristic conditions can be difficult to fully assess during this period; floristic condition would ideally be assessed in late July to early September when the greatest number of species are identifiable. Due to the survey dates, the DNR expects the WRAM results may reflect lower species richness and lower species coverages than might have been present in the wetlands during the peak growing season.

Enbridge assessed wetland functional values for human use values, wildlife habitat, fish and aquatic life habitat, shoreline protection, flood and storm water storage, water quality protection, and groundwater processes, and assessed the condition of wetlands as expressed by floristic integrity, within the delineation survey corridor. For each wetland, an overall wetland functional value (based on the average of each individual functional value) was assigned with a rating of "Low," "Low-Invasive," "Medium," or "High." Enbridge defines "Low-Invasive" wetlands as wetlands with an overall WRAM rating as "Low" where invasive/non-native species were documented.

Enbridge describes their WRAM assignment process as "conservative" because the highest potential, overall, general functional value was assigned to each wetland. Enbridge assigned each wetland complex an overall WRAM rating based on an average of the eight individual component rating; in instances where ratings were similar between levels (i.e., 3 "High" ratings, 3 "Medium" ratings, 1 "Low" rating, and 1 N/A rating), the overall rating was generally "rounded up" to "High."

Per DNR's standard WRAM process, a cumulative rating approach is not recommended; instead, ratings should be assigned per discrete function for that wetland (i.e., a wetland would have multiple functional value ratings, not one, cumulative rating). It is the DNR's opinion that an averaged or single WRAM rating is also not adequate for the proposed project; some functions are not going to be "High" given the landscape context of each wetland assessment area, and that rating could therefore skew and misrepresent a cumulative WRAM rating. For example, if a wetland has little connectivity to a shoreline, the wetland will have a "Low" function for shoreline protection since there is little opportunity for that wetland to affect the stability of the shoreline; however, if the wetland provided "Exceptional" wildlife habitat, the "average" or overall WRAM rating may be classified as "Medium," which would not be an accurate representation of the wetland's functional values.

5.8.4.3.1 DNR Review of WRAMs

The DNR has not confirmed Enbridge's WRAMs in the field nor did the DNR review each wetland delineation form and WRAM individually. The DNR instead reviewed a subset of randomly selected wetland WRAMs in greater detail and noted their observations.

The DNR observed instances of inconsistencies with the functional value ratings that were assigned by Enbridge within the subset of WRAMs. As an example, functional value ratings were recorded differently between similar wetlands, where the ratings would theoretically be the same. Additionally, there were wetlands recorded as supporting mostly to entirely native, forested vegetation that were designated with a "Low" rating for floristic condition. Based on site photos and species lists provided by Enbridge in the wetland delineation reports, a higher functional rating designation for floristic quality would have been more representative. Table 5.8-4 provides a general summary of DNR's review of randomly selected wetland WRAMs.

Table 5.8-4 Summary of DNR review of WRAMs performed by Enbridge, random subset.

Wetland ID	Plant community	DNR comments	Impact [a]
wasa056s_w	Hardwood swamp	Feature recorded as "Low" for Human Use, but could be rated as "Medium" due to proximity to infrastructure.	Low
wirb050f_w	Hardwood swamp	Feature appears to be a small, isolated depression that may support aquatic invertebrates.	Low
wira018e_w	Wet meadow	Feature recorded as a disturbed plant community with "Low" Floristic Integrity, however, data demonstrates the feature is dominated by native plant species with only 5% non-native cover; although this feature is a roadside ditch, the feature could be listed as "Medium" for Floristic Integrity.	Medium
wasv009e_w	Wet meadow/ sedge meadow	Feature recorded as "Medium" for Floristic Integrity, which seems appropriate given the feature's location and diversity of native flora.	None
wasa022e_w	Wet meadow	Feature is located near an intermittent stream within a pasture and impacted by grazing. Feature recorded as "Low" for Water Quality Protection and "Flood and Storm water Storage;" the feature could be listed as "Low" or "Medium" in these categories as the stream may be providing minor water quality or flooding benefits.	Low/ Medium
wase031f_w	Hardwood swamp	Feature recorded as "Low" for Floristic Integrity; feature could be listed as "Medium" based on data. Feature could be recorded as "yes" for "water flow through wetland is NOT channelized" under Storm and Floodwater Storage.	Low/ Medium

Wetland ID	Plant community	DNR comments	Impact [a]
wasd021s_w	Alder thicket	Feature could be recorded as “yes” for “3 or more strata present (>10% cover)” under Wildlife Habitat. Expected direct effects are recorded as “Low”: feature could be recorded as “medium,” as project activities may affect medium overall functional value of feature.	Low
wasa112s_w wasa112e_w wasa112f_w	Complex	Complex supports many different habitat types and is contiguous with an intermittent stream; feature could be recorded as “yes” for under Fish and Aquatic Life Habitat. Feature is recorded as “no” and/or “Low” under Groundwater Process, however, soils appear organic, suggesting function in groundwater processes. Feature is recorded as “Low” for all functional values, except for Shoreline Protection; feature could be recorded as higher ratings based on data.	High
wasc042f_w	Hardwood swamp	Small wetland with good vegetation quality.	Low
wasc069s_w	Shrub-carr	Feature functional value ratings appear appropriate.	None
wasa065f_w	Complex	Feature functional value ratings appear appropriate.	None
wasb051f_w	Hardwood swamp	Feature recorded as “Medium” for Floristic Integrity; feature could be listed as “High” based on recorded vegetation; *Chrysosplenium americanum* is abundant and has a C-value of 9. Photos also show an excellent quality wetland.	Medium/ High
wasc035e_w	Wet meadow ditch	Feature recorded as “High” for Flood and Storm water Storage and Water Quality Protection, which may be higher than what is appropriate for this type of road-side ditch feature and its location.	Low
wasv041f_w	Hardwood swamp	Expected direct effects are recorded as “Low” or N/A, which doesn’t appear appropriate based on the recorded data; project activities, such as clearing, would impact existing habitat and overall functional value of the feature; the feature could be recorded as “Medium” or “High” for direct effects.	Low/ Medium
wasa001s_w	Shrub-carr	Feature functional value ratings appear appropriate.	None

[a] Impact of DNR’s review to recommend changes. For example, an impact designated as “High” signifies DNR would strongly recommend changes to the assigned functional assessment.

5.8.4.3.2 Overall WRAM Ratings for Wetlands Affected by Project

Based on the WRAMs completed by Enbridge, over one-half of the wetlands that would be impacted by the proposed project have an overall WRAM value of “Medium”; approximately one-quarter of the wetlands have an overall WRAM value of “High”; and none of the wetlands had an overall WRAM value of “Exceptional.” Almost twenty percent of the wetlands that would be affected by the proposed project have an overall WRAM value of "Low" or "Low-Invasive." Almost all the wetlands that would be permanently converted to herbaceous wetland within the permanent corridor have an overall WRAM value of "Medium" or "High" (see Table 5.8-5).

Table 5.8-5 Wetland impacts by overall WRAM rating.

WRAM rating	Wetland Impacts [a] (acres)	Permanent conversion (acres)
Low-Invasive	8.0	0.1
Low	10.1	1.7
Medium	57.1	19.2
High	26.0	12.9
Total	**101.2**	**33.9**

[a] Includes areas of permanent wetland conversion.

Upon DNR's request, Enbridge provided individual functional value ratings for the wetlands that would be affected by the project, which is summarized in Table 5.8-6.

Table 5.8-6 Acres of wetland impacts by WRAM conditions and functional value significance ratings.

WRAM significance rating	Floristic integrity	Human use	Wildlife habitat	Fish and aquatic life habitat
Exceptional	0.0	0.5	0.0	0.0
High	28.0	4.6	31.0	4.0
Medium	49.6	35.5	51.0	37.4
Low	23.5	57.2	18.5	43.7
N/A or blank	0.1	3.3	0.5	16.0
WRAM significance rating	**Shoreline protection**	**Flood and stormwater storage**	**Water quality protection**	**Groundwater processes**
Exceptional	0.0	4.5	4.5	4.5
High	2.7	12.2	12.4	10.2
Medium	7.4	56.1	65.1	29.0
Low	2.3	28.2	19.1	56.9
N/A or blank	88.7	0.1	0.1	0.5

As shown in Table 5.8-6, many wetlands did not have the ability to perform shoreline protection; this functional value is not applicable if the wetland is not adjacent to a stream or lake. Generally speaking, for the wetlands that would be crossed and/or directly affected by the project, 5 acres (or 5%) have an "Exceptional" rating for Flood and Stormwater Storage, Water Quality Protection, and Groundwater Processes; 28 acres (or 28%) have a "High" rating for floristic integrity; and 31 acres (or 31%) have a "High" rating for wildlife habitat.

Table 5.8-7 shows the percentage of wetlands with at least a "Medium" functional value rating.

Table 5.8-7 Percentage of wetlands crossed or directly impacted by Enbridge's proposed Line 5 relocation with at least a "Medium" WRAM functional value significance rating.

	Floristic integrity	**Human use**	**Wildlife habitat**	**Fish and aquatic life habitat**
Percent of wetlands with at least a "Medium" rating	76.8%	40.2%	81.1%	40.9%
	Shoreline protection	**Flood and storm water storage**	**Water quality protection**	**Groundwater processes**
Percent of wetlands with at least a "Medium" rating	10.0%	72.0%	81.1%	43.2%

5.8.4.4 Wetland Floristic Quality Assessment by Timed-Meander Surveys

Enbridge performed timed meander surveys for approximately 73 wetland features (some of which had multiple wetland community types) between August and September 2022. Enbridge documented observed species and species cover using a cover class 'bucket' system (Daubenmire, 1959). The surveys occurred within the proposed Line 5 relocation ROW, workspaces, and access road areas. The timed-meander surveys were completed on a subset of wetlands that received a "Medium" to "High" floristic integrity rating during the 2019 and 2020 wetland delineations and WRAM functional value assessments (Sections 5.8.4.5 to 5.8.4.7). Survey methods were based on the DNR's Floristic Quality Assessment Methods and Timed-Meander Sampling Protocol for Wetland Floristic Quality Assessment (WFQA), but Enbridge made some modifications to the standard DNR methodology.

The WFQA provides an intensive evaluation of a wetland's biological integrity (or condition) at the site level, based on the condition of the plant community. The assessment uses two related, but separate, measures: the average coefficient of conservatism (Mean C) and the Floristic Quality Index (FQI). FQI values will be sensitive to factors that increase species richness, while Mean C relates directly to aggregate conservatism. (Bernthal, 2003).

Timed meander surveys were completed on a subset of wetlands that would be affected by the proposed project, but not all "Medium" or "High" floristic quality wetlands. Enbridge did not elaborate on why these wetlands were chosen for the more intensive floristic assessments and not others. As mentioned previously, it is the DNR's opinion that some wetland areas may have been undervalued for their floristic condition in the WRAM, possibly due to inconsistent application of the WRAM methodology or due to the late growing season date when surveys were conducted.

Enbridge also used cover classes instead of absolute cover levels, as is prescribed in the DNR's Timed Meander Survey protocol. Enbridge then used the midpoint of each cover class to assign coverage values in the Floristic Quality Assessment Calculators. Due to this modification, the DNR would not recommend using the weighted mean coefficient of conservatism metrics as calculated or the floristic condition benchmarks for weighted mean C values for evaluating floristic condition.

5.8.4.4.1 Coefficient of Conservatism

The WFQA method is based on the concept of species conservatism; each native plant species is assigned a coefficient of conservatism (C or C-value), which represents an estimated probability that a species is likely to occur in a landscape relatively unaltered from what is believed to be a pre-settlement condition.

This can also be described as the degree to which a species can tolerate disturbance, as well as a species' fidelity to undegraded conditions. The most conservative species require a narrow range of ecological conditions, are intolerant of disturbance, and are unlikely to be found outside undegraded, remnant natural areas, while the least conservative species can be found in a wide variety of settings and thrive in landscapes that have experienced disturbance to the soil, nutrient availability, or hydrologic regime. Coefficients range from 0 (highly tolerant of disturbance, little fidelity to any natural community) to 10 (highly intolerant of disturbance, restricted to pre-settlement remnants) (Bernthal, 2003). The terms "highly tolerant" and "highly intolerant" can be subjective; however, high mean C scores are indicative of conservative species which tend to be intolerant to disturbance.

Table 5.8-8 summarizes the unweighted mean C values for the wetlands that Enbridge assessed during the timed meander surveys.

Table 5.8-8 Unweighted Mean C score ratings by community.

Community	Mean C rating	Number of features
Alder thicket	Exceptional	2
	High	4
Coniferous bog	Exceptional	1
Coniferous swamp	Exceptional	1
Floodplain forest	Exceptional	1
	High	2
	Medium	4
Fresh (wet) meadow	Exceptional	2
	High	2
	Medium	4
	Low	1
Hardwood swamp	Exceptional	34
	High	11
	Medium	4
Hardwood swamp – forested seep	Exceptional	2
Open bog	Exceptional	2
Shrub-carr	Exceptional	1
	High	1
	Medium	1
Sedge meadow	Exceptional	1
Vernal pool	High	3
	Medium	2

Source: (Midwest Natural Resources, Inc., 2024)

Of all the wetlands surveyed with a full Timed Meander Survey, 55 percent indicated a mean C with an "Exceptional" average C-value rating, 27 percent indicated a "High" mean C-value rating, 17 percent had a "Medium" mean C-value rating, and one percent had a "Low" mean C-value rating. Of the forested wetland communities (n=65), 85 percent had a mean C-value rating of "Exceptional" or "High" and 15 percent had a rating of "Medium" or "Low." Of the shrub wetland communities (n=11), 91 percent had a mean C-value rating of "Exceptional" or "High" and nine percent had a rating of "Medium" or "Low." Of the herbaceous communities (n=10), 50 percent had a mean C-value rating of "Exceptional" or "High" and 50 percent had a rating of "Medium" or "Low."

5.8.4.4.2 Floristic Quality Index (FQI)

The Floristic Quality Index (FQI) is calculated by multiplying the mean C by the square root of the total number of native species. According to Enbridge, most of the wetland features were "High" to "Exceptional" under the statewide rating system for overall floristic quality as defined in the WRAM functional value assessment. (Bernthal, 2003). FQI ratings from the 2022 timed-meander surveys are included in Table 5.8-9.

Table 5.8-9 Unweighted FQI score ratings by natural community.

Community	FQI rating	Number of features
Alder thicket	Exceptional	2
Coniferous bog	Exceptional	4
Coniferous swamp	Exceptional	1
Floodplain forest	Exceptional	1
	High	1
	Medium	2
Fresh (wet) meadow	Exceptional	4
	Exceptional	2
	High	2
Hardwood swamp	Medium	4
	Exceptional	1
	High	34
Hardwood swamp – forested seep	Medium	11
Open bog	Exceptional	4
Shrub-carr	Exceptional	2
	Exceptional	2
Sedge meadow	High	1
Vernal pool	High	1
	Medium	1

Source: (Midwest Natural Resources, Inc., 2024)

Almost all the forested wetland features surveyed during the WFQA had an FQI rating of "High" or "Exceptional." Approximately 37.7 acres of forested wetlands surveyed during the WFQA would be affected by the project (including clearing, excavation, placement of matting, etc.) and approximately 19.9 acres of the 37.7 acres of forested wetlands surveyed during the WFQA would be permanently cleared. The entire project is proposed to permanently clear approximately 30 acres of forested wetland; generally speaking, two-thirds of the forested wetlands that would be permanently cleared by the proposed project would have a known FQI rating of "High" or "Exceptional." FQI data was not reported for the remaining 10.1 acres of forested wetlands that would be permanently cleared by the proposed project.

5.8.4.5 Mashkiiziibii Natural Resources Department Wetland Field Surveys

5.8.4.5.1 Potato River

In 2021, Mashkiiziibii Natural Resources Department (MNRD) conducted wetland desktop and field surveys within wetlands adjacent to the Potato River (WBIC 2906200) that were delineated in 2019 and 2020 by Enbridge.

During the wetland surveys, MNRD observed mature northern white cedar (*Thuja occidentalis*) and yellow birch (*Betula alleghaniensis*) trees. MNRD shared in their report that northern white cedar is a slow growing tree that is subject to heavy deer browse and suggests the revegetation of these trees may not be successful once cut. According to MNRD, effects from tree clearing within this area would create ruts, disrupt the microtopography, and result in loss of mature northern white cedar (Giizhik), which has traditional cultural uses (Section 4.2.1.14). Black ash (Wiisagaak*, Fraxinus nigra*) and balsam fir (Pegyunagakwitz, *Abies balsamea*) were also observed during field surveys and are culturally significant trees. A state-threatened fern species was also documented in large populations where the wetlands are proposed to be blasted and open-cut trenched to install the pipeline.

The basins within forested wetlands adjacent to the Potato River appeared to have old oxbows and braided channels, demonstrating the microtopography of the floodplain. MNRD reported "extensive microtopography created by downed logs, shallow rooted trees, and low basins with blackened leaves" (Thompson, 2022). MNRD stated "microtopographic disruption [would] take many decades to recover, if at all. The microtopography of wetlands influences water flow by spreading surface water and creating micro channels for water movement. The high points encourage tree regeneration while low points pool water, or contain seeps" (Thompson, 2022).

Very low to no prevalence of invasive or exotic plant species were observed by MNRD.

Observed wildlife included bald eagles (*Haliaeetus leucocephalus*), crayfish, cedar waxwing (*Bombycilla cedrorum*), ruby throated hummingbird (*Archilochus colubris*), bumblebees, and black bear tracks. Seeps and standing pools of water were observed in multiple locations within the wetlands, and many amphibians were observed, including green frogs (*Lithobates clamitans*), American toads (*Anaxyrus americanus*), and spring peepers (*Pseudacris crucifer*).

It is MNRD's opinion that the functional assessments that were performed for these wetlands undervalued the forested wetland's functional values and underemphasized the floristic diversity, seepage and recharge processes, and human use values of the wetlands. For example, Enbridge merged emergent and forested wetlands into one functional assessment in this area, which, according to MNRD, resulted in the devaluing of the forested wetland functions. Additionally, MNRD stated the "Expected Project Impacts" section of the WRAM documents did not accurately record the significance of the effects on the wetland features; for example, Enbridge recorded the direct project effects from blasting and open-cut trenching as "low" within the wetland MNRD recorded as having large populations of a state-threatened plant. MRND states blasting and trenching these wetlands would "drastically harm the rare features it presents," such as the rare plant species, amphibians, and wildlife habitat that were observed. MNRD shared their concerns regarding blasting in wetlands, stating water quality and subsurface hydrology in adjacent wetlands could be affected.

According to MNRD, there are wetlands that extend beyond what were delineated and mapped by Enbridge. MNRD also noted a change in wetland boundaries between the two different delineation years within a farmed wetland (wird017e later changed to wird1012e). MNRD reported there are many wetlands with thin, mucky or peat soils that would be "very vulnerable to disturbance, and [would] not restore to pre-construction integrity," as well as many wetlands associated with seeps and groundwater discharge, which would be "vulnerable to changes in subsurface hydrology, compaction, and loss of microtopography." Additionally, MNRD states "the value of upstream wetlands to the water quality, quality and health of the streams and rivers is not fully articulated or understood in these [functional value] assessments." It is MNRD's opinion that Enbridge's use of the word "temporary" is "misleading as the construction techniques of blasting and trenching [would] cause permanent (in our lifetime) impacts to existing function in the workspace" (Thompson, 2022).

5.8.4.5.2 Tyler Forks River

In September 2022 and July 2023, MNRD conducted wetland field surveys adjacent the Tyler Forks River (WBIC 2923100), a tributary to the Bad River (WBIC 2891900), and within the Bad River Reservation. MNRD's goal was to "field review wetlands mapped by [Enbridge], review additional areas mapped by the Wisconsin Wetland Inventory, and note any unmapped and unreported wetlands within the survey corridor. [MNRD] also assessed the possible impacts of pipeline construction on the wetlands" (Thompson, 2023a; 2023b). MNRD recorded vegetation, landscape position, hydrology, and wildlife information for identified wetlands.

MNRD's April 2023 field report designates at least 14 "missed wetlands" that may have been under-reported or not identified during Enbridge's 2019 and 2020 wetland delineations within this particular survey area. MNRD described "missed wetlands" as areas that had significant wetland vegetation, were in an appropriate landscape position, had evidence of hydrology, and based on professional judgement. Soil characteristics were noted at some, but not all, locations. Additionally, MNRD's report also identified differences in the extent of wetland boundaries or connecting surface waters within and outside Enbridge's proposed construction corridor. MNRD identified additional drainages and swales that were not documented in Enbridge's wetland delineation reports.

According to MNRD, wetlands near the Tyler Forks River are biodiverse with no presence of invasive species; mosses, lichens, orchids, and mature trees were observed in abundance. Uplands are also high quality: MNRD observed *Carex plantaginea* or seersucker sedge during their field review. This plant has not been recorded in Iron County and has a very low tolerance to human disturbance (C-value of 10); it is considered endangered in Minnesota.

During the wetland surveys, MNRD observed amphibians, such as spring peepers (*Pseudacris crucifer*), American toads (*Anaxyrus americanus*), wood frogs (*Lithobates sylvaticus*), bullfrogs (*Lithobates catesbeianus*), red backed salamanders (*Plethodon cinereus*), native crayfish, and state-threatened turtles, and amphibian habitat. According to MNRD, suitable habitat for the state-endangered American Marten (*Martes americana)* was also present.

MNRD documented the wetlands that would be crossed by Enbridge's proposed Line 5 relocation contain multiple plants and animals of cultural significance to Wisconsin's tribal nations, including aagimaak (black ash, *Fraxinus nigra*), aninaandag (balsam fir, *Abies balsamea*), gaagaagimizh (eastern hemlock, *Tsuga canadensis*), bine (ruffed grouse, *Bonasa umbellus*), Waabizheshi (American marten, *Martes americana*), jiibegob (leatherwood, *Dirca palustris*), and Skaa'agon-mins (musclewood, *Carpinus carolinana*) (Section 4.2.1).

It is MNRD's opinion Enbridge missed numerous wetland basins that are part of a wetland/upland mosaic that would be located within the proposed project corridor near Tyler Forks. MNRD reported the uplands adjacent to the field-surveyed wetlands as forested with mature trees that serve as valuable buffers to the wetlands and serve as songbird habitat. Based on DNR's understanding of MNRD's wetland survey reports, it is MNRD's opinion that Enbridge's evaluation on the proposed direct, indirect, and cumulative effects on wetlands that would be crossed by the project underestimate the actual physical and biological damage that could follow project construction and maintenance of the project.

MNRD's reports describe concerns that project construction and maintenance could create effects in underreported or unreported wetlands that would remain undocumented, and underreported or unreported wetlands outside of the immediate corridor could be affected by sediment during dewatering operations, by vehicles and equipment driving and rutting the soil, or be cleared of vegetation during construction, which could affect wildlife habitat, water transpiration, and soil properties. MNRD also expressed concern that impacts to and/or removal of microtopography would alter hydrology and result in loss of hydrologic connections within the landscape.

A summary of purported unreported or underreported wetlands based on MNRD's field surveys is provided below in Table 5.7-10.

Table 5.8-10 Unreported or underreported wetlands based on MNRD field surveys near the Tyler Forks River.

Feature ID	Approximate location based on MNRD report
MW 2022_A	Along proposed access road AR 083, approximately 385 feet north of Casey Sag Road; west of the forest trail and within Enbridge's wetland delineation survey corridor.
MW 2022_B	Along access road AR 083, southeast of MP 33.9; outside of forest trail and within Enbridge's wetland delineation survey corridor.
MW 2022_C	Between MP 33.9 and MP 34, southeast of the project corridor; connects to MW 2022_D, MW 2022_E, and wirb038e; outside of the project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_D	Between MP 33.9 and MP 34, northwest of the project corridor; connects to MW 2022_C, MW 2022_E, and wirb038e; outside of the project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_E	Between MP 33.9 and MP 34, northwest of the project corridor; connects to MW 2022_C, MW 2022_D, and wirb038e; outside of the project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_F	South of Tyler Forks River, northeast of wirb038e; outside of the project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_G	Adjacent to forest trail AR 083 and MP 33.9 junction, west of MW 2022_B; connects to MW 2022_H; within the project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_H	West of forest trail AR 083 and MP 33.9 junction; connects to MW 2022_G; outside of the project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_I	South of Vogues Road, southwest of wirc014f; within the project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_J	South of Vogues Road, southwest of wirc014f and south of MW 2022_I; outside of the project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_K	South of Vogues Road, southwest of wirc014f and MW 2022_J; immediately outside of the project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_L	South of Vogues Road, west of wirc1018f; within Project corridor and within Enbridge's wetland delineation survey corridor.
MW 2022_M	Southeast of wirc1022f; outside of the project corridor and immediately adjacent to Enbridge's wetland delineation survey corridor.
MW 2022_N	Approximately 150 feet north of wirc013f, within the project corridor and within Enbridge's wetland delineation survey corridor.
Unreported drainage feature	North along access road AR 083, near wetland feature wirb040e; along forest trail and within Enbridge's wetland delineation survey corridor.
Missed Wetland (Oly 288)	South of wetland wirc1019f; Delineated as upland by Enbridge, however MNRD observed depressions and microtopography that supported wetland vegetation.
wirb037s_w	Mapped by Enbridge as PSS wetland, however, MNRD observed abundant trees

Feature ID	Approximate location based on MNRD report
	and advises the more accurate classification should be PFO; wetland boundary extends farther south than what was delineated by Enbridge; wetland was delineated by Enbridge as an isolated basin, however, MNRD observed a connected system with a series of basins extending south and southwest, proposing additional missed wetlands.
wirb039s_w	Mapped by Enbridge as PSS wetland, however, MNRD advises the more accurate classification should be PFO; wetland boundary extends further northeast, beyond what was delineated by Enbridge.
wirc1018-f	MNRD suggests this wetland could be larger than what was delineated by Enbridge.
BE Not Mapped Wetland Marsh Thistle	Along access road AR 084; appears to connect to wirc018; invasive marsh thistle (*Cirsium palustre*) observed.
wirc019f	Along access road AR 084; wetland appears to extend outside of narrow road
BE Small Unmapped Wetland	Unmapped wetland near wirc021f, at intersection of AR 084 and the project corridor

5.8.4.5.3 Final Discussion

The DNR requested Enbridge update their application materials to incorporate the wetlands that were observed and reported within MNRD's wetland survey reports. The DNR also requested of Enbridge that if any of the missed or underreported wetlands documented by MNRD would be affected by the project, to update their wetland and waterway crossing table to incorporate those wetlands. Enbridge responded to the DNR's request that it "cannot be completed because the report does not include sufficient data. That report[s] includes only general statements that additional wetlands were found along the Project route. But no GPS location information is provided regarding potential additional wetlands, and no GIS shapefiles are provided delineating the additional wetland boundaries. Accordingly, the report omits necessary wetland information for a delineation prepared consistent with the USACE 1987 Delineation Manual."

5.8.4.6 High-quality Wetlands within the Proposed Project Area

An abundance of high-quality wetlands are present within Enbridge's proposed Line 5 relocation ROW. These wetlands generally:

- have very minimal to no invasive plant species;
- are dominated by native plant species;
- support a diverse plant community;
- contain mature, native trees;
- support state endangered or threatened plant species;
- consist of diverse habitat and habitat vegetation;
- support state endangered or threatened wildlife;
- have had reported observations of reptiles, amphibians, and birds during field surveys;
- have dense vegetation and storm water properties that protect water quality of nearby resources;
- are adjacent to or hydrologically connected to high-quality waterways;
- support groundwater recharge;

- have hunting and recreational potential; or
- are generally undisturbed (signs of historical logging could still be present).

In general, high-quality wetlands are sensitive to any disturbance of soils, hydrology, or vegetation. It is the DNR's opinion that complete restoration of functional and condition following disturbance in high-quality wetlands is exceptionally difficult. Successful examples include comprehensive revegetation plans with diligent monitoring and long-term maintenance. For areas that are currently mature forested wetlands that would be crossed by Enbridge's proposed Line 5 relocation, once permanently converted to herbaceous wetlands, these wetlands would no longer be considered floristically high-quality forested wetlands as they would be prevented from reverting to their pre-construction, mature forest condition. Similarly with the high-quality shrub and forested wetlands that would experience temporary conversion, it would take multiple decades to re-grow to pre-construction conditions, even with active and long-term restoration efforts. Restoration of floristic composition, floristic species richness, or pre-construction functionality after disturbance can be exceptionally difficult and can take several decades.

5.8.4.6.1 High-quality Wetlands Crossed by Greater Than 100 Feet of Pipeline

At the request of the USACE, Enbridge provided a list of wetlands designated with an overall WRAM value of "High" that would be crossed by over 100 feet of pipeline centerline; these wetlands are listed in Table 5.8-11 and described in greater detail below. Additional information on these wetlands can also be found in the Wetland Delineation Reports (not found in the appendices) and the Wetland and Waterway Crossing Table (Appendix B).

Note that the FQI and Mean C-values listed in the tables shown in this section use the WRAM ranking criteria for floristic condition. As noted elsewhere, the DNR does not recommend use of the weighted Mean C-values given that Enbridge did not properly follow the Timed Meander Survey protocol (which the weighted mean C benchmarks were established using). The DNR does have Natural Heritage Conservation program community-specific benchmarks for Mean C-value scores, but those were not used by Enbridge to assign floristic condition rankings in their report.

Table 5.8-11 "High" overall WRAM wetlands that would be crossed by greater than 100 feet of pipeline.

MP	Feature ID	Individual functional value significance rating							
		Floristic integrity	Human use	Wildlife habitat	Fish and aquatic life habitat	Shoreline protection	Flood and storm water storage	Water quality protection	Groundwater processes
MP 3.1	**wasm002**	High	Medium	High	N/A	N/A	Exceptional	Exceptional	Exceptional
MP 4.1	**wasa1054**	High	Low	High	Low	Medium	Medium	Medium	High
MP 10.6	**wase1016**	Medium	High	High	Medium	N/A	Medium	High	Low
MP 14.2	**wasa1006**	High	Low	High	Low	N/A	Medium	Medium	Medium
MP 16.6	**wasc1041**	Medium	Medium	High	Medium	High	High	High	Medium
MP 18.9	**wasd1024**	High	Low	High	Low	N/A	High	High	Medium
MP 22.7	**wasc071**	High	High	High	High	N/A	High	Medium	Medium
MP 24.2	**wasd1008**	High	Exceptional	High	Low	High	High	Medium	High
MP 28.7	**wasw023**	Medium	Low	High	Medium	N/A	Medium	High	High
MP 29.4	**wasw021**	High	Medium	High	Medium	N/A	Medium	Medium	Medium
MP 29.5	**wasw025**	High	Medium	High	Medium	N/A	Medium	Medium	Medium
MP 29.6	**wasw026**	High	Medium	High	Medium	N/A	Medium	Medium	Medium
MP 31.1	**wirb1007**	High	Medium	High	Medium	N/A	Medium	High	High
MP 34.3	**wirc013**	High	Medium	High	Medium	N/A	Medium	Medium	High
MP 34.9	**wirc1019**	Medium	High	High	Medium	N/A	Medium	Medium	Medium

MP	Feature ID	Individual functional value significance rating							
		Floristic integrity	Human use	Wildlife habitat	Fish and aquatic life habitat	Shoreline protection	Flood and storm water storage	Water quality protection	Groundwater processes
MP 35.3	**wirc1016**	High	Medium	High	Medium	N/A	Medium	High	Low
MP 35.9	**wira008**	High	Medium	High	Low	High	Medium	Medium	Medium
MP 37.4	**wirc1002**	High	Medium	High	Medium	N/A	Medium	High	High
MP 37.6	**wird003**	High	Medium	High	Medium	N/A	High	Low	High
MP 37.8	**wird001**	High	Low	High	Low	High	High	Medium	Low

wasm002 (begins near MP 3.1): Wetland wasm002 is a 20.6-acre forested/emergent wetland complex. The wetland complex is a mosaic of upland-wetland areas. Natural communities present in the wetland are northern sedge meadow and hardwood swamp. This wetland feature has an “Exceptional” functional value significance rating for Flood and Storm Water Storage, Water Quality Protection, and Groundwater Processes; “High” rating for Floristic Integrity and Wildlife Habitat; “Medium” rating for Human Use; and “N/A” for Fish and Aquatic Life Habitat and Shoreline Protection. Based on the timed-meander survey, the floristic integrity ranges from “High” to “Exceptional.” The wetland feature would be trenched for approximately 1,700 feet and would also serve as a general construction workspace and HDD workspace for crossing the White River. Project construction would result in approximately 4.5 acres of temporary wetland impact. Approximately 2.1 acres of forested wetland would be permanently converted to emergent wetland as part of the Project’s permanent corridor.

Sample Name	Natural Community	FQIa	Mean C
wasm002e	Fresh (Wet) Meadow	28.7 High	4.66 High
wasm002f	Hardwood Swamp	41.8 Exceptional	4.64 High

wasa1054 (begins near MP 4.1): Wetland wasa1054 is a 6.4-acre forested wetland located within the floodplain of the White River. This wetland is designated as a floodplain forest natural community. This wetland feature has a “High” functional value significance rating for Floristic Integrity, Wildlife Habitat, and Groundwater Processes; “Medium” rating for Shoreline Protection, Flood and Storm water Storage, and Water Quality Protection; “Low” rating for Fish and Aquatic Life Habitat and Human Use. Based on the timed-meander survey, the wetland has “High” floristic integrity. Floodplain wetlands are naturally prone to frequent disturbances and therefore typically have lower floristic metrics (while no floristic benchmarks have been created by the DNR for northern floodplain forests, southern Wisconsin’s Mean C-values of greater than 4.1 are considered excellent condition floodplain forest communities–a value much lower than other non-naturally disturbed forested communities in the region like southern hardwood swamps). The wetland would be crossed via HDD for approximately 560 feet. Approximately 0.4 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge’s proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wasa1054f	Floodplain Forest	28.7 High	3.41 Medium

wase1016 (begins near MP 10.6): Wetland wase1016 is a 6.3-acre forested wetland designated as a hardwood swamp natural community. This wetland feature has a “High” functional value significance rating for Human Use, Wildlife Habitat, and Water Quality Protection; “Medium” rating for Floristic Integrity, Fish and Aquatic Life Habitat, and Flood and Storm water Storage; “Low” rating for Groundwater Processes; “N/A” for Shoreline Protection. Based on the timed-meander survey, the floristic rankings range from “High” to “Exceptional.” The wetland would be trenched approximately 1,200 feet and would also serve as a general construction workspace. Project construction would result in approximately 2.5 acres of temporary wetland impact. Approximately 1.3 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge’s proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wase1016	Hardwood Swamp	45.8 Exceptional	4.41 High

wasa1006 (begins near MP 14.2): Wetland wasa1006 is a 3.4-acre forested wetland located near the Brunsweiler River. This wetland is designated as a hardwood swamp natural community. This wetland feature has a “High” functional value significance rating for Floristic Integrity, Wildlife Habitat; “Medium” rating for Flood and Storm water Storage, Water Quality Protection, Groundwater Processes; “Low” rating for Human Use and Fish and Aquatic Life Habitat; “N/A” for Shoreline Protection. Based on the timed-meander survey, the floristic rankings range from “High” to “Exceptional” and the observed vegetation is indicative of species that may have experienced some minor disturbance in the past but is otherwise in decent condition. The wetland would be crossed via HDD for approximately 580 feet. Approximately 0.4 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge’s proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wasa1006f	Hardwood Swamp	34.7 Exceptional	4.44 High

wasc1041 (begins near MP 16.6): Wetland wasc1041 is a 3.5-acre forested wetland located adjacent to Trout Brook. This wetland is designated as a floodplain forest natural community. This wetland feature has a “High” functional value significance rating for Wildlife Habitat, Shoreline Protection, Flood and Storm water Storage and Water Quality Protection; “Medium” rating for Floristic Integrity, Human Use, Fish and Aquatic Life Habitat, and Groundwater Processes. Based on the timed-meander survey, the wetland has “Exceptional” floristic integrity. Floodplain wetlands are naturally prone to frequent disturbances and therefore typically have lower floristic metrics; while no floristic benchmarks have been created by the DNR for northern floodplain forests, southern Wisconsin Mean C-values of greater than 4.1 are considered excellent condition floodplain forest communities–a value much lower than other non-naturally disturbed forested communities in the region like southern hardwood swamps. The wetland would be crossed via HDD for approximately 520 feet. Approximately 0.4 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge’s proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wasc1041f	Floodplain Forest	34.7 Exceptional	3.48 Medium

wasd1024 (begins near MP 18.9): Wetland wasd1024 is a 5.4-acre wetland complex supporting components of fresh (wet) meadow, hardwood swamp, coniferous bog, and open bog. This wetland complex is designated as a fresh (wet) meadow, hardwood swamp, coniferous bog, and open bog natural communities. This wetland feature has a “High” functional value significance rating for Floristic Integrity, Wildlife Habitat, Flood and Storm water Storage, and Water Quality Protection; “Medium” rating for Groundwater Processes; “Low” rating for Human Use and Fish and Aquatic Life Habitat; “N/A” for Shoreline Protection. Based on the timed-meander survey, the wetland complex ranges from “High” to “Exceptional” floristic integrity. The open bog and black spruce (coniferous) bog are both of exceptional quality and appear to be intact and undisturbed. The wetland would be crossed via HDD for approximately 800 feet. Approximately 0.4 acres of forested and 0.1 acres of shrub-scrub wetland would be permanently converted to emergent wetland as part of Enbridge’s proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wasd1024e	Fresh (wet) meadow	29.1 High	4.44 High
wasd1024f1	Hardwood Swamp	27.9 High	4.59 High
wasd1024f2	Coniferous Bog	41.1 Exceptional	6.76 Exceptional
wasd1024s	Open Bog	33.2 Exceptional	6.91 Exceptional

wasc071 (begins near MP 22.7): Wetland wasc071 is a 5.3-acre forested wetland designated as a hardwood swamp natural community. This wetland feature has a “High” functional value significance rating for Floristic Integrity, Human Use, Wildlife Habitat, Fish and Aquatic Life Habitat, and Flood and Storm water Storage; “Medium” rating for Water Quality Protection and Groundwater Processes; “N/A” for Shoreline Protection. Based on the timed-meander survey, the wetland has “Exceptional” floristic integrity. The wetland would be blasted and trenched for approximately 410 feet and would also serve as a general construction workspace. Project construction would result in approximately 0.9 acres of temporary wetland impact. Approximately 0.5 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge’s permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wasc071f	Hardwood Swamp	46.5 Exceptional	5.30 Exceptional

wasd1008 (begins near MP 24.2): Wetland wasd1008 is a 4.1-acre forested wetland adjacent to the Bad River. This wetland is designated as a floodplain forest natural community. This wetland feature has an “Exceptional” functional value significance rating for Human Use; “High” rating for Floristic Integrity, Wildlife Habitat, Shoreline Protection, Flood and Storm water Storage, and Groundwater Processes; “Medium” rating for Water Quality Protection; “Low” rating for Fish and Aquatic Life Habitat. Based on the timed-meander survey, the wetland has “High” floristic integrity. Floodplain wetlands are naturally prone to frequent disturbances and therefore typically have lower floristic metrics; while no floristic benchmarks have been created by the DNR for northern floodplain forests, southern Wisconsin Mean C-values of greater than 4.1 are considered excellent condition floodplain forest communities–a value much lower than other non-naturally disturbed forested communities in the region like southern hardwood swamps. The wetland would be crossed via HDD for approximately 670 feet. Approximately 0.5 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge’s proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wasd1008f	Floodplain Forest	24.6 High	3.63 Medium

wasw023 (begins near MP 28.7): Wetland wasw023 is 1.2-acre scrub-shrub wetland located adjacent to UNT Gehrman Creek. This wetland is designated as an alder thicket natural community. This wetland feature has a “High” functional value significance rating for Wildlife Habitat, Water Quality Protection, and Groundwater Processes; “Medium” rating for Floristic Integrity, Fish and Aquatic Life Habitat, and Flood and Storm water Storage; “Low” rating for Human Use; “N/A” for Shoreline Protection. Based on the timed-meander survey, the wetland has “Exceptional” floristic integrity. The wetland would be blasted and trenched approximately 130 feet and would also serve as a general construction workspace. Project construction would result in approximately 0.3 acres of temporary wetland impact. Approximately 0.2 acres of scrub-shrub wetland would be permanently converted to emergent wetland as part of Enbridge’s proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wasw023ss	Alder Thicket	36.8 Exceptional	4.68 High

wasw021 (begins near MP 29.4): Wetland wasw021 is a 7.7-acre forested wetland designated as hardwood swamp natural community. This wetland feature has a “High” functional value significance rating for Floristic Integrity, Wildlife Habitat; “Medium” rating for Human Use, Fish and Aquatic Life Habitat, Flood and Storm water Storage, Water Quality Protection, and Groundwater Processes; “N/A” for Shoreline Protection. Based on the timed-meander survey, the wetland has “Exceptional” floristic integrity. The wetland would be blasted and trenched for approximately 520 feet and would also serve as a general construction workspace. This wetland would also be crossed by an existing access road (access road 070) for approximately 190 feet. Project construction would result in approximately 1.1 acres of temporary wetland impact (which includes approximately 0.02 acres of temporary wetland impact from the use and maintenance of the access road). Approximately 0.6 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge’s proposed permanent Line 5 relocation corridor. Permanent forested conversion is not proposed along the access road.

Sample Name	Natural Community	FQIa	Mean C
wasw021f	Hardwood Swamp	35.0 Exceptional	5.00 Exceptional

wasw025 (begins near MP 29.5) and wasw026 (begins near MP 29.6): Wetlands wasw025 and wasw026 are part of an 8.2-acre forested wetland complex and appears to be part of a larger wetland upland-wetland mosaic complex. This wetland feature is designated as a hardwood swamp natural community. This wetland feature has a “High” functional value significance rating for Floristic Integrity and Wildlife Habitat; “Medium” rating for Human Use, Fish and Aquatic Life Habitat, Flood and Storm water Storage, Water Quality Protection, and Groundwater Processes; “N/A” for Shoreline Protection. Based on the timed-meander survey, the wetland has "Exceptional" floristic integrity. The wetlands would be blasted and trenched for approximately 630 feet and would also serve as a general construction workspace. Project construction would result in approximately 1.4 acres of temporary wetland impact. Approximately 0.7 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wasw025f/wasw026f	Hardwood Swamp	41.4 Exceptional	4.94 Exceptional

wirb1007 (begins near MP 31.1): Wetland wirb1007 is a 7.3-acre forested wetland designated as a hardwood swamp – forested seep natural community. This wetland feature has a "High" functional value significance rating for Floristic Integrity, Wildlife Habitat, Water Quality Protection, and Groundwater Processes; "Medium" rating for Human Use, Fish and Aquatic Life Habitat, and Flood and Storm water Storage; "N/A" for Shoreline Protection. Based on the timed-meander survey, the wetland has "Exceptional" floristic integrity. The wetland would be blasted and trenched for approximately 1,060 feet and would also serve as a general construction workspace. Project construction would result in approximately 2.4 acres of temporary wetland impact. Approximately 1.2 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wirb1007f	Hardwood Swamp - Forested Seep	45.3 Exceptional	5.06 Exceptional

MNRD described this wetland as "a mature hardwood swamp with active seeps throughout the wetland with upland islands. This seepy ground with rivulets and complicated hydrology is at the base of an upland slope that sends feeder waterways towards it." MNRD observed a state-threatened plant species in abundance within this wetland. Other observed vegetation included sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), black ash (*Fraxinus nigra*), hop horn beam (*Ostrya viginiana*), American basswood (*Tilia americana*), green ash (*Fraxinus pennsylvanica*), northern white cedar (*Thuja occidentalis*), stern rough sedge (*Carex scrabata*), dwarf red raspberry (*Rubus pubescens*), northern lady fern (*Athyrium angustum*), fowl manna grass (*Glyceria striata*), clearweed (*Pilea pumila*), willow herb (*Epilobium coloratum*), bottlebrush grass (*Elymus hystrix*), common nipplewort (*Lapsana communis*), Virginia creeper (*Parthnocissus quinquefolia*), jewelweed (*Impatiens capensis*), mad dog skullcap (*Scutellaria lateriflora*), zig zag goldenrod (*Solidago flexicaulis*), northern beech fern (*Phegopteris connectilis*), interrupted fern (*Osmunda claytonia*), and nodding sedge (*Carex gynandra*). MNRD observed seeps and standing pools in multiple locations and wildlife tracks from black bears, raccoons, and white-tailed deer (*Odocoileus virginianus*), hornets, woodpecker holes in trees, and amphibians, such as green frogs (*Lithobates clamitans*), American toads (*Anaxyrus americanus*), and spring peepers (*Pseudacris crucifer*) (Thompson, 2022).

wirc013 (begins near MP 34.3): Wetland wirc013 is a 48.1-acre forested/emergent/shrub-scrub wetland complex. This wetland complex contains 44.1 acres of hardwood swamp, designated as a northern hardwood swamp natural community. This wetland feature has a "High" functional value significance rating for Floristic Integrity, Wildlife Habitat, and Groundwater Processes; "Medium" rating for Human Use, Fish and Aquatic Life Habitat, Flood and Storm water Storage, and Water Quality Protection; "N/A" for Shoreline Protection. Based on the timed-meander survey, the wetland has "Exceptional" floristic integrity. The wetland would be trenched for approximately 1,600 feet and would also serve as a general construction workspace. Blasting is not proposed. Project construction would result in approximately 3.7 acres of temporary wetland impact. Approximately 1.8 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor.

Wetland wirc013f_x was visited by MNRD and described as "a stunning wetland with at least two orchid species, and a plethora of native trees, shrubs, and forbs including mature northern white cedar and mature black ash. The habitat had pools of standing water and running rivulets of water that do not appear on the [Enbridge's] maps." MNRD describes portions of this wetland as "a very extensive undisturbed swamp forest" that has habitat, wildlife, and aesthetic functional values. MNRD also states the wetland is rich in water, seeps, small streams, biodiversity, and microtopography. MNRD expressed concerns that open-cut trenching through these wetlands, as well as other forested wetlands throughout Enbridge's proposed project route, are at a high risk of long-term damage to the structure, functions, and wildlife presences within and adjacent to these wetland (Thompson, 2023a).

Sample Name	Natural Community	FQIa	Mean C
wirc013f_x	Northern Hardwood Swamp	54.6 Exceptional	5.67 Exceptional

wirc1019 (begins near MP 34.9): Wetland wirc1019 is a 1.6-acre forested wetland designated as a hardwood swamp natural community. Based on aerial imagery, the wetland appears to be a depressional area within an upland area where a recent timber harvest occurred. This wetland feature has a "High" functional value significance rating for Floristic Integrity, Wildlife Habitat, and Water Quality Protection; "Medium" rating for Human Use, Fish and Aquatic Life Habitat, and Flood and Storm water Storage; "Low" rating for Groundwater Processes; "N/A" for Shoreline Protection. Based on the timed-meander survey, the wetland has "Exceptional" floristic integrity. The wetland would be trenched for approximately 310 feet and would also serve as a general construction workspace. Blasting is not proposed. Pipeline construction would result in approximately 0.6 acres of temporary wetland impact. Approximately 0.3 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wirc1019f	Hardwood Swamp	42.5 Exceptional	5.19 Exceptional

wirc1016 (begins near MP 35.3): Wetland wirc1016 is a 1.4-acre forested wetland designated as a coniferous swamp natural community. This wetland feature has a "High" functional value significance rating for Floristic Integrity, Wildlife Habitat, and Water Quality Protection; "Medium" rating for Human Use, Fish and Aquatic Life Habitat, and Flood and Storm water Storage; "Low" rating for Groundwater Processes; "N/A" for Shoreline Protection. Based on the timed-meander survey, the wetland has "Exceptional" floristic integrity. The wetland would be trenched approximately 220 feet and would also serve as a general construction workspace. Blasting is not proposed. Project construction would result in approximately 0.5 acres of temporary wetland impact. Approximately 0.3 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wirc1016f	Coniferous Swamp	41.6 Exceptional	5.47 Exceptional

wira008 (begins near MP 35.9): Wetland wira008 is an 8.3-acre forested/emergent/shrub-scrub wetland complex designated as northern sedge meadow, hardwood swamp, coniferous swamp, and alder thicket natural communities. This wetland feature has a "High" functional value significance rating for Floristic Integrity, Wildlife Habitat, and Shoreline Protection; "Medium" rating for Human Use, Flood and Storm water Storage, Water Quality Protection, and Groundwater Processes; "Low" rating for Fish and Aquatic Life Habitat. Based on the timed-meander survey, the wetlands range from "High" to "Exceptional" floristic integrity. The wetlands would be trenched for approximately 330 feet and would also serve as a general construction workspace. Blasting is not proposed. This wetland would also be crossed by an existing access road (access road 087) for approximately 190 feet. Project construction would result in approximately 1 acre of temporary wetland impact (which includes approximately 0.30 acres of temporary wetland impact from the use and maintenance of the access road). Approximately 0.1 acres of scrub-shrub and 0.3 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor. Permanent forested conversion is not proposed along the access road.

Sample Name	Natural Community	FQIa	Mean C
wira008e_x	Fresh (Wet) Meadow	28.3 High	4.85 Exceptional
wira008f	Hardwood Swamp	36.1 Exceptional	4.74 Exceptional
wira008f_x	Coniferous Swamp	35.0 Exceptional	6.19 Exceptional
wira008s	Alder Thicket	32.2 Exceptional	4.46 High

wirc1002 (begins near MP 37.4): Wetland wirc1002 is a 3.7-acre forested wetland designated as coniferous swamp natural community. This wetland feature has a "High" functional value significance rating for Floristic Integrity, Wildlife Habitat, Water Quality Protection, and Groundwater Processes; "Medium" rating for Human Use, Fish and Aquatic Life Habitat, Flood and Storm water Storage; "N/A" for Shoreline Protection. Based on the timed-meander survey, the wetland has "Exceptional" floristic integrity. The wetland would be crossed via HDD for approximately 330 feet. Project construction would result in approximately 0.2 acres of temporary wetland impact. Approximately 0.2 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor.

Sample Name	Natural Community	FQIa	Mean C
wirc1002f	Coniferous Swamp	45.7 Exceptional	5.05 Exceptional

wird003 (begins near MP 37.6): Wetland wird003 is a 5.2-acre forested/emergent wetland complex designated as vernal pool and coniferous swamp natural communities. This wetland feature has a "High" functional value significance rating for Floristic Integrity, Wildlife Habitat, Flood and Storm water Storage, and Groundwater Processes; "Medium" rating for Human Use and Fish and Aquatic Life Habitat; "Low" rating for Water Quality Protection; "N/A" for Shoreline Protection. Based on the timed-meander survey, the wetlands range from "High" to "Exceptional" floristic integrity. The wetland would be crossed via HDD for approximately 480 feet. Project construction would result in approximately 0.3 acres of temporary wetland impact. Approximately 0.3 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor.

MNRD observed this forested wetland to have a mature stand of northern white cedar (*Thuja occidentalis*), eastern hemlock (*Tsuga canadensis*), black ash (*Fraxinus nigra*), sugar maple (*Acer saccharum*), balsam fir (*Abies balsamea*), yellow birch (*Betula alleghaniensis*), paper birch (*Betula papyrifera*), and red oak (*Quercus rubra*). Northern white cedar seedlings were also observed. Northern white cedar (Giizhik), black ash (Wiisagaak), and balsam fir (Pegyunagakwitz) have traditional uses and are found on public land in the Ceded Territories (Section 4.2.1). MNRD recorded the herbaceous vegetation to include fowl manna grass (*Glyceria striata*), nodding sedge (*Carex gynandra*), nodding trillium (*Trillium cernuum*), big-leaved avens (*Geum macrophyllum*), sensitive fern (*Onoclea sensibilis*), swamp red current (*Ribes triste*), swamp saxifrage (*Saxifraga pensylvanica*), blue bead lily (Godotaagaagaans, *Clintonia borealis*) and woodland horsetail (*Equisetum slyvaticum*). Swamp red current (Miishijiiminagaawanzh), big-leaved avens (Wica'), woodland horsetail (Siba'), and blue bead lily (Godotaagaagaans) are important cultural medicinal species and swamp red current is a traditional food (Section 4.2.1.13). MRND observed "extensive microtopography created by downed logs, shallow rooted trees, and low basins with blackened leaves" (Thompson, 2022).

Sample Name	Natural Community	FQIa	Mean C
wird003e	Vernal Pool	31.8 High	4.64 High
wird003f	Coniferous Swamp	49.4 Exceptional	5.21 Exceptional

wird001 (begins near MP 37.8): Wetland wird001 is a 6.8-acre forested wetland designated as a floodplain forest natural community. This wetland feature has a "High" functional value significance rating for Floristic Integrity, Wildlife Habitat, Shoreline Protection, and Flood and Storm water Storage; "Medium" rating for and Water Quality Protection; "Low" rating for Human Use, Fish and Aquatic Life Habitat, and Groundwater Processes. Based on the timed-meander survey, the wetland has "Exceptional" floristic integrity. Floodplain wetlands are naturally prone to frequent disturbances and therefore typically have lower floristic metrics; while no floristic benchmarks have been created by the DNR for northern floodplain forests, southern Wisconsin Mean C-values of greater than 4.1 are considered excellent condition floodplain forest communities–a value much lower than other non-naturally disturbed forested communities in the region like southern hardwood swamps. The wetland would be crossed via HDD for approximately 660 feet. Project construction would result in approximately 0.5 acres of temporary wetland impact. Approximately 0.5 acres of forested wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor.

MNRD observed this wetland to have mature, northern white cedar (*Thuja occidentalis*), as well as black ash (*Fraxinus nigra*), sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), ostrich fern

(*Matteuccia struthiopteris*), and purple meadowrue (*Thalictrum dasycarpum*). According to MNRD, this wetland is part of the Potato River basin with an abundance of microtopography, old oxbows, and braided channels, and is vegetated with needle spike rush (*Eleocharis acicularis*), sensitive fern (*Onoclea sensibilis*), fowl manna grass (*Glyceria striata*), arrowhead (*Sagittaria latifolia*), Greater bladder sedge (*Carex intumescens*), Devil's pitchfork (*Bidens frondosa*), Great water dock (*Rumex britannica*), rice cut grass (*Leersia oryzoides*), and white grass (*L. virginica*) (Thompson, 2022).

Sample Name	Natural Community	FQIa	Mean C
wird001f	Floodplain Forest	41.0 Exceptional	4.59 High

5.8.4.6.2 Additional High-quality Wetlands Crossed by Project

The wetlands in Table 5.8-12 have an overall WRAM rating as “High” but would not be crossed by more than 100 feet of pipeline centerline (but would still be crossed or affected by project components). Additional information on these wetlands can also be found in the Wetland Delineation reports and the Wetland and Waterway Crossing Table (Appendix B).

Table 5.8-12 "High" overall WRAM wetlands that would be crossed by less than 100 feet of pipeline.

MP	Feature ID	Pipeline crossing method	Wetland classification	Total impacts (acres)	Permanent conversion (acres)	Individual functional value significance rating							
						Floristic integrity	Human use	Wildlife habitat	Fish and aquatic life habitat	Shoreline protection	Flood and storm water storage	Water quality protection	Ground-water processes
MP 3.1	**wasm001**	HDD	PFO	0.01	0.01	High	Medium	High	N/A	N/A	Exceptional	Exceptional	Exceptional
MP 5.9	**wasc060**	Trench	PFO	0.05	0.03	High	Medium	Medium	Medium	N/A	High	High	Low
	wasc061	Workspace	PEM	0.01	-	Medium	Medium	Medium	Medium	N/A	High	Exceptional	High
	wasc062	Trench	PFO	0.15	0.06	High	Medium	Medium	Medium	N/A	High	High	Low
MP 14.7	**wasc1033**	Trench	PEM/ PSS	0.17	0.07	Medium	Low	High	Medium	High	High	High	Low
MP 15.9	**wasc1014**	Trench	PFO	0.21	0.12	Medium	NA	High	Medium	Medium	High	High	Low
MP 16.8	**wasc1045**	HDD	PEM/ PFO	0.17	0.02	Medium	Low	High	Medium	High	Medium	High	Medium
MP 17.2	**wasb1004**	Workspace	PFO	0.06	-	High	Medium	High	Medium	Low	Medium	High	Medium
MP 20.2	**wase1034**	Access Road	PEM/ PFO	0.11	-	High	High	High	Medium	Medium	Low	Low	Medium
	wasv059	HDD	PFO	0.02	0.02	Medium	Medium	High	High	Medium	High	Low	High
MP 22.6	**wasc069**	Trench, Blasting	PSS	0.14	0.08	High	Medium	High	High	N/A	High	Medium	Medium
MP 22.9	**wasc072**	Trench, Blasting	PFO	0.09	0.05	High	High	High	High	N/A	High	Medium	Medium
	wasc074	Access Road	PEM	0.01	-	High	High	High	High	N/A	High	Medium	Medium
MP 25.4	**wasd1013**	Workspace	PFO	0.01	-	High	Low	High	N/A	N/A	Low	Medium	Medium

MP	Feature ID	Pipeline crossing method	Wetland classification	Total impacts (acres)	Permanent conversion (acres)	Individual functional value significance rating							
						Floristic integrity	Human use	Wildlife habitat	Fish and aquatic life habitat	Shoreline protection	Flood and storm water storage	Water quality protection	Ground-water pro-cesses
MP 28.6	**wasw024**	Trench	PFO	0.13	0.06	Medium	Low	High	Medium	N/A	Medium	High	High
MP 31.9	**wirc030**	Access Road	PEM	0.02	-	Medium	Medium	Medium	High	N/A	High	High	Medium
MP 33.0	**wirb054**	Access Road	PEM/ PSS	0.43	-	Low	Medium	High	Medium	N/A	High	High	Medium
	wire1001	Access Road	PEM/ PFO	0.13		High	Medium	High	Medium	N/A	Medium	High	N/A
MP 34.1	**wirc018**	Access Road	PEM/ PSS	0.10	-	Medium	High	High	Medium	N/A	Medium	Medium	Medium
MP 34.9	**wirc1019**	Access Road	PEM/ PFO	0.91	-	Medium	High	High	Medium	N/A	Medium	Medium	Medium
MP 36.1	**wira008**	Trench, Access Road	PEM/ PSS/ PFO	1.0	0.37	High	Medium	High	Low	High	Medium	Medium	Medium
MP 36.3	**wirc1013**	Access Road	PEM/ PFO	0.76	-	High	Medium	High	Low	N/A	Medium	High	Medium
MP 36.9	**wirc1010**	Access Road	PEM	0.01	-	High	Medium	High	High	N/A	Medium	Medium	Medium
MP 3.1	**wasm001**	HDD	PFO	0.01	0.01	High	Medium	High	N/A	N/A	Excep-tional	Exceptional	Exceptional
MP 5.9	**wasc060**	Trench	PFO	0.05	0.03	High	Medium	Medium	Medium	N/A	High	High	Low
	wasc061	Work-space	PEM	0.01	-	Medium	Medium	Medium	Medium	N/A	High	Exceptional	High
	wasc062	Trench	PFO	0.15	0.06	High	Medium	Medium	Medium	N/A	High	High	Low
MP 14.7	**wasc1033**	Trench	PEM/PSS	0.17	0.07	Medium	Low	High	Medium	High	High	High	Low

MP	Feature ID	Pipeline crossing method	Wetland classific ation	Total impacts (acres)	Permanent conversion (acres)	Individual functional value significance rating							
						Floristic integrity	Human use	Wildlife habitat	Fish and aquatic life habitat	Shoreline protection	Flood and storm water storage	Water quality protection	Ground-water pro-cesses
MP 15.9	**wasc1014**	Trench	PFO	0.21	0.12	Medium	NA	High	Medium	Medium	High	High	Low
MP 16.8	**wasc1045**	HDD	PEM/ PFO	0.17	0.02	Medium	Low	High	Medium	High	Medium	High	Medium
MP 17.2	**wasb1004**	Work-space	PFO	0.06	-	High	Medium	High	Medium	Low	Medium	High	Medium
MP 20.2	**wase1034**	Access Road	PEM/ PFO	0.11	-	High	High	High	Medium	Medium	Low	Low	Medium
	wasv059	HDD	PFO	0.02	0.02	Medium	Medium	High	High	Medium	High	Low	High
MP 22.6	**wasc069**	Trench, Blasting	PSS	0.14	0.08	High	Medium	High	High	N/A	High	Medium	Medium
MP 22.9	**wasc072**	Trench, Blasting	PFO	0.09	0.05	High	High	High	High	N/A	High	Medium	Medium
	wasc074	Access Road	PEM	0.01	-	High	High	High	High	N/A	High	Medium	Medium
MP 25.4	**wasd1013**	Work-space	PFO	0.01	-	High	Low	High	N/A	N/A	Low	Medium	Medium
MP 28.6	**wasw024**	Trench	PFO	0.13	0.06	Medium	Low	High	Medium	N/A	Medium	High	High
MP 31.9	**wirc030**	Access Road	PEM	0.02	-	Medium	Medium	Medium	High	N/A	High	High	Medium
MP 33.0	**wirb054**	Access Road	PEM/ PSS	0.43	-	Low	Medium	High	Medium	N/A	High	High	Medium
	wire1001	Access Road	PEM/ PFO	0.13		High	Medium	High	Medium	N/A	Medium	High	N/A
MP 34.1	**wirc018**	Access Road	PEM/ PSS	0.10	-	Medium	High	High	Medium	N/A	Medium	Medium	Medium

MP	Feature ID	Pipeline crossing method	Wetland classification	Total impacts (acres)	Permanent conversion (acres)	Individual functional value significance rating							
						Floristic integrity	Human use	Wildlife habitat	Fish and aquatic life habitat	Shoreline protection	Flood and storm water storage	Water quality protection	Ground-water pro-cesses
MP 34.9	**wirc1019**	Access Road	PEM/ PFO	0.91	-	Medium	High	High	Medium	N/A	Medium	Medium	Medium
MP 36.1	**wira008**	Trench, Access Road	PEM/ PSS/ PFO	1.0	0.37	High	Medium	High	Low	High	Medium	Medium	Medium
MP 36.3	**wirc1013**	Access Road	PEM/ PFO	0.76	-	High	Medium	High	Low	N/A	Medium	High	Medium
MP 36.9	**wirc1010**	Access Road	PEM	0.01	-	High	Medium	High	High	N/A	Medium	Medium	Medium

5.8.4.6.3 Hardwood Swamp-Vernal Pool Wetlands

Vernal pools, also referred to by their natural community type “ephemeral ponds,” are small, fishless pools with impeded drainage, usually in forest landscapes, that hold water for a short time following snowmelt and spring rain, but typically dry out by mid-summer. They flourish with productivity during their brief existence. Vernal pools provide critical breeding habitat for invertebrates and many amphibians, such as frogs and several salamanders, because the pools lack the fish that would typically prey on the invertebrates and amphibians, their egg masses, or larvae (tadpoles). Vernal pools also provide feeding, resting, and breeding habitats for songbirds and a food source for many mammals. In many ways, they contribute to the biodiversity of a woodlot, forest, and the larger landscape.

The DNR’s Ecosystem Management Planning Team describes the North Central Forest Ecological Landscape as “probably Wisconsin’s most important place in which to manage ephemeral ponds because they are abundant in some areas and many of the local watersheds around them have remained forested. Management guidelines and more effective protective measures are needed to increase awareness of their values, avoid isolating them from adjoining habitats, and prevent inadvertent damage” (DNR, 2015d).

Common wetland plants found in ephemeral ponds include yellow water crowfoot (*Ranunculus gmelinii*), mermaid weed (*Proserpinaca palustris*), Canada blue joint grass (*Calamagrostis canadensis*), floating manna grass (*Glyceria borealis*), spotted cowbane (*Cicuta maculate*), smartweeds (*Polygonum spp.*), orange jewelweed (*Impatiens capensis*), and sedges (*Carex* spp.). Trees adjacent to ephemeral ponds provide various benefits, such as maintaining cool water temperatures, preventing premature drying, and contributing to the food web. Fallen leaves from these trees helps provide a detritus-based food source for various invertebrates (“Ephemeral Pond,” n.d.).

It should be noted that the conservation value of vernal pools may not be fully represented by Enbridge’s WRAM, which is based on functional values. Vernal pools have tremendous value for amphibians and certain invertebrates that are only found in such habitats. Vernal pools are best evaluated using the DNR’s ephemeral pond survey methodology, which evaluates the pond’s significance to amphibian breeding and obligate invertebrates.

Extensive, long-term effects on ephemeral ponds can occur from blasting or general construction activities given the sensitive hydrology and subtle landscape position of ephemeral ponds. Effects can include altering a pond’s hydroperiod and average depth or permanently draining the pond.

Four wetland features were identified during wetland delineations as hardwood swamps with vernal pools (“hardwood swamp-vernal subtype”):

- **wirb1005f (MP 30.81):** This 0.04-acre (1,750 square foot) wetland feature is dominated by black ash (*Fraxinus nigra*) and predominantly unvegetated with relatively bare ground cover; spinulose wood fern (*Dryopteris carthusiana*) is present within the wetland growing on rotted tree stumps. Observed vegetation was native and no invasive species were observed. Tadpoles were observed at the time of the wetland delineation. The feature is located on public land and relatively undisturbed. This wetland feature has a “High” functional value significance rating for Fish and Aquatic Life Habitat, and Groundwater Processes; “Medium” rating for Floristic Integrity, Wildlife Habitat, Flood and Storm water Storage, and Water Quality Protection; “Low” rating for Human Use; “N/A” for Shoreline Protection. The wetland feature is located immediately adjacent to the trench line within the construction workspace; Enbridge’s proposed project would result in approximately 0.02 acres of permanent wetland conversion and 0.04 acres of temporary wetland impacts (which includes approximately 20 square feet of blasting).

- **wirc1022f (MP 34.79):** This 0.06-acre (2,600 square foot) wetland feature is a dominated by green ash (*Fraxinus pennsylvanica*) and bladder sedge (*Carex intumescens).* Observed vegetation was native and no invasive species were observed. Signs of harvesting were located nearby at the time of the wetland delineation. This wetland feature has a "Medium" functional value significance rating for Floristic Integrity, Human Use, Wildlife Habitat, Flood and Storm water Storage, and Water Quality Protection; "Low" rating for Fish and Aquatic Life Habitat and Groundwater Processes; and "N/A" for Shoreline Protection. The wetland feature is located immediately adjacent to the trench line within the construction workspace; Enbridge's proposed project would result in approximately 0.01 acres of permanent wetland conversion and 0.04 acres of temporary wetland impacts. Blasting is not proposed.

- **wirc1003f (MP 37.03):** This 0.01-acre (630 square foot) wetland feature is a seasonally flooded vernal pool that drains into an Unnamed Tributary of Potato River (feature ID sirc1033i) that crosses a logging road. Wetland wirc1003 is a forested/emergent wetland complex. The feature is surrounded by red maple (*Acer rubrum*) but is otherwise lacking vegetation within the pool. Immediately outside the delineation corridor is marsh marigold (*Caltha palustris*), Pennsylvania bittercress (*Cardamine pensylvanica*), jewelweed (*Impatiens capensis*), fowl mannagrass (*Glyceria striata*), cinnamon fern (*Osmundastrum cinnamomeum*), and fringed sedge (*Carex crinita*). No invasives species were observed in the complex. This wetland feature has a "High" functional value significance rating for Wildlife Habitat and Groundwater Processes; "Medium" rating for Floristic Integrity, Human Use, Fish and Aquatic Life Habitat, Flood and Storm water Storage, and Water Quality Protection; and "N/A" for Shoreline Protection. The wetland complex wirc1003 would be crossed by an existing access road (approximately 100 feet, access road 090) during construction and result in approximately 180 square feet of temporary wetland impacts to wirc1003f. Permanent wetland conversion is not proposed. Blasting is not proposed.

- **wird003f (begins near MP 37.6):** This 5.2-acre wetland feature is a forested/emergent wetland complex, designated as a vernal pool community fed by seepage and scattered with open pools. Wetland wird003f is mostly bare ground with areas of evergreen wood fern (*Dryopteris intermedia*). The wetland was also dominated by a canopy of yellow birch (*Betula alleghaniensis*), green ash (*Fraxinus pennsylvanica*), northern white cedar (*Thuja occidentalis*), eastern hemlock (*Tsuga canadensis*), and sugar maple (*Acer saccharum*). This wetland complex has a "High" functional value significance rating for Floristic Integrity, Wildlife Habitat, Flood and Storm water Storage, and Groundwater Processes; "Medium" rating for Human Use, Fish and Aquatic Life Habitat; "Low" rating for Water Quality Protection; and "N/A" for Shoreline Protection. Invasive species were not observed in the complex. Wetland complex wird003 would be crossed via HDD for approximately 480 feet. Project construction would result in approximately 0.3 acres of temporary wetland impacts to wird003f; the wetland would be permanently converted to emergent wetland as part of Enbridge's proposed permanent Line 5 relocation corridor. Blasting is not proposed.

5.8.4.6.4 Bogs

Bogs are acidic, low nutrient, northern Wisconsin peatlands dominated by *Sphagnum* mosses that occur in deep layers and accumulate over time as peat. The bog surface is often uneven, with pronounced hummock and hollow microtopography. Hummocks formed by accumulating *Sphagnum* moss and leatherleaf often reach two feet or more in height relative to the adjacent hollows. In northern Wisconsin, bogs are frequently found in the kettle depressions of pitted outwash and morainal landforms. They also frequently occur on the borders of lakes that have low nutrient inputs. Vascular plant diversity is very low in the most acidic sites but includes characteristic and distinctive specialists such as the narrow-leaved sedge species (*Carex oligosperma* and *Carex pauciflora*), cotton-grasses (*Eriophorum spp.*), and ericaceous shrubs, especially leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), bog rosemary

(*Andromeda polifolia*), and small cranberry (*Vaccinium oxycoccos*). Trees are absent or stunted and achieve very low cover values.

In the strictest sense, bogs receive nutrients only from precipitation and limited internal runoff. The thick layers of *Sphagnum* isolate the bog from the influence of nutrient-enriched groundwater, and create an environment characterized by high acidity and low oxygen and nutrient levels that is inhabited by a limited number of highly specialized plants able to tolerate or thrive in the extreme conditions. Poor fen, open bog, and muskeg often occupy different parts of each of these communities responds to slight differences in local site conditions (DNR, n.d.-g).

Extensive, long-term effects on bogs can occur from general construction activities, given the uneven, pronounced hummock and hollow microtopography and abundance of sensitive, non-vascular plant species (e.g., mosses). Three wetland features were identified during wetland delineations as bogs: wase001e, wasd1024s, and wasd1024f2.

- **Wetland wase001e (near MP 18.5)** is described as 1.6-acre open, acid peatland surrounded by young, upland forest. A recreational area with turf grass is present to the southeast. The plant community is comprised of native vegetation, with no observed invasive species. The wetland is dominated by leatherleaf (*Chamaedaphne calyculata)* and lake sedge (*Carex lacustris)*, with small patches of black spruce (*Picea mariana*) that become dominant outside of the wetland delineation survey area. Within other areas of the wetland, few-seeded sedge (*Carex oligosperma*) and woolgrass (*Scirpus cyperinus*) are present. Continuous sphagnum moss matting is present throughout the wetland. Redbellied snakes (*Storeria occipitomaculata)* were observed in the sphagnum and there is potential for bird, mammal, insect, and herptile habitat. This wetland feature has a “High” functional value significance rating for Floristic Integrity; “Medium” rating for Human Use, Wildlife Habitat, Flood and Storm water Storage, Water Quality Protection, and Groundwater Processes; and “N/A” for Fish and Aquatic Life Habitat and Shoreline Protection. Wetland wase001e is proposed for open-cut trenching along the edge of the feature (approximately 20 feet), resulting in 0.05 acres of permanent wetland conversion and 0.10 acres of temporary wetland impacts. Blasting is not proposed.

- **Wetland complex wasd1024 (near MP 19)** is a 5.4-acre feature that supports rich plant diversity of native vegetation and includes a 0.6-acre fresh wet meadow dominated by Canada bluejoint (*Calamagrostis canadensis*) and woolgrass (*Scirpus cyperinus*); a 0.1-acre hardwood swamp dominated by interrupted fern (*Osmunda claytoniana)* and quaking aspen (*Populus tremuloides*); a 3.8-acre coniferous bog with a continuous cover of sphagnum moss and dominated by black spruce (*Picea mariana*), leatherleaf (*Chamaedaphne calyculata)*, three-leaf false solomon's-seal (*Maianthemum trifolium*), and three-seed sedge (*Carex trisperma*); and 0.8-acres of open bog with a continuous cover of sphagnum moss and dominated by leatherleaf (*Chamaedaphne calyculata)*. The wetland soils within the bogs can be described as histosols with saturated peat extending through the entire length of the soil sample. Birds and insects were observed and there is potential for bird, mammal, insect, aquatic invertebrate, and herptile habitat. This wetland complex has a “High” functional value significance rating for Floristic Integrity, Wildlife Habitat, Flood and Storm water Storage, and Water Quality Protection; “Medium” rating for Groundwater Processes; “Low” rating for Human Use and Fish and Aquatic Life Habitat; and “N/A” for Shoreline Protection. The wetland complex wasd1024 is proposed to be crossed via HDD for approximately 800 feet. Project construction would result in approximately 0.6 acres of temporary wetland impacts and 0.5 acres of permanent wetland conversion, as part of Enbridge’s proposed permanent Line 5 relocation corridor. Blasting is not proposed.

5.8.4.6.5 Coniferous Swamps

Coniferous swamps can be characterized by canopies of black spruce (*Picea mariana*) and tamarack (*Larix laricina*) and include understories of bryophytes (mosses), speckled alder (*Alnus incana*), black ash (Fraxinus nigra), and Labrador-tea (*Rhododendron groenlandicum*). Conifer swamps are generally described as consisting of saturated, acidic, peat soil (DNR, n.d.-f; n.d.-h).

Extensive, long-term effects to swamps can occur from blasting and/or general construction activities, given the sensitive interface between surface water and groundwater and presence of sensitive, non-vascular plant species (e.g. mosses).

- **Wetland complex wasv019 (near MP 21.3)** is a 7.3-acre wetland complex consisting of a 3-acre ground water-driven coniferous swamp, 0.4-acre shrub-carr, and a 3.9-acre fresh (wet) meadow. The wetland complex consists of diverse, native plant communities with minimal observed invasive species: the coniferous swamp is dominated by brome-like sedge (*Carex bromoides),* northern white cedar (*Thuja occidentalis),* and yellow birch (*Betula alleghaniensis)*; the shrub-carr feature is dominated by common rush (*Juncus effusus*) and willows (*Salix bebbiana* and *Salix discolor*); the fresh (wet) meadow is dominated by common rush (*Juncus effusus*) and rattlesnake mannagrass (*Glyceria canadensis*). Multiple species of birds were observed during the delineation and there is potential for bird habitat and deer wintering. The wetland complex is regularly grazed by cattle and the cows have access to the forested area of the wetland complex, but little to no disturbance within the coniferous swamps that were observed at the time of the delineation. This wetland complex has a “High” functional value significance rating for Floristic Integrity and Wildlife Habitat; “Medium” rating for Shoreline Protection, Flood and Storm water Storage, Water Quality Protection, and Groundwater Processes; and “Low” rating for Human Use and Fish and Aquatic Life Habitat. The wetland complex wasv019 is proposed to be crossed via open-cut trenching, resulting in approximately 0.4 acres of permanent wetland conversion within the swamps and 1.3 acres of temporary wetland impacts (which includes approximately 0.2 acres of blasting) within the wetland complex. The pipeline ROW crossing within the coniferous swamps would be approximately 360 feet and approximately 690 feet for the wetland complex.

5.8.4.6.6 Seepage Wetlands

Seepage wetlands (seeps) are groundwater-fed. Seep and springs are characteristic features of many northern wet-mesic forests and are common on the slopes adjacent to waterways within the Superior Coastal Plain (Section 5.7.3.25). Seeps provide critical habitat for wildlife and plants, including rare plant species. The DNR’s Ecosystem Management Planning Team considers wetlands that receive or support groundwater seepage as areas meriting high levels of protection due to the ecological value they provide (DNR, 2015b; 2015d). Construction within seepage wetlands could have short-term or long-term effects to wetland hydrology, groundwater recharge and discharge, wildlife habitat, and habitat supporting rare plant species.

During the 2019 and 2020 wetland delineations, Enbridge identified approximately 60 wetland complexes within the proposed Line 5 relocation project area that have or likely have groundwater seeps (Figure 5.7-3). The DNR requested Enridge evaluate wetland delineation and field data for known, likely, or possible groundwater-fed wetland. This included reviewing data for presence of skunk cabbage (*Symplocarpus foetidus*) and marsh marigold (*Caltha palustris*), which can be indicators for groundwater-fed wetlands. Enbridge determined approximately 157 wetland complexes, approximately 50.3 acres, within Enbridge’s proposed Line 5 relocation corridor contained data that indicated the presence of seeps, springs, discharge, skunk cabbage, or marsh marigold. During additional review of wetland data by the DNR, wetlands wasd1028, wase057, wase1024, wire1001, and wira013 contained information that may indicate the presence of seepage wetlands. These five wetland complexes, approximately 1.7 acres, did not appear to be included in Enbridge’s determinations.

Based on Enbridge and DNR review, approximately 52 acres of wetlands where indicators of seeps, springs, and groundwater discharge were observed would be impacted by the proposed project (blasting, excavation, placement of matting, vehicular access, etc.), which includes approximately 19.3 acres of permanent wetland conversion (18.4 PFO, 0.9 PSS). Additional discussion on groundwater and groundwater effects can be found later in this chapter and in Sections 5.5 and 6.4.

5.8.4.7 Wetlands in ASNRI within the Project Area

Areas of Special Natural Resources Interest (ASNRI) include areas recognized by the state or federal government as possessing special ecological, cultural, aesthetic, educational, recreational, or scientific qualities. Certain areas, surface waters, and wetlands are designated ASNRI by statute in s. 30.01(1m), Wis. Stat. ASNRI for the purposes of Wisconsin's Water Quality Standards for Wetlands are listed in s. NR 103.04, Wis, Adm. Code. Section NR 103.04, Wis, Adm. Code, specifies that wetlands in ASNRI include those wetlands both within the boundary of designated ASNRI and those wetlands which are in proximity to or have a direct hydrologic connection to such designated areas. ASNRI in proximity to Enbridge's proposed Line 5 relocation route and route alternatives and the sections in this EIS where they are discussed include:

- Cold water communities as defined in s. NR 102.04 (3) (a), Wis. Adm. Code, including all trout streams and their tributaries and trout lakes – (Section 5.7.8)
- Lakes Michigan and Superior and the Mississippi river – (Section 5.7.1)
- State and federal designated wild and scenic rivers, designated state riverways and state designated scenic urban waterways as defend in ss. 30.26 and 30.275, Wis. Stat., subchs. III and IV of ch. 30, Wis. Stat., ch. NR 302, Wis. Adm. Code, and 16 USC ch. 28.
- Unique and significant wetlands identified in special area management plans (SAMP), special wetland inventory studies (SWIS), advanced delineation and identification studies (ADID) and areas designated by EPA under Section 404(c) (33 USC § 1344(c))
- Calcareous fens
- Habitat used by state or federally designated threatened or endangered species – (Sections 5.9.4, 5.10.8, and 5.10.9)
- State parks, forests, trails and recreation areas – (Section 5.12)
- State and federal fish and wildlife refuges and fish and wildlife management 3+areas – (Section 5.12)
- State and federal designated wilderness areas 16 USC ch. 23 and s. NR 1.415, Wis. Adm. Code)
- Designated or dedicated state natural areas (SNAs) established under ss. 23.27 to 23.29, Wis. Stat. – (Section 5.9.3)
- Wild rice waters – (Section 4.2.1.10 and 5.7.11)
- Any other surface waters identified as outstanding or exceptional resource waters in ch. NR 102, Wis. Adm. Code. – (Section 5.7.8)

The proposed route would cross designated trout streams (some streams multiple times) 15 times, RA-01 would cross designated trout streams 12 times, RA-02 would cross designated trout streams 20 times, and RA-03 would cross designated trout streams 25 times. RA-01 would cross approximately 0.5 mile of the Copper Falls State Park. Some portions of the park, including Copper Falls (a section of the Bad River) have been designated as ASNRI.

5.8.5 Wetland Effects from Construction

Construction activities conducted adjacent or within wetlands could negatively affect wetland functional values, such as floristic diversity, wildlife habitat, and water quality protection. Disturbance in and adjacent to wetlands can lead to:

- an increase of invasive species and a decrease in native species diversity;
- long-term effects on wildlife habitat and corridors by the siting of project components and clearing vegetation;
- temporary and permanent effects on hydrology (the vertical and horizontal movement of water through the soil) from blasting, open-cut trenching, mounding and subsidence, soil compaction, and associated dewatering activities;
- decreases of the natural water quality benefit of wetlands from vegetation clearing and project activities.

If site-appropriate erosion and sediment control BMPs within the construction corridor are not installed, are improperly installed, are not regularly maintained, or are not immediately repaired if they become defective, sediment and debris from within the construction corridor could be transported outside of the corridor into wetlands and waterways, potentially affecting water quality and wildlife habitat. Effects could include, but are not limited to, sediment settling over spawning areas and recently laid eggs, covering or polluting food sources for wildlife, increasing turbidity within surface waters, increasing or introducing phosphorus or other compounds into the resource, and reducing the aesthetic and beauty of the resource. More information on stormwater, sediment, and erosion control can be found in Section 2.8.10 and Section 5.6.

The degree and nature of effects to wetlands depends on multiple factors, such as the characteristics of the wetlands, quality of the wetlands, ground conditions at the time of construction, the type and duration of construction activities, and the post-construction site restoration and maintenance. Short-term wetland effects can become long-term effects if the construction phases are not well managed or if restoration techniques are not applied properly. The following sections provide additional discussion on wetland effects.

5.8.5.1 Areas of & Activities Resulting in Direct Effects to Wetland

Direct project-related disturbance within wetlands would occur within the construction corridor, which includes temporary workspaces, permanent ROW, access roads, and valve sites. Project activities that would result in direct effects on wetlands during construction include vegetation clearing, grading, excavation, blasting, placement of construction matting, placement of temporary spoils, and equipment/vehicle use and staging. Project activities within the construction corridor would result in impacts to wetlands that are within or adjacent to the ROW corridor. Generally speaking, project activities could result in:

- soil compaction or rutting from driving heavy equipment and vehicles or from the placement of construction matting;
- increased opportunities to introduce or spread invasive species from vehicle and equipment traffic;
- increased opportunities for debris, sediment, or fluids from vehicles and equipment to enter wetlands and sensitive resources;
- temporary effects on wildlife and fish from construction activity and noise;
- effects on wetland hydrology in areas of trenching and blasting.

Of the 101.1 acres of wetlands that would be crossed and directly affected by the project, approximately 88.2 acres would be associated with the mainline ROW, 12.5 acres would be associated with access roads, and 0.3 acres would be associated with valve sites. According to Enbridge, wetlands within the pipe yards would not be affected. Wetland effects are discussed in greater detail below and project components are discussed in greater detail in Chapter 2.

5.8.5.2 Permanent ROW

A permanent, 50-foot pipeline corridor ROW (30-foot corridor ROW for HDD crossings) would be constructed as part of the project along the pipeline. Unless installed via boring, excavation would occur within the permanent ROW to install the pipeline. Additional discussion on construction ROW requirements can be found in Section 2.2.

5.8.5.3 Temporary ROW & Workspaces

Temporary workspaces would be adjacent to and contiguous with the permanent, 50-foot corridor ROW (30-foot corridor ROW for HDD crossings); temporary workspaces would be used during construction to store excavated topsoil and subsoil and serve as an equipment/vehicle work area and travel lane. Generally, for areas of open-cut trenching in wetlands, this would be an additional 45-feet on the outside of the permanent ROW (Figure 2.2-2), creating a construction corridor of 95-feet.

For areas at the starting and ending segments of the pipeline installation, additional workspaces would be required for equipment/vehicle staging, material fabrication, etc. For wetlands crossed by trenching, these additional workspaces would be approximately 150 feet by 50 feet (7,500 square feet, 0.2 acres); for areas of HDD, these additional workspaces would be approximately 200 feet by 100 feet (20,000 square feet, 0.5 acres). Depending on the site, these additional workspaces may or may not be located within wetlands. Additional discussion on temporary workspaces can be found in Section 2.3.1.

Direct wetland effects within the temporary ROW and workspaces would result from the placement of construction matting, storage of excavated soils, use of equipment and vehicles, grading, or vegetation clearing. The temporary ROW and workspaces would be cleared prior to construction and Enbridge states wetland areas would be seeded with a wetland seed mix to provide temporary cover and allow natural revegetation via the seeds and rhizomes in the topsoil. For forested wetland areas, Enbridge plans to allow a mix of planting and natural reforestation via stump sprouting, root sprouting, and natural recruitment. See Section 5.8.7 for more information on wetland restoration.

5.8.5.4 Access Roads

Approximately 32 miles of access roads would be used during project construction. Access roads would be located within or adjacent wetlands. Of the 32 miles, approximately 7.1 miles of access roads would intersect wetlands.

Enbridge proposes using existing public and private roads to access the proposed Line 5 relocation construction ROW to the extent practicable. Enbridge proposes to improve existing access roads with grading, placement of gravel/rock, culvert replacement, or placement of temporary construction matting. According to Enbridge, Enbridge does not propose to install gravel in wetlands crossed by access roads, and instead, intends to place construction matting in these locations, unless the matting would not allow for safe ingress/egress. In cases where construction matting alone would create a safety risk for entering/exiting construction areas, Enbridge proposes to install a geotextile fabric layer underneath stone as part of a stone access pad and would remove all stone after construction. Additional discussion on access roads can be found in Section 2.3.3

Direct wetland effects within proposed access roads would result from placement of construction matting, placement of gravel, grading, or vehicular/equipment use. New, permanent access roads would be constructed to access mainline valve sites 1, 4, and 5, which would result in approximately 1,000 square feet of permanent wetland fill.

5.8.5.5 Mainline Valve Sites

Ten mainline block valve sites would be constructed as part of the proposed project. Wetlands are located within and adjacent to these valve sites and could be affected by temporary access disturbances or the construction of permanent access roads to the valve sites. More information on the proposed mainline block valve sites can be found in Section 2.1.4.2.

5.8.5.6 Pipe Yards

During construction, Enbridge would use four off-ROW staging areas for pipe and materials storage, vehicles, and equipment, identified as pipe yards. The four proposed sites (Bayside Yard, South Range Yard, Peters Yard, and Gurney Yard) have been previously used for commercial/industrial purposes including sand/gravel extraction and timber storage.

Enbridge states the proposed pipe yards have been designed to avoid resource impacts to the extent practicable. Wetlands are located within and adjacent the Bayside Yard and Peters Yard in Ashland County but would be avoided during construction. BMPs would also be installed around these resources to prevent indirect effects to the wetlands. Additional information on staging areas can be found in Section 2.3.2.

5.8.5.7 Excavation & Spoil Management

Of the 101.1 acres of wetlands that would be crossed and directly affected by Enbridge's proposed Line 5 relocation, approximately 6.3 acres would be crossed via boring (HDD or direct bore), 76.4 acres would be crossed via open-cut trenching, and 2.6 acres would be blasted during pipeline installation.

Enbridge states grading activities to prepare the trench line would be confined to the area of the trench, except for areas where grading outside of the trench line is required to ensure safety and to restore the construction ROW after backfilling the trench. The anticipated trench width within wetlands would be fewer than 30 feet wide within the 95-foot-wide workspace. A backhoe would be used to excavate the trench in wetlands. Enbridge states that in general, the excavated trench would be open for a maximum of three days per pipeline segment.

When constructing in wetland areas without standing water, up to 12 inches of topsoil (organic layer) would be stripped from the trench line and stockpiled separately from trench spoil to preserve the native seed stock. Enbridge states that in wetlands with standing water, they would attempt to segregate as much of the organic layer as possible based on site and saturation conditions. Where there may be standing water over more cohesive layers, Enbridge states they would take the first excavated bucket of material and separate it as best as practicable from subsoil material based on the limitations of the soil characteristics and the limits of workspace. More information on trenching can be found in Section 2.6.6.

Excavated material would be side-casted (stockpiled) within the construction ROW, separate from topsoil. Enbridge states they cannot anticipate the exact extent of the surface area that would be used for temporary wetland spoil storage because this is dependent on the soil type, soil moisture content, and ability to stack the material into a cohesive pile. Enbridge does not propose to store the excavated, segregated soils on construction matting or similar materials during open-cut trenching. Enbridge states inclusion of matting under to spoil storage increases duration of construction in a wetland, increases equipment traffic in a wetland to install and remove matting, increases the duration required to complete backfill, and does not result in less wetland disturbance. Enbridge states they would install erosion and sediment controls along the edge of the ROW where there is increased risk of material migrating outside of the approved workspace.

The risk of not using timber matting or some other barrier between the temporarily disturbed wetland and the topsoil is that the topsoil could settle into the natural microtopography of these wetlands, and either be left behind, or result in additional excavation of the wetland under the topsoil when the topsoil is scraped back into place.

Based on field notes from the 2019 and 2020 wetland delineations, the project would cross wetlands that have mucky peat soil layers or are covered with sphagnum moss and other native bryophytes. Wetlands containing peat and/or native mosses could be especially affected during excavation; once excavated and side-casted, these materials could dry out, degrade, and/or die off prior to being returned to the open-trench. Depending on how these materials are segregated, stored, maintained, and returned to the trench, they may not return to pre-existing conditions. In addition, the peat is more likely to lose its structural matrix when cut and moved around, which could result in compaction post-construction in the ROW (Mattson, Miller, and Bishop, n.d.). Enbridge is not proposing alternative soil segregation or spoil management methods within delineated peat wetlands, bogs, or wetlands with native mosses.

Backfilling of the excavated trench would occur after pipeline installation and would consist of replacing the material excavated from the trench. In areas where topsoil segregation occurred, the subsoil would be replaced, and the topsoil spread uniformly over the area from which it was removed. Enbridge states subsequent to pipe installation, backfilling of wetland trenches would take place immediately. Additionally, Enbridge states after the trench is backfilled with subsoil, the previously segregated topsoil would be spread over the trench area and mounded no more than 12 inches above the adjacent, undisturbed soil. It is expected the mounded topsoil would settle to pre-construction elevations that match adjacent undisturbed areas. See Sections 2.6.12 for additional discussion on trench backfilling and 5.8.5 for backfilling wetlands in areas of blasting.

If the trench is backfilled and mounded too high within wetlands, the wetlands could be permanently converted to uplands or create a hydrologic berm. In this situation, water that moves horizontally across the landscape would likely encounter this topographic break and pond behind the berm-like feature and result in drier-than-normal conditions on the down-slope side of the feature. This ponded water would then risk changing the type, condition, and functioning of the wetland by flooding out native vegetation, encouraging a different suite of species to grow and inhabit this zone, and could result in tree die-off. On the down-slope side that is no longer receiving the normal amount of overland flow, the wetland could degrade in function, condition, and could experience a shift in wetland type (or in severe circumstances, result in conversion to upland). If the trench is backfilled and mounded too low, depressions, ditches, and ponds could form, altering hydrologic flows and habitats within the resource. This change in hydrology would also likely result in a change in wetland condition, function, and/or natural community type. In the event of the backfill either resulting in mounding of the trench or concave subsidence, the threat of colonization of these areas by non-native invasive species could also increase substantially.

Additional discussion on trenching can be found in Sections 2.5.1, 2.6.6, 2.6.6, and 2.6.12.

5.8.5.8 Construction Matting, Vehicular, & Equipment Access

Wetland soils in wetland types with hydrology regimes characterized by continuous inundation from a water table consist of primarily organic matter (decomposed plant material) which forms very slowly. If disturbed by digging, filling, and compaction, these soils may not readily recover and may not easily be repaired. Operating equipment in wetlands can endanger amphibians and other aquatic life. Equipment, matting, and vehicle use in wetlands could also increase the risk of introducing or spreading invasive species. Changes in flow in the shallow groundwater system on the surface could occur due to compaction from equipment and vehicles.

The use of heavy machinery and/or temporary stockpiling of soil during construction can crush wetland vegetation and damage wetland soils, causing soil compaction, rutting, and soil mixing. Soil compaction reduces the water-holding capacity of the soil and could result in increased runoff. Compacted soils can result in a change in vegetation, potentially reducing plant diversity, restricting the development of root systems, and/or promoting the growth of invasive species. Surface drainage patterns and hydrology could also be temporarily altered, and there can be increased potential for the trench to act as a drainage channel.

Soil compaction and rutting could be minimized through the use of construction matting and/or completing construction during stable, dry or frozen ground conditions. Construction matting is used to spread the distribution of equipment weight when crossing wetlands during the growing season or when wetlands were not stable or frozen. Additional discussion on construction matting can be found in Section 2.8.3. Additional discussion on soil compaction can be found in Section 5.6.3.1.

Enbridge states they would install construction matting through wetlands along the construction ROW and access roads. Enbridge does not propose to store the excavated, segregated soils on construction matting or similar materials during open-cut trenching (See Section 5.8.5.7).

It is anticipated construction matting would be placed in wetlands for greater than 60 consecutive days during the growing season. Enbridge states that post construction, all disturbed areas, including construction matting locations, would be restored and revegetated in accordance with the EPP (See Appendix D and Section 5.8.7 for more information on wetland restoration).

Enbridge states wetland disturbance associated with the use of temporary access roads would be from rutting/soil mixing and compaction. Enbridge has committed to installing temporary matting through wetlands along access roads to minimize the risk of rutting, soil mixing, and compaction. Enbridge is not proposing to decompact wetlands and states compaction would be alleviated by natural freeze-thaw cycles.

5.8.5.9 Blasting Effects on Wetlands

Enbridge identified areas along the proposed route where conventional trenching alone would be inadequate to install the pipeline, such as in areas with shallow bedrock, and therefore, blasting would be required as part of the pipeline installation process. For wetlands with bedrock parent material, Enbridge states that upon blasting, the blasted, fractured bedrock would be removed from the trench; upon pipeline installation, native fill would be used to backfill the trench to original grade and the original topsoil would be returned. Enbridge states the “native fill” includes the fractured bedrock material as well as the native subsoil that is present above the bedrock layer. The depth of blasting would be approximately one foot below the bottom of the pipeline. Additional discussion on trench installation in bedrock areas can be found in Section 2.5.1.4.

Blasting within wetlands could affect wetland hydrology and affect the surface or groundwater flow paths. In turn, groundwater recharge and discharge capabilities, flood storage, floristic integrity, available wildlife habitat, microtopography, and hydraulic connectivity with other wetlands could be permanently altered.

In regard to restoration of hydrology in wetland areas with bedrock, Enbridge states bedrock would still be present beneath and adjacent to the pipeline upon backfilling the trench, allowing for groundwater to fill the interstitial space between the backfilled material and ultimately continue its natural flow path as it did prior to construction. To minimize potential for subsurface drainage within the backfilled bedrock areas, Enbridge would install trench breakers at the end of sections backfilled with sand.

The most common blasting agent contains a mixture of ammonium nitrate and fuel oil; if not properly detonated or managed, nitrogen pollutants (i.e., nitrate, nitrite, ammonia) could be released into wetlands during blasting. The introduction of nitrogen compounds could promote excess plant growth, and if transported into runoff or groundwater, could contribute to growth of nuisance vegetation, including invasive species, or degrade downstream water quality.

Enbridge states the short-term and long-term impacts of blasting within a wetland would be dependent upon the effectiveness of BMPs installed to protect the wetlands during construction, as well as the effectiveness of restoration of disturbed areas once construction ceases. Enbridge expects short-term and long-term impacts from blasting within wetlands would be negligible. Enbridge states where blasting would be used within wetlands, the wetlands would be restored as near as practicable to pre-construction conditions and reasonable attempts would be made to return the subsoil to its pre-construction density. According to Enbridge, they would make every reasonable effort to reduce the extent of blasting required for Line 5 construction.

Enbridge proposes approximately 2.6 acres of wetlands would be blasted (0.5 acres PEM, 0.2 acres PSS, 1.9 acres PFO). Blasting is proposed in wetlands with “High” Floristic Integrity, Human Use, Wildlife Habitat, Fish and Aquatic Life Habitat, Flood and Storm water Storage, Water Quality Protection, and Groundwater Processes functional values. As shown in Table 5.8-13, almost one-half of the wetlands that would be blasted have a “High” floristic integrity or a “High” wildlife habitat functional value directly within the blasting area; almost one-fifth of the wetlands would be blasted have a “High” functional value for water quality protection or groundwater processes directly within the blasting area.

Table 5.8-13 Wetlands with “High” or “Exceptional” Functional Values Directly within the Blasting Area

Table 5.7-14 Wetlands with “High” or “Exceptional” Functional Values Directly within the Blasting Area

Functional Value	Amount of Blasting (acres)
Floristic Integrity	1.1
Human Use	0.1
Wildlife Habitat	1.1
Fish and Aquatic Life Habitat	0.1
Shoreline Protection	0.0
Flood and Storm Water Storage	0.1
Water Quality Protection	0.5
Groundwater Processes	0.6

More information on blasting, including safety measures, are discussed in Sections 2.5.1.3 and 5.8.2 and in Enbridge’s General Blasting Plan (Appendix F).

5.8.5.10 Temporary Wetland Effects

Temporary wetland effects would occur within Enbridge’s proposed Line 5 relocation construction corridor, including along access roads and at valve sites. Temporary wetland disturbance would occur from the installation of the pipeline via excavation (open-cut trenching, bore pit excavation, and blasting), vegetation clearing, placement of excavated fill that would be side-casted along the trench, placement of construction matting, and vehicular and equipment access. Additional discussion can be found in Section 2.6, Construction Phases & Sequencing.

According to Enbridge, total temporary impacts in wetlands would be approximately 101.1 acres, with 88.2 acres of temporary impact associated with mainline construction and 12.6 acres of temporary impact associated with access roads. The remaining temporary wetland fill would result from construction of mainline valve site #1 (0.3 acres) and shifting of a waterline (< 0.1 acres). A breakdown of the temporary impacts by wetland type and construction component are included in Table 5.8-14.

Table 5.8-14 Summary of temporary wetland impacts by wetland type.

Eggers and Reed wetland type	**Project component**			**Total (acres)**
	Mainline ROW (acres)	**Access road (acres)**	**Valve sites (acres)**	
Fresh (wet) meadow	16.7	7.6	0.3	-
Sedge meadow	2.2	0.6	-	-
Seasonally flooded basin	0.2	<0.01	-	-
Shallow marsh	0.1	0.3	-	-
Open bog	0.2	-	-	-
Total emergent:	**19.3**	**8.6**	**0.3**	**28.3**
Shrub-carr	6.5	0.5	-	-
Alder thicket	2.2	0.8	-	-
Total shrub:	**8.7**	**1.3**	-	**10.0**
Hardwood swamp	56.4	2.5	-	-
Hardwood swamp (vernal subtype)	0.1	-	-	-
Floodplain Forest	2.5	0.2	-	-
Coniferous swamp	0.7	-	-	-
Coniferous bog	0.4	-	-	-
Total forested:	**60.2**	**2.6**	-	**62.8**
Total:	**88.2**	**12.5**	**0.3**	**101.1**

5.8.5.11 Permanent Wetland Fill

Permanent wetland fill would result in the loss of wetland acreage and the functional values those wetlands provided. Enbridge’s proposed Line 5 relocation project would permanently fill approximately 998 square feet (0.02 acres) of wetlands for the construction of permanent access roads to access mainline valve sites 1, 4, and 5 (Table 5.8-15).

Table 5.8-15 Summary of permanent wetland impacts at proposed mainline valve sites.

Valve site ID	Permanent wetland fill (square feet)	Wetland classification	Wetland plant community	WRAM functional value rating summary
Valve site 1	371.1	PEM	Fresh (wet) meadow	Medium: Flood and Storm water Storage, Water Quality Protection Low: Floristic Integrity, Wildlife Habitat, Fish and Aquatic Life Habitat, Groundwater Processes N/A: Human Use, Shoreline Protection
Valve site 4	409.6	PEM	Fresh (wet) meadow	Low: Floristic Integrity, Human Use, Wildlife Habitat, Fish and Aquatic Life Habitat, Flood and Storm water Storage, Water Quality Protection, Groundwater Processes N/A: Shoreline Protection
Valve site 5	172.6	PEM	Fresh (wet) meadow	Medium: Floristic Integrity, Wildlife Habitat, Fish and Aquatic Life Habitat, Flood and Storm water Storage, Water Quality Protection, Groundwater Processes N/A: Human Use, Shoreline Protection
	44.9	PSS	Shrub-carr	
Total:	**998.2**			

Enbridge states the amount of permanent wetland fill has been minimized to the extent practicable taking into consideration the factors for valve siting and placement. Each mainline valve requires a permanent access road for operational, maintenance, and emergency access. Enbridge states they have minimized the width of the access roads to the extent practicable to maintain safe ingress/egress of operation equipment as well as emergency equipment (e.g., fire trucks).

5.8.5.12 Wetland Conversion

Wetland conversion would change wetland plant community types by removing the shrub and/or tree strata. Clearing of wetlands dominated by woody vegetation results in a conversion from forested wetland into herbaceous wetland. Clearing of woody vegetation can impact wildlife habitat, affect wetland functional values, and increase the occurrence of invasive species. The permanent removal of woody vegetation from wetlands could affect wildlife habitat and diminish recreational and aesthetic values. The temporary removal of woody vegetation, such as shrubs and trees, from areas that would not be permanently maintained as herbaceous ROW would experience multi-year to multi-decadal delay in the return of the climax community composition and functional values. This delay would result in a temporal loss in the return of pre-construction condition and functions. Wildlife could be temporarily displaced to adjacent habitat until herbaceous vegetation has reestablished following construction, but this displacement could be more long-term for wildlife using forested or shrub-dominant systems as their primary habitat (i.e., species that are not open-wetland specialists) that are converted to herbaceous wetland communities. Clearing can also lead to fragmentation of wetland complexes or ecosystems, further impacting wildlife habitat. Along rivers, streams, and open water resources, removing riparian wetland vegetation could decrease streambank/shoreline protection, which can lead to increased sedimentation into these aquatic resources, alter the hydrologic connection between the stream and wetland, or increase water temperatures. Removal of shrubs and trees can also shift wetland hydrology by altering evapotranspiration rates, often resulting in much wetter wetlands. Additionally, the increased sunlight to the understory upon tree clearing could alter species composition, favoring early successional species, aggressive or non-native plant species, and subsequently impacting the wetland’s ability to support previous habitat and wildlife species.

The entire pipeline ROW would be permanently cleared and maintained to meet PHSMA requirements for aerial inspections and operational maintenance. The pipeline ROW would be permanently cleared and maintained at a width of 50 feet for areas of open-cut trenching pipeline installation and at a width of 30 feet for areas of pipeline installation via HDD. According to Enbridge, corridor maintenance clearing would occur on a three-to-five-year cycle and vegetation would be cut approximately six inches above ground surface. For the PSS or PFO communities that currently exist in the proposed ROW corridor, those wetland communities would be permanently converted to PEM and continuously disturbed to maintain the ROW corridor in a herbaceous state.

According to Enbridge, clearing would be accomplished with chainsaws, mowers, or hydraulic tree-cutting equipment. Vegetation and trees within wetlands would be cut off at ground level, leaving existing root systems intact. Cleared debris would either be removed from the wetland for disposal or would be left in wetland and spread evenly in the construction ROW at a depth that would not inhibit revegetation. Wetlands that are not in actively cultivated or rotated cropland, the extent of tree stump removal would be limited to directly over the ditch line, unless removal is required for safety reasons.

According to Enbridge, during initial clearing, 20-foot sections of undisturbed herbaceous vegetation on all stream banks would remain, except where grading is necessary for bridge installation or otherwise restricted by regulatory agencies. Woody vegetation within the 20-foot section would be cut and removed during clearing, however, stumps and root structures would be left intact. Sediment control measures at the 20-foot sections adjacent streams would be installed and maintained immediately after clearing and prior to initial ground disturbance. Temporary erosion and sediment control devices would be installed after clearing and prior to grubbing and grading activities at the base of sloped approaches to streams, wetlands, and roads.

The entire proposed project corridor would be cleared of forest, shrub, and tall herbaceous vegetation prior to pipeline installation. According to Enbridge, upon pipeline installation, 67.1 acres of wetlands (28.1 acres PEM, 32.8 acres PFO, 6.3 acres PSS) would revegetate from the native seed stock and supplement plantings within the construction workspaces (Table 5.8-16). Approximately 33.9 acres (30.0 acres PFO, 3.9 acres PSS) of wetland would be permanently and continuously cleared and maintained as herbaceous wetland within the permanent ROW (Table 5.8-16). The total amount of wetland conversion would be 72.7 acres (62.8 acres of forested wetlands and 9.9 acres of shrub-scrub). Table 5.8-16 summarizes conversion acres by wetland natural community type. Table 5.8-18 summarizes wetlands intersected by Enbridge’s proposed Line 5 relocation route and route alternatives, based on the Wisconsin Wetland Inventory.

Table 5.8-16 Acres of permanent and temporary wetland conversion on Enbridge's proposed relocation.

Wetland plant community	Temporary conversion	Permanent conversion	Total
Palustrine forested			
Hardwood swamp	31.9	27.0	58.9
Floodplain forest	0.5	2.2	2.7
Hardwood swamp (vernal subtype)	0.1	0.03	0.13
Coniferous swamp	0.3	0.4	0.7
Coniferous bog	0	0.4	0.4
Subtotal	32.8	30.0	62.8
Scrub-shrub			
Shrub-carr	4.1	2.9	7.0
Alder thicket	2.1	0.9	3.0
Open bog	0.1	0.1	0.2
Subtotal	6.3	3.9	10.2
Total	**39.1**	**33.9**	**73**

[1] Palustrine emergent wetland types are not included in the total conversion acreage sums because these wetlands would not be converted to another wetland community type.

Table 5.8-17 Acres of wetland within the permanent ROW and temporary workspace that would not be converted by Enbridge's proposed Line 5 relocation.

Wetland plant community	Permanent ROW	Temporary workspace	Total
Palustrine Emergent			
Fresh (wet) meadow	8.1	17.0	25.1
Sedge meadow	1.0	1.8	2.8
Seasonally flooded basin	0.1	0.1	0.2
Shallow marsh	0.0	0.4	0.4
Total	**9.2**	**19.3**	**28.5**

Table 5.8-18 Acres of desktop-identified wetlands within the permanent ROW and temporary workspaces of Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed	RA-01	RA-02	RA-03
Pipeline length (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Palustrine forested				
Northern hardwood swamp	35.5	48.5	66.3	136.2
Northern wet forest/cedar swamp	5.1	15.1	20.4	200.8
Scrub-shrub				
Alder thicket/shrub-carr	1.1	2.3	3.2	24.9
Palustrine emergent				
Northern sedge meadow	1.9	1.8	0.9	6.1
Other				
Other	4.2	4.3	2.2	11.3
Total	**47.8**	**72.0**	**93.0**	**379.4**

Note: Wetland acreages are based on the Wisconsin Wetland Inventory (WWI) and may not be reflective of all wetlands crossed by the routes. Wetland type is based on a combination of WWI wetland type, Eggers & Reed (2015), and vegetative cover from Wiscland version 2 (DNR, 2019b).

5.8.5.13 Quality of Converted Wetlands

As shown in Table 5.8-19, almost half of the forested and shrub-scrub wetlands that would be permanently cleared and maintained as part of Enbridge's proposed pipeline relocation ROW provide "High" floristic integrity and wildlife habitat functional values. Almost one quarter of the wetlands provide "High" or "Exceptional" flood and stormwater storage, water quality protection, and ground water processes functional values. According to the timed-meander survey, approximately two-thirds of the forested wetlands that would be permanently cleared by the proposed project would have a known FQI rating of "High" or "Exceptional."

The impacts that result from wetland type conversion from PFO and PSS to PEM would experience temporary losses of those types of wetlands and their associated functional values that would likely last decades. For example, the sudden conversion of mature forested wetland systems during the construction phase would likely take decades to restore to a mature forest. While there would be no net loss in the acreage of wetlands for very long, there would be long-term impacts to the functions and the condition of the wetlands that are temporarily converted.

Table 5.8-19 WRAM functional value significance ratings for permanent wetland conversion (acres).

WRAM significance rating	Floristic integrity	Human use	Wildlife habitat	Fish and aquatic life habitat	Shoreline protection	Flood and stormwater storage	Water quality protection	Groundwater processes
Exceptional	0.0	0.5	0.0	0.0	0.0	2.1	2.1	2.1
High	13.6	1.8	14.8	2.0	1.7	4.4	4.9	5.7
Medium	17.2	14.8	16.2	14.1	2.9	21.3	22.7	10.2
Low	3.2	16.2	2.8	11.8	0.9	6.2	4.1	15.8
N/A or blank	0.0	0.6	0.2	6.0	28.4	0.0	0.0	0.0

5.8.5.14 Effects on Floral Diversity

- Clearing of vegetation could lead to fragmented forests and non-forested areas, thereby reducing the size, integrity, and diversity of plant communities.
- The clearing of overstory vegetation would produce higher light levels in the understory and could allow early successional species, and potentially invasive species, to become established along the edge of the newly cleared areas. If invasives species were to become established in areas that previously had none, there could be a lasting impact to the wetlands.
- The success of wetland restoration within areas of temporary impacts would depend on site conditions, native seed bank viability, restoration methods, post-construction monitoring and maintenance routines, and many other variables. If herbaceous wetland vegetation does not restore to pre-existing conditions (or successfully convert from PFO/PSS to PEM conditions) in areas of temporary wetland impact, floral diversity and floral composition could be permanently changed.
- Within high-quality shrub and forested wetlands that would experience temporary conversion, it could take multiple decades to re-grow to pre-construction conditions, even with active and long-term restoration efforts. Even after multiple decades, it is possible these wetlands may not be restored to their original floristic composition, floristic species richness, or pre-construction functionality.
- The temporary removal of woody vegetation, such as shrubs and trees, from areas that would not be permanently maintained as herbaceous ROW would experience multi-year to multi-decadal delay in the return of the climax community composition and functional values. This delay would result in a temporal loss in the return of pre-construction condition and functions.
- There could be long-term impacts on floral diversity due to the permanent conversion of forested and shrub-scrub habitats to open habitat within the maintained pipeline ROW. For areas that are currently mature shrub or forested wetlands, once they are permanently converted to herbaceous wetlands, these shrub and forested wetlands would no longer be considered floristically “high-quality,” as they would be prevented from reverting to their pre-construction, mature, shrub or forest condition. Almost half of the forested and shrub-scrub wetlands that would be permanently cleared and maintained as part of the pipeline ROW provide “High” floristic integrity functional values, based on the WRAM performed by Enbridge. According to the timed-meander survey, approximately two-thirds of the forested wetlands that would be permanently cleared by the proposed project would have a known FQI rating of “High” or “Exceptional” (Section 5.8.4.4).
- Wetlands that were previously dominated as forested or shrub-scrub communities would be at a higher risk of impacts to floristic integrity, as there would be fewer native seeds in the soil seed bank that are commonly found in northern PEM wetlands.
- Construction within a wetland would increase the risk of introducing or spreading invasive species, which can be particularly detrimental in wetlands that have not experienced historic anthropogenic impacts. The introduction or spread of invasives species in a wetland that was once dominated by native vegetation pre-construction would decrease that wetland’s floral diversity. Once established, invasive species can be extremely damaging to the floral diversity of wetlands. Invasive species could impact the wetlands within the ROW, wetlands adjacent to the ROW, and could potentially impact the wetlands throughout the region. More information on invasive species can be found in Sections 2.8.11 and 5.11.
- Rare, culturally significant (Section 4.2.1.13), and other plant species that prefer dense canopy or mature trees could be impacted by temporary and permanent vegetation clearing. Additionally, construction activities, such as open-cut trenching and vehicle and equipment use, could displace or eradicate sensitive and rare plant species. If disturbed, these species may not return to the wetland for some time, if ever.

- Secondary impacts associated with the clearing of existing vegetation could include a temporary increase in soil erosion and runoff, increased soil temperatures, soil mixing and soil compaction, root damage, and increased windthrow of trees adjacent to newly cleared areas. This, in turn, could negatively affect plant diversity if the pre-construction species are not successfully restored and could also increase the risk of invasive species to dominate.
- Permanent deforestation and conversion to non-forested vegetation can greatly contribute to changes in the landscape's hydrology. Forested canopy intercepts rainfall, facilitates transpiration, and slows the rate of snow melt and runoff that moves through the landscape. Removal of forested canopy can increase the rate of runoff flowing over the land surface and into waterways, thereby increasing the risks of flooding and the erosion of soil, particularly the clayey soils. This would be especially apparent within the Superior Coastal Plain Ecological Landscape (DNR, 2015c).
- For areas of temporary wetland conversion, Enbridge's restoration approach would generally rely on the natural revegetation of the native seed bank but would also include supplemental bare root stock plantings of tree species in forested wetland (Section 5.8.7). It could be difficult to successfully restore the wetlands that would be impacted by the project with a partially passive wetland restoration approach, especially in higher quality wetlands or wetlands that provide higher functional values.

5.8.5.15 Effects on Wetland Functional Values within the Project Area

Construction activities could result in short-term or long-term functional and condition degradation in wetlands, including wildlife use, hydrologic flow patterns, and floristic integrity.

Enbridge states project construction in wetlands would temporarily diminish the recreational and aesthetic values, temporarily remove or alter wildlife habitat, and potentially impact groundwater and surface water hydrology (particularly in the vicinity of blasting or as a result of changes in topography). Enbridge also states the impact of construction on vegetation and habitat in PEM wetlands would be relatively brief since herbaceous vegetation would typically regenerate within one or two growing seasons. According to Enbridge, these impacts would be greatest during and immediately following construction and that most impacts (except for vegetation and habitat impacts) would cease after backfilling and restoring contours. Enbridge states impacts on vegetation and habitat in PFO and PSS wetlands would last longer due to the longer recovery period of these vegetation types.

Enbridge's proposed project would result in approximately 101.1 acres of direct and temporary wetland impact and 0.02 acres of permanent wetland impact. This includes approximately 39.1 acres of temporary shrub and forested wetland conversion (6.3 acres and 32.8 acres) and 33.9 acres of permanent shrub and forested wetland conversion (3.9 acres and 30.0 acres) (Section 5.8.5.12). Impacts to wetland functional values that could occur as a result of the project are listed and discussed in greater detail in the sections that follow. The impacts described below are reasonably anticipated as a result of this proposed project; alternative, additional, or other impacts to wetland functional values could occur, including impacts described under one functional value could relate or apply to other functional values.

5.8.5.16 Effects on Habitat for Fish, Wildlife, & Aquatic Organisms

Installing and operating the proposed project could result in direct and indirect impacts to wildlife and their habitat (Section 5.10).

- Direct impacts could include wildlife mortality and displacement through habitat loss, change to habitat quality, and habitat fragmentation. Almost half of the forested and shrub-scrub wetlands that would be permanently cleared and maintained as part of Enbridge's proposed pipeline relocation ROW provide "High" wildlife habitat functional values, based on the Enbridge's WRAM.

- The permanent conversion of forested and shrub-scrub habitats to open habitat within the maintained pipeline ROW could have long-term effects on wildlife habitat: clearing vegetation could reduce cover, nesting, and foraging habitat for some species, and could also cause mortality of some individuals of small, slower moving species. Some species could benefit from the habitat alteration.
- Forest fragmentation can reduce the available habitat for forest interior species, create barriers to wildlife movement, increase predation, and allow edge species to penetrate deeper into forest patches and interiors. When openings are formed through forested areas, there is often a shift in predator/prey dynamics (Bernthal and Trochlell, 1998).
- The fragmentation of forested wetlands can impact populations of songbirds and sensitive wildlife that require a large amount of contiguous suitable habitat.
- The clearing of riparian vegetation could impact fish and aquatic habitat and food sources; if the hydrological connection is not restored properly, fragmentation and isolation of fish and aquatic species could occur, affecting reproduction, food sources, and migration (Bernthal and Trochlell, 1998).
- Vegetation that may have once provided shelter or a food source for wildlife could be temporarily or permanently impacted or lost.
- Wetland conversion could result in loss of wetland plant diversity, which in turn can reduce the diversity of invertebrate and amphibian populations that serve as a food source for birds and other wildlife.
- Extensive, long-term impacts to ephemeral ponds can occur from blasting or general construction activities given the sensitive hydrology and subtle landscape position of ephemeral ponds. Impacts could include altering the pond’s hydroperiod and average depth or permanently draining the pond; this in turn, could impact the habitat, food sources, and breeding areas for fish and aquatic organisms.
- The destruction and/or removal of rotting logs, rocks, and microtopographic areas could remove suitable habitat for amphibians, reptiles, and other wildlife in the area.
- Wetland conversion can result in increased runoff from the landscape, which in turn can increase flooding and streambank erosion. For streams in the Lake Superior clay plain, streambank erosion caused by excess runoff can lead to habitat degradation from sedimentation. This reduced water quality could impact aquatic habitats for many miles downstream from the primary wetland impact locations.
- The hydrologic functioning on a watershed scale can be significantly impacted by wetland loss or conversion; as wetlands are continually lost or altered in a watershed, the hydrologic regime of streams can become less stable. This in turn can lead to the deterioration of habitat quality within waterways (Bernthal and Trochlell, 1998).
- The extent of project impacts on fish and wildlife habitat can be dependent on the time of year and type of construction activities taking place. For example, tree clearing during sensitive nesting periods could have a greater impact on bird species compared to tree clearing outside of the sensitive nesting periods.

5.8.5.17 Effects on Storm & Flood Protection

- Wetland conversion can result in increased runoff from the landscape, which in turn can increase flooding and streambank erosion. As stated previously, for streams in the clay plain, streambank erosion caused by excess runoff can lead to habitat degradation from sedimentation.

- Wetland loss or conversion within the watershed could exacerbate erosion impacts to streams. Headwater wetlands are particularly important for the hydrologic functioning of the larger watershed. Many of the wetlands in the project area occur in headwaters areas.
- Permanent deforestation and conversion to non-forested vegetation can greatly contribute to changes in the landscape's hydrology. Forested canopy intercepts rainfall, facilitates transpiration, and slows the rate of snow melt and runoff that moves across the landscape. Removal of forested canopy can increase the rate of runoff flowing over the land surface and into waterways, thereby increasing the risks of flooding and the erosion of soil, particularly the clayey soils. This would be especially apparent within the within the Superior Coastal Plain Ecological Landscape (DNR, 2015c).
- There could be long-term effects to flood storage capabilities within forested wetlands that would be permanently converted to herbaceous vegetation. The roughness that shrub and forested wetlands serve to slow down flood waters, which can in turn reduce peak flows downstream and down-watershed; by reducing these wetland types, the downstream waters could see increased storm peaks. Almost one quarter of the wetlands that would be impacted by Enbridge's proposed Line 5 relocation project provide "High" or "Exceptional" flood and stormwater storage functional values, based on the WRAM performed by Enbridge.

5.8.5.18 Effects on Water Quality Protection

- Because wetlands filter pollutants and remove suspended solids from surface waters, wetland loss or conversion can have a significant impact on water quality. Wetland vegetation traps sediments and reduces nutrients through plant uptake. The loss or decrease of these wetland functions, in addition to the increased runoff from the landscape and streambank erosion, can result in increased sedimentation and nutrient input into surface waters which can threaten water quality in lakes and rivers. Almost one quarter of the wetlands that would be impacted by Enbridge's propose Line 5 pipeline relocation project provide "High" or "Exceptional" water quality protection functional values, based on the WRAM performed by Enbridge.
- Woody vegetation and dense herbaceous vegetation can improve water quality: when water moves across the surface, especially during flood events, the upright plant stems and trunks slow the water down, facilitating nutrients, sediments, and toxins to drop out of the water column and not enter the receiving waterbodies.
- Woody vegetation and dense herbaceous vegetation can improve water quality by increasing the roughness coefficient of the landscape. The loss of wetlands and the conversion and continuous clearing of wetlands could reduce the wetlands roughness coefficient, which in turn could result in decreased water quality protection. This factor is proving to be more important with climate change and the increase in severe storm events that result in fast, over-land flowing waters.
- Clearing or altering the elevations of wetlands adjacent to agricultural fields could reduce the filtering potential and storage capacity when receiving farm or cattle run-off; this in turn could increase the volume or concentration of point source pollution entering other nearby water resources or wildlife habitat.

5.8.5.19 Effects on Shoreline Protection

- There could be long-term impacts to the streams that intersect areas of wetland impact. Riparian wetlands serve an important role in stream bank stabilization and floodplain storage. Temporarily, these streams could experience increased erosion during storm events due to the reduced vegetation and stability of the shorelines. Long-term, these wetlands could continue to experience shoreline destabilization from the lack of tree and shrub roots holding the banks stabile and in place.

- Shoreline destabilization could lead to an increase in sedimentation into nearby water resources, potentially impacting water quality, aquatic and wildlife habitat, and food sources.
- The removal of shoreline vegetation can impact aquatic habitat and riparian zones that serve as a buffer to filter or prevent pollutants from entering sensitive resources.

5.8.5.20 Effects on Hydrologic Function

- There could be long-term effects to groundwater recharge and discharge capabilities within forested wetlands that would be permanently converted to herbaceous vegetation.
- Almost one quarter of the wetlands that would be impacted by the project provide “High” or “Exceptional” ground water processes functional values, based on the WRAM performed by Enbridge. There could be short-term or long-term impacts to the wetland-groundwater interactions and connectiveness from the trenching and/or blasting during construction.
- The proposed project would result in 2.6 acres of impacts to wetlands from blasting during pipeline installation. Long-term impacts to wetlands can occur from blasting, given the sensitive interface between surface water and groundwater. During blasting, parent bedrock material may be permanently removed from the trenched area, which could permanently alter the hydrology of the wetland and the recharge/discharge capabilities.
- The DNR’s Ecosystem Management Planning Team states black ash and other ash species “are sensitive to hydrologic disruption and growing season frosts” and suggests protecting site hydrology wherever northern white cedar swamps occur because wet-mesic forests are sensitive to hydrologic alterations (DNR, 2015d). Disturbance to the hydrology within these types of wetlands could have long-term impacts to the resource.
- Extensive, long-term impacts to ephemeral ponds can occur from blasting or general construction activities given the sensitive hydrology and subtle landscape position of ephemeral ponds. Impacts can include altering the pond’s hydroperiod and average depth or permanently draining the pond; this in turn, could impact the habitat, food sources, and breeding areas for fish and aquatic organisms.

5.8.5.21 Effects on Recreational, Cultural, Educational, Scientific & Natural Scenic Beauty

- Construction within wetlands can temporarily alter and reduce the recreational and aesthetic value of the wetlands; depending on the success of restoration within these wetlands, aesthetic and recreational values could be impacted permanently. For example, the conversion of forested wetlands to emergent wetlands for the maintenance, monitoring, and operation of the permanent ROW corridor is a permanent aesthetic impact. Altered aesthetics is a particular concern for Ojibwe people living in the region (Section 4.2.1.6).
- The clearing of vegetation can impact wildlife and their habitat (Section 5.10), which could impact the hunting, fishing, birding, and wildlife viewing opportunities by the public.
- Conversion of forested and shrub wetlands to herbaceous wetlands could cause degradations to the natural viewscapes of these wetlands. For example, within areas that are currently mature, forested wetlands that would be crossed by the proposed project, once these wetlands are permanently converted to herbaceous wetlands, they would no longer offer the same aesthetic experience.

5.8.5.22 Cumulative Effects

Cumulative effects for the purposes of WEPA describe the gradual effect of a project's wetland impacts added to past, present, and future wetland impacts. Individual wetlands along Enbridge's proposed Line 5 relocation route may not always appear to provide substantial functional values when assessed individually, however, they may be very important components of the wetland complex as a whole and could be especially critical to support wildlife, aquatic life, provide sediment and nutrient trapping, provide flood and storm water storage, or support groundwater recharge functions (Bernthal and Trochlell, 1998).

Anticipated cumulative effects of the proposed project and considerations include:

- A forested wetland can take many decades to centuries to fully establish to the condition some of the higher quality forested wetlands are currently in. The temporary vegetation clearing that is proposed to high-quality shrub and forested wetlands would last many years, resulting in a loss of those wetland functional values until the shrub and forested vegetation are restored. These impacts would be combined with impacts from other long, linear projects in the same watersheds that are still recovering, as well as to any future, similar projects. Because the delay between construction and fully-functioning, high-quality forested systems is a long time span, it can be assumed these impacts would be cumulative in nature.
- Enbridge's proposed Line 5 relocation route transects large, woody habitat blocks, adding to the already constructed pipelines and transmission lines. Every new line that does not already utilize pre-existing disturbance areas (such as existing ROWs and corridors) could further fragment valuable habitat corridors and forest-interior zones, causing stress and impact on the native wildlife populations (Section 5.10).
- Emerald ash borer has caused devastation to forested wetlands throughout southern Wisconsin and is expected to soon spread into northern Wisconsin. As can be seen in the data provided by Enbridge, many of the forested wetlands proposed for impact contain ash species, often as a key dominant species within the native wetland systems. The impacts from emerald ash borer are likely to further complicate any restoration attempts of forested wetland systems in this project area.
- The DNR's Ecosystem Management Planning Team states wet-mesic forests (northern wet-mesic forest and hardwood swamp communities; Section 5.9.2) within the North Central Forest Ecological Landscape are more common in this region than anywhere else in the state and shares that "maintaining the viability of the northern white cedar swamps is of paramount importance in the North Central Forest because the community is common and widespread there and constitutes a major repository of biodiversity for rare plants and some animals." (DNR, 2015d).
- In addition to the direct and secondary impacts discussed in Section 5.8.5, Enbridge's proposed wetland restoration efforts could be further hampered or delayed due to climate change: the changing climate would likely result in additional strain on the native vegetation, especially after a large disturbance such as the disturbances proposed by this project (Chapter 7).
- Impacts to high-quality wetlands could further reduce the area available to threatened, endangered, rare, and special concern plant species. Plant species with high C-values are unlikely to establish in areas that have been disturbed; post-construction, the proposed project area and areas immediately adjacent the proposed project may no longer provide suitable habitat for plant species with high C-values or rare plant species. Disturbance to these systems can reduce refugia for rare plants. As these refugia are further and further apart, the likelihood of pollination could be threatened.
- Enbridge does not propose to store the excavated, segregated soils on construction matting or similar materials during open-cut trenching. The risk of not using timber matting or some other barrier between the temporarily disturbed wetland and the topsoil is that the topsoil could settle

into the natural microtopography of these wetlands, and either be left behind, or result in additional excavation of the wetland under the topsoil when the topsoil is scraped back into place. Cumulatively, these impacts could have short-term or long-term impacts on the wetland vegetation, hydrology, wildlife habitat, and topography post-construction.

- Upon pipeline installation, if the trench is backfilled and mounded too high within wetlands, the wetlands could be permanently converted to uplands or create a hydrologic berm. If the trench is backfilled and mounded too low, depressions, ditches, and ponds could form, altering hydrologic flows and habitats within the resource. This change in hydrology would also likely result in a change in wetland condition, function, or natural community type. In the event the backfill either results in mounding of the trench or concave subsidence, the threat of colonization of these areas by non-native invasive species would increase substantially.
- Northern Wisconsin has experienced increased storm events and intensity of storm events, and as a result of these stresses, the region has experienced increased erosion and head-cutting, further degrading water quality (Section 7.4.2). As additional wetlands are disturbed and susceptible to erosion, water quality could further degrade. As these impacts increase or future disturbances are approved, additional areas are subject to head-cutting or erosion which will again decrease water quality (Association of State Wetland Managers, Inc., 2018).
- According to NOAA, the Great Lakes region, and specifically northern Wisconsin, are expected to experience more intense precipitation events as the climate continues to change (Section 7.4.2; (WICCI, 2021). The years 2012, 2016, and 2018 notably had intense precipitation events in the Lake Superior region. The preservation of wetlands in the northern Wisconsin landscape is crucial to help mitigate the effects from the flooding that results from these intense precipitation events also including erosion, increased sedimentation in habitats, and damage to local infrastructure such as culverts and roads (NOAA, 2024a).

5.8.6 Wetland Avoidance & Minimization

Wisconsin's wetland permitting standards require consideration of practicable alternatives that avoid impacting wetlands. Where complete wetland avoidance is not practicable (i.e. reasonably available and capable of being implemented) due to cost, site availability, available technology, logistics, and proximity to the proposed project site, in light of the overall purpose and scope of the project, permitting standards require that all practicable measures to minimize wetland functional value impacts will be taken. Enbridge states the route review process consisted of an assessment of technical and economic feasibility; constructability; impacts on environmental resources; and coordination with agencies and other stakeholders to identify and, where feasible, avoid sensitive habitats or resources.

According to Enbridge, the proposed Line 5 pipeline relocation route (including the ROW configuration) was designed in a manner that minimizes the environmental footprint while adhering to the purpose and need of the proposed project (Section 2.1.2). Enbridge states through the routing process they avoided wetlands, waterbodies, and steep slope areas at the macro and micro routing level to the extent practicable and wetlands were avoided by minor alignment shifts. Enbridge believes that the proposed route provides the least environmentally damaging practicable alternative.

Enbridge considered the following information and limitations during project construction design:

- Enbridge was unable to find connected existing corridors that it could follow along the eastern portion of the route; while several roads and other corridors are present in the area, none of them travel in the direction required by Enbridge.
- The routing process included avoiding impacts to communities, such as impacts to residences, schools, churches, commercial buildings, and traffic.

- Enbridge states route modification, workspace modifications, or crossing method modifications (i.e., incorporating more HDDs) to minimize impacts on a site-specific resource or resource area, such as a specific wetland or waterbody, would likely shift impacts to other sensitive resource areas, and increase the overall length of the route. This would increase the acreage of land disturbed and the duration of construction.
- Enbridge states any changes to the route would require initiating new landowner approvals, require new surveys if there is workspace beyond the existing survey corridor, increase overall project costs, and result in project delays.
- Pipeline construction involves a series of discrete activities typically conducted in a linear sequence.
- Open-trenching would install pipeline at a significantly faster rate than HDD installation.
- To the extent practicable, Enbridge states that HDD crossings are proposed for saturated (e.g., standing water) wetlands with unconsolidated substrates, boggy wetlands, and deep peat wetlands.
- Enbridge states installation using the HDD method may not be feasible without additional ROW and suitable topography and subsurface geology; the HDD method typically requires more workspace in adjacent areas, which can increase impacts on resources in these areas, including other wetlands and waterbodies. These additional impacts offset environmental advantages gained by use of the HDD. Further use of the HDD method would result in extension of the construction schedule to accommodate the additional time required to complete an HDD, resulting in longer disturbance to resources near the HDD locations that would remain disturbed until the HDDs could be completed.
- Enbridge states HDDs are generally not practicable for narrow waterbody crossings, particularly for large diameter pipelines which require long HDDs.
- Enbridge states the number of HDD rigs available at any one time is limited as there are only so many experienced HDD contractors and rigs capable of installing a 30-inch diameter pipeline available to support the work across the country.
- Inadvertent releases of drilling mud could occur during the HDD process and could impact resources.
- Enbridge states that due to the depth of HDD installation, the pipeline cannot be accessed for maintenance if there were to be an integrity issue between the entrance and exit. An integrity issue along the HDD segment could require the complete replacement of the HDD segment with new pipe, resulting in new impacts.

Additional discussion of route and construction method selection can be found in Sections 2.1.2 and 2.8.

5.8.6.1 Wetland Avoidance

Due to the abundance and distribution of wetlands present along Enbridge's proposed Line 5 relocation route, impacts to wetlands cannot be practicably avoided by the construction of the proposed long, linear project and the associated valve sites. The amount of permanent wetland fill that would result from the proposed project is not dependent on the pipeline installation method. Permanent wetland fill is a result of permanent access roads to valve sites. According to Enbridge, the amount of permanent wetland fill has been minimized to the extent practicable taking into consideration the factors for valve siting and placement. Each mainline valve requires a permanent access road for operational, maintenance, and emergency access. Enbridge states they have minimized the width of the access roads to the extent practicable to maintain safe ingress/egress of operation equipment as well as emergency equipment (e.g., fire trucks).

5.8.6.2 Wetland Minimization

Construction methods that would minimize impacts to wetlands include:

- Installing the pipeline via HDD or direct boring.
- Conducting construction activities when wetland soils are frozen or stable and vegetation is dormant.
- Using construction matting and wide-track vehicles with equipment crossing of wetlands when wetlands are not stable or not frozen.
- Placing temporarily excavated wetland soils on construction matting or similar material.
- Using adjacent roadways and existing off-ROW access roads for access when possible.
- Siting structures and access roads on the edges of wetlands rather than in the middle of wetlands to avoid fragmenting wetland complexes.
- Reducing the construction workspace in wetlands.
- Installing site-specific sediment and erosion control measures and devices prior to construction activities, with daily inspections and maintenance throughout all construction and restoration phases.
- Implementing a construction sequencing plan that minimizes the amount of land disturbed or exposed (susceptible to erosion) at one given time across the project.
- Implementing a spill prevention and response protocol for construction activities in wetlands.
- Accurately identifying and marking the boundary of wetlands.
- Preparing and implementing an invasive species management plan that identifies known areas of invasive species populations, addresses site restoration activities, and includes specific protocols to avoid the spread of invasive species.
- Minimizing the amount of vegetation clearing in wetland and minimizing conversion of wetland types.
- Removing all brush piles, wood chips, and woody debris from wetlands following clearing activities.
- Conducting surface and sub-surface assessments prior to construction, including hydrology and soil evaluations. This includes modifying the engineering plans, as needed, to avoid and minimize long-term impacts to surface and subsurface resources and to re-establish conditions post-construction.
- Preparing and implementing dewatering practices that prevent sedimentation into wetlands.
- Revegetating disturbed areas and areas of exposed soil as soon as possible and seeding with a cover crop or native seed mix to help prevent the establishment of invasive species.
- Scheduling construction to avoid disrupting sensitive species.

- Limiting the amount of time necessary to complete construction.
- Developing a detailed, site-specific post-construction restoration plan.

Enbridge stated disturbances to wetlands would be reduced by the following methods:

- Incorporating BMPs and implementation of its EPP (Appendix D).
- Incorporating the use of HDDs or direct-bore at 13 locations to minimize waterbodies and adjacent riparian area disturbance.
- Reducing the width of wetland vegetation clearing between the HDD drill entry and exit holes to 30 feet at all but one HDD location.
- Reducing the construction ROW width to 95 feet in wetlands for open-cut trench installation.
- Installing temporary matting through wetlands along access roads to minimize the risk of rutting/soil mixing and compaction.
- Installing temporary matting through wetlands along the construction ROW to minimize the risk of rutting/soil mixing and compaction.
- Routing to avoid wetland disturbance wherever practicable.
- Limiting vegetation clearing.
- Limiting stump and root removal to the area of the trench.
- Limiting grading in wetlands to the area of the trench.
- Attempting to segregate as much of the organic layer as possible based on site/saturation conditions.
- Completing construction activities as efficiently and quickly as practicable.
- Using low ground pressure equipment in wetland wherever practicable; where low ground pressure equipment is not used, construction equipment will operate from timber construction mats or equivalent means.
- Limiting the duration of an open trench to a maximum of 3 days, where possible.
- Developing a post-construction wetland monitoring plan.
- Developing an invasive species plan.
- Using tarps or similar covering below areas of field coating to capture drips/overspray during application.
- Limiting grading activities in wetlands to the area of the trench, unless required to ensure safety and to restore the construction ROW after backfilling the trench.

- Developing and implementing a spill control and inadvertent release response plans.
- Developing and implementing a blasting plan
- Installing signs identifying the boundaries of sensitive resource areas, waterbodies, and wetlands.
- Minimizing the width of the trench through wetlands to the extent practicable considering the depth of the trench, soil type, soil saturation, and personnel safety.
- Where it was practical, the proposed pipeline route was collocated with other existing corridors to minimize the creation of an entirely new ROW.
- Maximizing the use of existing access roads rather than developing new access roads.
- Attempting to locate the proposed pipeline relocation project in open areas instead of wooded areas. This is evident primarily along the western portion of the proposed route.
- Construction workspaces were modified or reduced where practicable to avoid sensitive wetland resources while still maintaining adequate room to safely construct the relocated pipeline.
- Where a wetland could not be avoided practicably, the pipeline was routed to minimize the crossing distance, where practicable
- Using Environmental Inspectors during construction.
- According to Enbridge, saturated (e.g., standing water) wetlands with unconsolidated substrates, boggy wetlands, and deep peat wetlands have not been identified within the proposed Line 5 relocation project area that are not already proposed for HDD crossings.

5.8.6.3 Examples of Wetland Avoidance & Minimization Measures

Enbridge states they designed HDD workspaces to avoid impacts to adjacent wetlands and waterways, where practicable. Enbridge provided descriptions of the design decisions that were made to reduce impacts at each of the proposed HDD locations:

- White River Crossing (near MP 3.6 to MP 4.5): the exit workspace was extended back 770 feet to reduce impacts to forested wetland wasm002f and the workspace is located within the largest available upland area; the entry workspace was extended back 430 feet to reduce impacts to forested wetland wasd021f and is located mostly in upland.
- Deer Creek Crossing (near MP 6.2 to MP 6.5): the exit workspace was extended back 445 feet and as far as practicable to reduce impacts to forested wetlands wase073f and wase074f; the entry workspace is sited to avoid wetland impacts.
- Marengo River Crossing (near MP 11.1 to MP 11.5): the entry workspace was extended back 365 feet to reduce impacts to forested wetland wase1055f and intermittent waterbodies sase1018i and sase1019i. The exit workspace is sited to avoid wetland impacts.
- Brunsweiler River Crossing (near MP 13.9 to MP 14.4): the entry workspace is extended to reduce impacts to wetland wasc1052e and narrowed to reduce impacts to wasc1053e; the exit workspace is sited to reduce impacts to wetland wasc1028e and is located mostly in upland.

- Trout Brook Crossing (near MP 16.4 to MP 16.9): the entry workspace is extended 425 feet to reduce impacts to forested wetland wasc1045f, scrub/shrub wetland wasc1044s, and perennial waterbody sasc1014p (unnamed tributary of Billy Creek). The exit workspace is located in an open field, located mostly in upland.

- Silver Creek Crossing (near MP 18.8 to MP 19.5): the entry and exit workspaces are located mostly in upland.

- Krause Creek Crossing (near MP 22.1 to MP 22.6): the entry and exit workspaces are located mostly within upland.

- Tyler Forks Crossing (near MP 33.8 to MP 34.2): the entry workspace will avoid wetland impacts and the exit workspace was sited to reduce impacts to wirc032 to the extent practicable and is located mostly in upland.

- Potato River Crossing (near MP 37.4 to MP 38.1): The entry workspace was extended 334 feet to reduce impacts to forested wetlands wirc1002f and wird003; the exit workspace is located mostly within upland.

5.8.7 Wetland Restoration

Site restoration (if required) would consist of efforts to return areas impacted by the construction back to their original condition. Restoration typically occurs in any disturbed areas within easements or ROW, temporary construction areas, staging areas, access routes, and any other areas used for project-related activities. To limit temporal impacts to wetland functions and condition, site restoration, including re-vegetation, of the disturbed areas should be completed as soon as possible following construction. Sediment and erosion control devices should be installed before ground disturbance occurs to reduce erosion and trap sediment from entering sensitive resources and should be in place until vegetation is re-established.

Enbridge states site cleanup would begin within 72 hours after backfilling the trench and final grading, topsoil replacement, seeding, and installation of permanent erosion control measures would be completed within 20 days after backfilling the trench. Additional information on ROW cleanup and restoration can be found in Sections 2.6.14 and 2.6.12 and in Enbridge’s EPP (Appendix D) and site-specific wetland and waterbody restoration and post-construction monitoring plans (Appendix V).

Cleared vegetation, especially forested vegetation, could take many years to reestablish and may not be expected to reestablish to preconstruction conditions on its own in all cases. The outcome is vegetation- and species-dependent. The key to species re-establishment can be the soil moisture gradient. Removal of trees can make wetland areas wetter, with less evapotranspiration taking place. The wetter the area is, the longer it can take for trees to establish and species that grow well in wetter environments can have a competitive edge. In addition, increased sunlight to the understory can alter species composition, favoring early successional species, aggressive or non-native plant species, and subsequently impacting the wetland’s ability to support previous habitat and wildlife species.

Actions that can promote successful restoration include, but are not limited to:

- Prompt seeding and using seed mixes that are appropriate for the wetland community type that is being restored.
- Development and implementation of a post-construction monitoring and reporting plan with performance measures (Appendix V).

- Completing multiple monitoring events within the following year post-construction to ensure seed germination and revegetation. Bog species can take longer to recover due to acidity, low oxygen, and nutrient-poor bog soils. Peat can also take many years to recover.
- Early detection and rapid response treatment of undesirable non-native species, particularly in the communities where none were present before (Appendix AB).
- Stabilizing soils adjacent to streams as soon as practicable to avoid the transportation of sediment downstream during flooding events.
- Ensuring original wetland elevations are restored. Multiple visits may be needed after construction to ensure that the soil has settled to its original grade and is not mounded too high or sunken too low. Many of these wetlands will naturally have hummock and hollow microtopography which is important for the functioning of the wetland.
- Minimizing soil compaction during construction.
- Installing BMPs prior to land disturbance and using appropriate BMP measures.
- Taking and evaluating pre- and post-construction photographs.
- Correctly identifying and segregating topsoil from subsoil to ensure topsoil is separated and placed as last layer in trench backfill.
- Restoring areas of rutting or unplanned soil disturbance due to equipment operation.
- Restoring moss-dominated wetland areas to their pre-construction condition. Mosses should not be allowed to dry out too long so these open trench areas should be excavated, and the soil replaced, in the shortest time span possible.

The DNR has recommended Enbridge perform the following actions or activities in an effort to support successful wetland restoration:

- Performing annual post-construction monitoring for six consecutive years (Years 1-6), then once annually every three years for an additional nine years (Year 9, Year 12, Year 15). These additional monitoring events could provide a better understanding on how shrub and forested wetlands are restoring.
- Completing multiple monitoring events within the year following post-construction to ensure seed germination and revegetation;
- Planting plugs within wetlands with standing water and monitoring these wetlands until emergent vegetation has been re-established;
- Planting and using native and local live plantings, seedlings, rootstocks, plugs, tree saplings, seed mixes, or sod mats in shrub and forested wetlands that will not be permanently converted to herbaceous wetland.
- Preparing and implementing pro-active management actions as part of the post-construction monitoring (i.e., if X conditions are observed during the post-construction monitoring event, then Y would be performed as soon as practicable). As an example, if an invasive plant species is newly observed in a wetland during post-construction monitoring, Enbridge generally proposes to record the observance and report it to the DNR by the end of the year in their annual post-construction monitoring report. If applicants have a pro-active management plan in place that specifically addresses actions that would be taken if a newly observed invasive species is recorded during post-construction monitoring, applicants may be able to remove or treat the invasive plant species during or soon after the monitoring event. This action could prevent the invasive species from establishing and spreading.

Generally, Enbridge proposes a partially passive restoration approach with additional supplemental plantings within areas of wetland impact, relying on the natural revegetation of the native seed bank within wetlands that are not proposed for permanent conversion. While the intention is to restore PSS and PFO wetlands to their pre-construction type and functions via natural reforestation (stump sprouting, root sprouting, recruitment), these wetlands would not likely be restored for at least a decade and in some circumstances, multiple decades (depending on how old and well-established the pre-construction shrub and forested systems are); these delays would result in a temporal loss in the return of pre-construction condition and functions. To address this concern, Enbridge has proposed implementing a more active restoration approach in forested wetland areas that would be temporarily cleared. These actions are discussed in greater detail in Section 5.8.7.2 and 5.8.7.3.

Appendix V includes Enbridge's Wetland and Waterway Restoration and Post-Construction Monitoring Plan. Additional documents relevant to Enbridge's restoration and post-construction monitoring plans are available on the DNR permitting website.

5.8.7.1 In-Place & In-Kind Restoration

Enbridge states they would restore affected wetlands to pre-construction conditions to the maximum extent practicable. Enbridge defines "in-place" restoration as reestablishment or restoration of a wetland to its original location. Enbridge defines "in-kind" restoration as restoration of a wetland to a similar structural and functional type compared to its original condition.

Enbridge states palustrine emergent wetlands impacted by the proposed Line 5 relocation would be restored in-place and would restore the resource's former structural and "functional type." PSS and PFO wetlands impacted by temporary workspace would be restored in-place and would return to their original structural and "functional type." According to Enbridge, these wetlands would all be restored both in-place and in-kind.

As stated previously, it is important to note that while the intention is to restore PSS and PFO wetlands to their pre-construction type and functions, these wetlands would not likely be restored for at least a decade and in some circumstances, multiple decades (depending on how old and well-established the pre-construction shrub and forested systems are). This delay would result in a temporal loss in the return of pre-construction condition and functions.

Palustrine scrub-shrub and palustrine forested wetlands impacted by the proposed Line 5 relocation within the permanently maintained ROW (50-foot-wide corridor for open-cut trench installation, 30-foot-wide corridor for HDD installation) would be converted to palustrine emergent wetlands. Because the PSS and PFO wetlands would be restored to a different structural type, Enbridge states wetland restoration along the permanent ROW corridor would be considered "in-place" but not "in-kind."

5.8.7.2 Seeding

Upon backfilling the pipeline, Enbridge would seed wetlands (unless standing water is present) and would use wetland seed mixes that were derived from the Minnesota Board of Water and Soil Resources. Enbridge considers the seed mixes to be effective in stabilizing wetlands disturbed by construction activities.

Enbridge states "the goal of Enbridge's restoration seeding is not to replace the existing species already present within the specific wetlands, but to stabilize and augment growth during the restoration phase" (Enbridge, 2024d). The selected seed mixes are intended to augment revegetation via natural recruitment from native seed stock in the topsoil and are not intended to change the natural species composition. In a February 2024 email to EPA (Enbridge, 2024d), Enbridge shared "the natural seed bank present within the Project areas will over time overtake seeded areas and will provide the most influence on community composition in that area." Further, Enbridge states the wetland seed mix (applied to wetlands without standing water) would provide temporary cover and allow natural revegetation via the seeds and rhizomes in the topsoil spread back over the ROW after the pipeline is installed (See Wetland and Waterway Restoration and Post-Construction Monitoring Plan, Appendix V). Enbridge proposes shrub and forested wetlands that would be cleared outside of the permanent ROW corridor would be restored via natural reforestation (i.e., stump sprouting, root sprouting, and natural recruitment). No fertilizer, lime, or mulch would be applied in wetlands.

In a February 2024 email to EPA (Enbridge, 2024d), Enbridge shared "the use of specialty seed mixes to match specific species and/or communities along the Project corridor is not a practicable approach to revegetation. Enbridge has attempted this approach on past projects at great expense and very limited success, typically requiring additional wetland disturbance after construction to reseed with a more suitable seed mix that helps provide the cover and stabilization while the native seedbed material reestablishes. Enbridge has had the best restoration success with the re-establishment of plants present within the native seedbed."

Enbridge states their contractor would be responsible for acquiring seeds from suppliers and Enbridge would encourage the contractor to use local seed suppliers capable of providing the seed types and qualities needed for the proposed Line 5 relocation project.

Wetlands with standing water would not be seeded; Enbridge states the reestablishment of vegetation in these types of wetlands occurs best through natural process without supplemental seeding. EPA recommended that Enbridge plant live plantings in wetlands with standing water following pipeline installation.

Table 5.8-20 and Table 5.8-21 provide wetland and waterbody bank seed mixes, respectively (also found in Appendix B of Enbridge's EPP; Appendix D).

Table 5.8-20 Native sedge/wet meadow seed mixture.

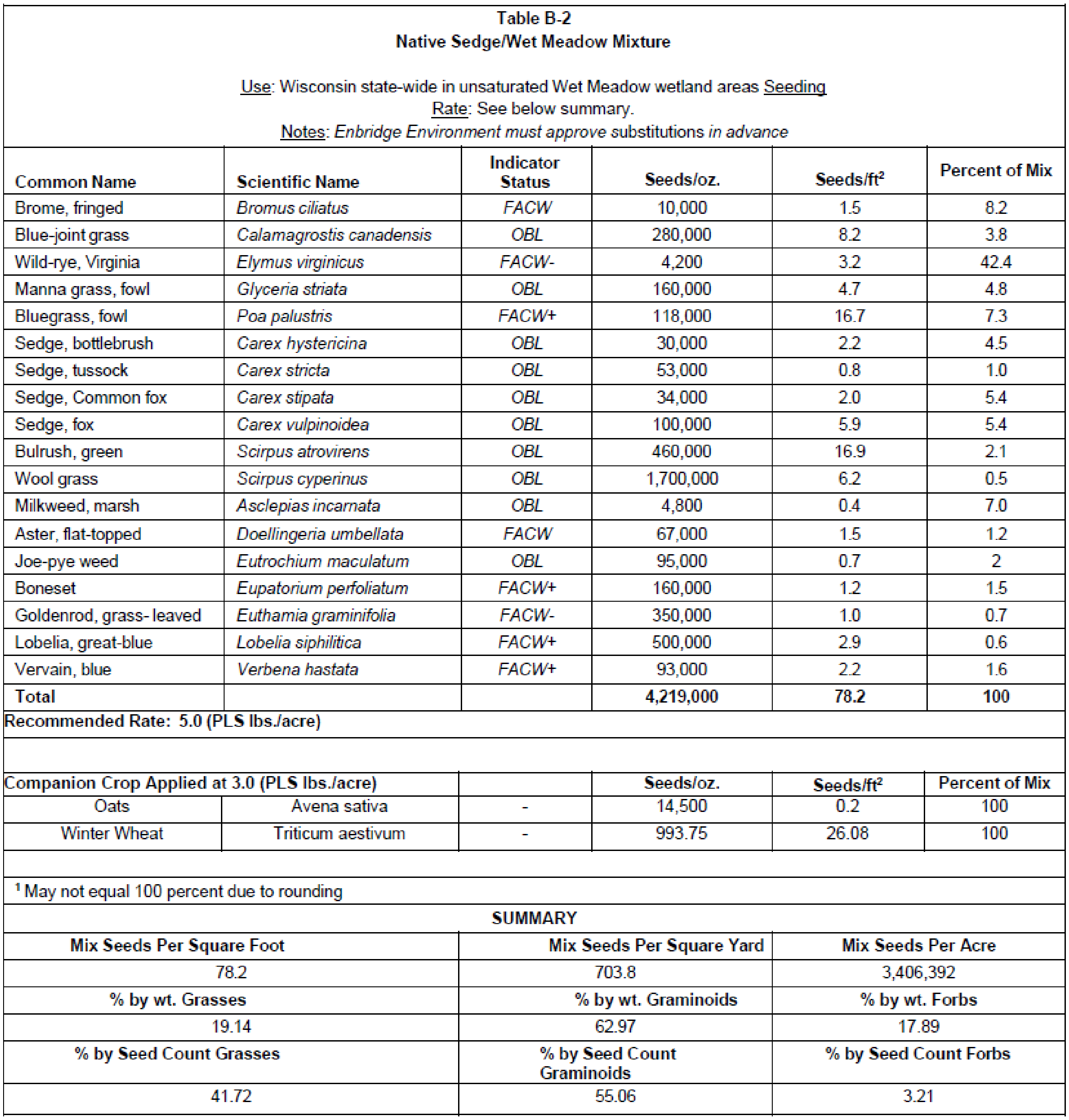


Table B-2
Native Sedge/Wet Meadow Mixture

Use: Wisconsin state-wide in unsaturated Wet Meadow wetland areas Seeding
Rate: See below summary.
Notes: *Enbridge Environment must approve* substitutions *in advance*

Common Name	Scientific Name	Indicator Status	Seeds/oz.	Seeds/ft^2	Percent of Mix
Brome, fringed	*Bromus ciliatus*	*FACW*	10,000	1.5	8.2
Blue-joint grass	*Calamagrostis canadensis*	*OBL*	280,000	8.2	3.8
Wild-rye, Virginia	*Elymus virginicus*	*FACW-*	4,200	3.2	42.4
Manna grass, fowl	*Glyceria striata*	*OBL*	160,000	4.7	4.8
Bluegrass, fowl	*Poa palustris*	*FACW+*	118,000	16.7	7.3
Sedge, bottlebrush	*Carex hystericina*	*OBL*	30,000	2.2	4.5
Sedge, tussock	*Carex stricta*	*OBL*	53,000	0.8	1.0
Sedge, Common fox	*Carex stipata*	*OBL*	34,000	2.0	5.4
Sedge, fox	*Carex vulpinoidea*	*OBL*	100,000	5.9	5.4
Bulrush, green	*Scirpus atrovirens*	*OBL*	460,000	16.9	2.1
Wool grass	*Scirpus cyperinus*	*OBL*	1,700,000	6.2	0.5
Milkweed, marsh	*Asclepias incarnata*	*OBL*	4,800	0.4	7.0
Aster, flat-topped	*Doellingeria umbellata*	*FACW*	67,000	1.5	1.2
Joe-pye weed	*Eutrochium maculatum*	*OBL*	95,000	0.7	2
Boneset	*Eupatorium perfoliatum*	*FACW+*	160,000	1.2	1.5
Goldenrod, grass- leaved	*Euthamia graminifolia*	*FACW-*	350,000	1.0	0.7
Lobelia, great-blue	*Lobelia siphilitica*	*FACW+*	500,000	2.9	0.6
Vervain, blue	*Verbena hastata*	*FACW+*	93,000	2.2	1.6
Total			**4,219,000**	**78.2**	**100**

Recommended Rate: 5.0 (PLS lbs./acre)

Companion Crop Applied at 3.0 (PLS lbs./acre)			**Seeds/oz.**	**Seeds/ft^2**	**Percent of Mix**
Oats	Avena sativa	-	14,500	0.2	100
Winter Wheat	Triticum aestivum	-	993.75	26.08	100

[1] May not equal 100 percent due to rounding

SUMMARY

Mix Seeds Per Square Foot	**Mix Seeds Per Square Yard**	**Mix Seeds Per Acre**
78.2	703.8	3,406,392
% by wt. Grasses	**% by wt. Graminoids**	**% by wt. Forbs**
19.14	62.97	17.89
% by Seed Count Grasses	**% by Seed Count Graminoids**	**% by Seed Count Forbs**
41.72	55.06	3.21

(Enbridge, n.d.)

Table 5.8-21 Waterbody banks seed mixture.

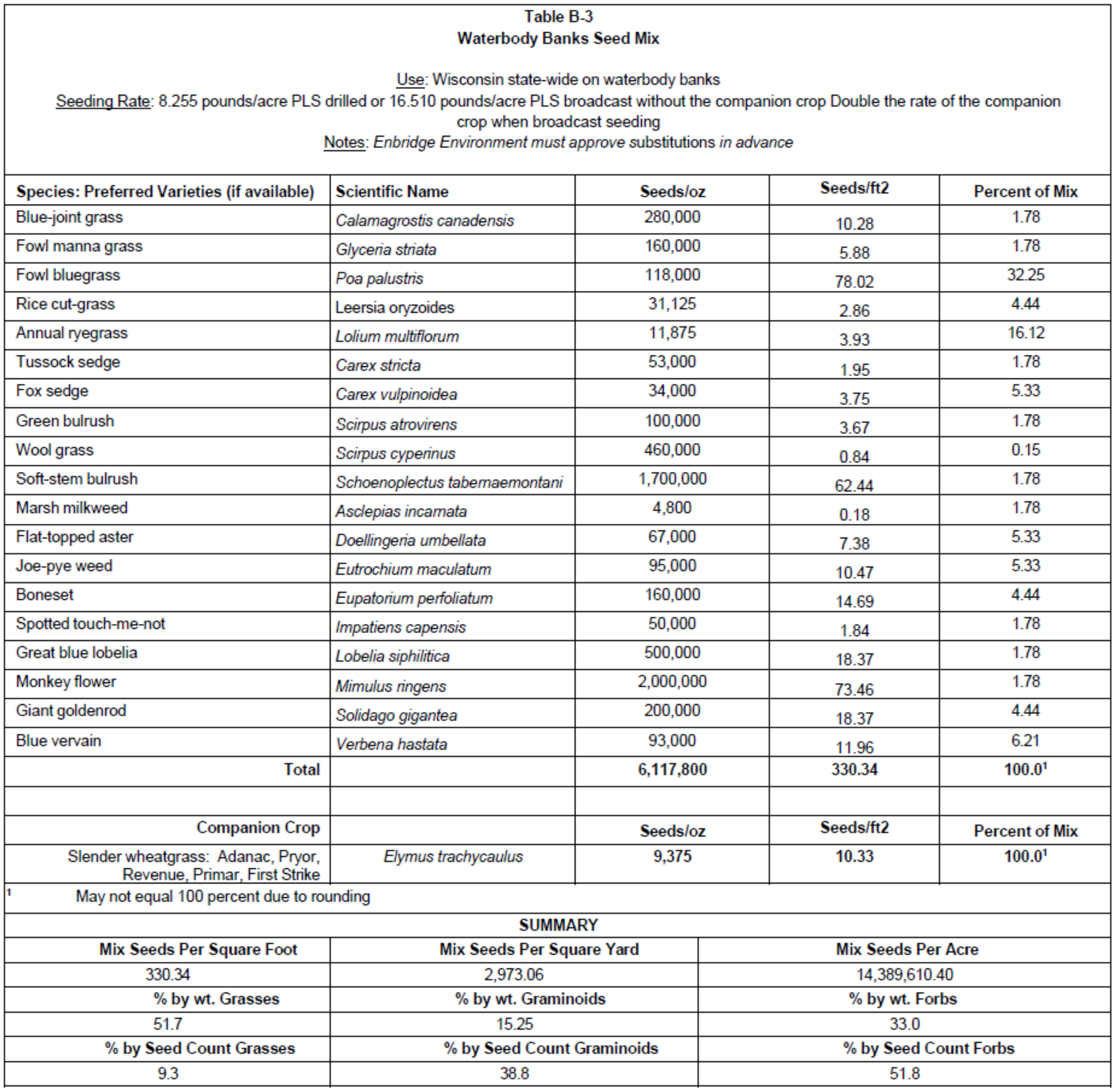


Table B-3
Waterbody Banks Seed Mix

Use: Wisconsin state-wide on waterbody banks
Seeding Rate: 8.255 pounds/acre PLS drilled or 16.510 pounds/acre PLS broadcast without the companion crop Double the rate of the companion crop when broadcast seeding
Notes: *Enbridge Environment must approve substitutions in advance*

Species: Preferred Varieties (if available)	Scientific Name	Seeds/oz	Seeds/ft2	Percent of Mix
Blue-joint grass	*Calamagrostis canadensis*	280,000	10.28	1.78
Fowl manna grass	*Glyceria striata*	160,000	5.88	1.78
Fowl bluegrass	*Poa palustris*	118,000	78.02	32.25
Rice cut-grass	Leersia oryzoides	31,125	2.86	4.44
Annual ryegrass	*Lolium multiflorum*	11,875	3.93	16.12
Tussock sedge	*Carex stricta*	53,000	1.95	1.78
Fox sedge	*Carex vulpinoidea*	34,000	3.75	5.33
Green bulrush	*Scirpus atrovirens*	100,000	3.67	1.78
Wool grass	*Scirpus cyperinus*	460,000	0.84	0.15
Soft-stem bulrush	*Schoenoplectus tabernaemontani*	1,700,000	62.44	1.78
Marsh milkweed	*Asclepias incarnata*	4,800	0.18	1.78
Flat-topped aster	*Doellingeria umbellata*	67,000	7.38	5.33
Joe-pye weed	*Eutrochium maculatum*	95,000	10.47	5.33
Boneset	*Eupatorium perfoliatum*	160,000	14.69	4.44
Spotted touch-me-not	*Impatiens capensis*	50,000	1.84	1.78
Great blue lobelia	*Lobelia siphilitica*	500,000	18.37	1.78
Monkey flower	*Mimulus ringens*	2,000,000	73.46	1.78
Giant goldenrod	*Solidago gigantea*	200,000	18.37	4.44
Blue vervain	*Verbena hastata*	93,000	11.96	6.21
Total		**6,117,800**	**330.34**	**100.0**[1]
Companion Crop		**Seeds/oz**	**Seeds/ft2**	**Percent of Mix**
Slender wheatgrass: Adanac, Pryor, Revenue, Primar, First Strike	*Elymus trachycaulus*	**9,375**	**10.33**	**100.0**[1]

[1] May not equal 100 percent due to rounding

SUMMARY

Mix Seeds Per Square Foot	**Mix Seeds Per Square Yard**	**Mix Seeds Per Acre**
330.34	2,973.06	14,389,610.40
% by wt. Grasses	**% by wt. Graminoids**	**% by wt. Forbs**
51.7	15.25	33.0
% by Seed Count Grasses	**% by Seed Count Graminoids**	**% by Seed Count Forbs**
9.3	38.8	51.8

(Enbridge, n.d.)

5.8.7.3 Supplemental Plantings in Forested Wetland

Enbridge is proposing to augment the natural reestablishment of tree species within the temporary workspaces of forested wetlands via supplemental plantings. Enbridge is proposing to plant bare root stock at a density of 100 to 300 stems per acre within the temporarily cleared forested wetlands. Depending on the species and nursery availability, Enbridge would select two to four tree species from the following list:

- Balsam Fir (*Abies balsamea*) - FACW
- Black Spruce (*Picea mariana*) - FACW
- Red Maple (*Acer rubrum*) - FAC
- Swamp White Oak (*Quercus bicolor*) - FACW
- Tamarack (*Larix laricina*) – FACW
- White Pine (*Pinus strobus*) - FACU
- Yellow Birch (*Betula alleghaniensis*) – FAC

It is anticipated bare root stock would be two to three years old at the time of planting. Supplemental plantings would occur after the first year of post-construction monitoring to ensure any grading or site stabilization issues have been addressed prior to planting.

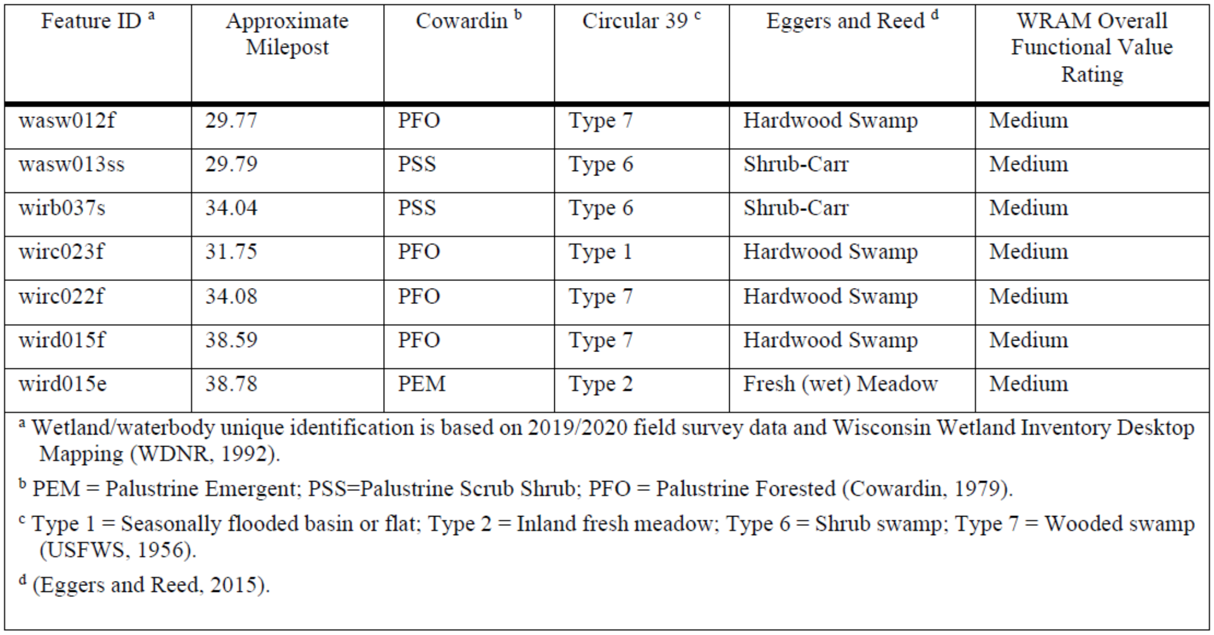
5.8.7.4 Post-Construction Monitoring in Wetlands

Enbridge's "goal is to restore areas disturbed during the Project as near as practicable to the conditions encountered pre-construction." (Wetland and Waterbody Restoration and Post-Construction Monitoring Plan, Appendix V). Enbridge developed a Wetland and Waterbody Restoration and Post-Construction Monitoring Plan to evaluate and determine the success of wetland and waterbody restoration within impacted project areas post-construction. The plan was developed based on pre-construction monitoring data (e.g., wetland delineations, floristic surveys, water quality monitoring, elevation surveys). Enbridge states the purpose of the plan is to establish the monitoring procedures and performance standards that will be used to:

- determine the status of wetlands and waterbodies restoration;
- document where successful wetland and waterbody restoration has been achieved; and
- identify additional mitigative measures that may be warranted if successful restoration has not been achieved.

Enbridge proposes to collect post-construction data from wetlands impacted by the proposed project and will also conduct a more intensive methodology for wetlands with a "High" overall functional value; wetlands with a "Medium" overall function value that have a "High" floristic quality rating; and select wetlands adjacent to ASNRI waterways.

Table 5.8-22 Wetlands adjacent to ASNRI waterways with more intensive monitoring methodology.



Feature ID [a]	Approximate Milepost	Cowardin [b]	Circular 39 [c]	Eggers and Reed [d]	WRAM Overall Functional Value Rating
wasw012f	29.77	PFO	Type 7	Hardwood Swamp	Medium
wasw013ss	29.79	PSS	Type 6	Shrub-Carr	Medium
wirb037s	34.04	PSS	Type 6	Shrub-Carr	Medium
wirc023f	31.75	PFO	Type 1	Hardwood Swamp	Medium
wirc022f	34.08	PFO	Type 7	Hardwood Swamp	Medium
wird015f	38.59	PFO	Type 7	Hardwood Swamp	Medium
wird015e	38.78	PEM	Type 2	Fresh (wet) Meadow	Medium

[a] Wetland/waterbody unique identification is based on 2019/2020 field survey data and Wisconsin Wetland Inventory Desktop Mapping (WDNR, 1992).

[b] PEM = Palustrine Emergent; PSS=Palustrine Scrub Shrub; PFO = Palustrine Forested (Cowardin, 1979).

[c] Type 1 = Seasonally flooded basin or flat; Type 2 = Inland fresh meadow; Type 6 = Shrub swamp; Type 7 = Wooded swamp (USFWS, 1956).

[d] (Eggers and Reed, 2015).

Source: Wetland and Waterbody Restoration and Post-Construction Monitoring Plan, Appendix V

5.8.7.5 General Monitoring Approach

Post-construction monitoring activities would begin during the growing season in the first year following construction. During Years 1-6 post-construction monitoring, Enbridge proposes to visit each wetland along the pipeline construction workspace, access roads, pipeyards, and valve sites to evaluate the topography and stabilization of the wetland crossings, specifically crowning or subsidence over the trench. The following wetland site conditions would also be recorded:

- Initial establishment of wetland vegetation, exposed or bare areas devoid of vegetative cover
- Observations of hydrologic indicators
- Observations of wildlife
- Observations of elevation changes that affect wetland hydrology
- Photographs
- Status of erosion controls and general site stabilization
- Visual evidence of rutting, compaction, or erosion; status of erosion controls; off -road vehicle activity or other third-party disturbances

5.8.7.6 Timed Meander Surveys

Enbridge is proposing to conduct a “modified” timed-meander survey (restricted to project area instead of entire feature) in each wetland within the permanent and temporary workspaces along the mainline construction corridor during Years 1, 3, and 5 post-construction. Plant species, cover, and abundance would be recorded in 5-minute intervals.

5.8.7.7 Monitoring Plots

During Year 1 monitoring, Enbridge would establish 10-square meter plots within a select amount of wetlands. Plots would be determined in the field and would be located within an area representative of the wetland being monitored. At a minimum, two representative plots would be established every one-acre of affected wetland, with one plot established within the permanent easement and one within the temporary workspace.

Plots would be established in:

- 50 percent of the wetlands with an overall “Low” and “Medium” WRAM rating, which would be randomly selected prior to conducting Year 1 monitoring.
- All wetlands with an overall “High” WRAM rating.
- All wetlands with an overall “Medium” WRAM rating AND individual “High” rating for floristic quality.
- Select wetlands adjacent to ASNRI waterways (Table 5.8-22).
- Plots would not be established in wetlands that would be crossed via HDD and limited to vegetation clearing; these areas would be monitored using the modified timed meander survey.

Each plot would be sampled in Years 2, 4 and 6 post-construction June to August (resampling could occur within three weeks on either side of the original sampling date). Photos would be taken and all observed plant species within the plot would be recorded; species cover, abundance, distribution, and invasive species data would also be recorded.

5.8.7.8 Monitoring within PFO & PSS Wetlands

Enbridge would conduct additional monitoring within the areas of temporary PFO and PSS clearing during post-construction years 9, 12, and 15 to evaluate the success of woody species reestablishment.

5.8.7.9 Aerial Patrols

In accordance with federal requirements, Enbridge would conduct aerial patrols of the permanent pipeline corridor at intervals not exceeding three weeks, but at least 26 times each calendar year.

5.8.7.10 Wetland Hydrological Monitoring

To address agencies' concerns regarding hydrological alterations in areas of blasting, Enbridge is proposing to install shallow groundwater monitoring wells within select wetlands to monitor for changes in near-surface saturation and hydrology. Wetlands with hydrological monitoring were preliminarily determined in coordination with USACE and Enbridge using the following criteria:

- Wetland is located within the mainline construction corridor (excludes temporary access roads, pipeyards, valve sites);
- Wetland will be crossed by the pipeline centerline (excludes wetlands that are within the temporary workspace, but will not be excavated to install the pipeline);
- Pipeline centerline crossing distance was at least 100 feet in length to provide appropriate locations for groundwater monitoring well placement;
- Preference was assigned to wetlands with permanent conversion within the permanent easement;
- Preference was assigned to wetlands located on Tri-State Holdings parcels, public land parcels, followed by select private parcels;
- Preference was assigned to wetlands without access concerns (i.e., no large river crossings);
- Preference was assigned to wetlands with a "High" overall functional value or wetlands with a "Medium" overall function value that have a "High" floristic quality rating;
- Selected wetlands include both features where blasting is anticipated as well as features where blasting is not anticipated.

Groundwater elevation monitoring wells are proposed to be installed in 2024 within the selected wetlands on either side of the construction ROW but located outside of the construction workspace. Monitoring wells would be installed in pairs upgradient and downgradient of the pipeline to a depth of 15 inches to assess whether there are changes in groundwater elevations near the pipeline. During construction and following trench backfill and establishment of final grade, a third monitoring well would be installed at each monitoring well site, within the trench line. Monitoring wells would be installed in accordance with the USACE document "Guidance on Design, Installation and Interpretation of Monitoring Wells for Wetland Hydrology Determinations."

Data loggers would be used to collect groundwater elevation data during the frost-free period prior to construction and in Years 1-3 post-construction (or until the performance standards have been met). Where performance standards at specific sites have not been met by Year 3 of monitoring, Enbridge proposes, in consultation with the applicable agencies, they may extend monitoring at those sites or investigate potential reasons for the difference in groundwater elevations.

1.8.6.3.7 Summary of Post-Construction Monitoring Activities

Table 5.8-23 summarizes the proposed post-construction monitoring activities by year. More information on post-construction monitoring methods and analysis can be found in Enbridge's Wetland and Waterbody Restoration and Post-Construction Monitoring Plan (Appendix V).

Table 5.8-23 Summary of Post-Construction Monitoring Activities

Monitoring Activities	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
General Revegetation Success	X	X	X	X	X	X
Topography (crowning/subsidence/rutting/elevation changes)	X	X	X	X	X	X
Stabilization	X	X	X	X	X	X
Photos taken in each direction	X	X	X	X	X	X
Observations of Hydrologic Indicators	X	X	X	X	X	X
Status of erosion controls	X	X	X	X	X	X
Observations of off-road vehicle activity	X	X	X	X	X	X
Incidental wildlife observations	X	X	X	X	X	X
Noxious/invasive species presence/ comparison against preconstruction condition	X	X	X	X	X	X
Plot sampling (select wetlands)	X [a]	X		X		X
Timed-meander survey	X		X		X	
Access Roads, Yards MLV 1, 2, and 7	X	X	X			
Hydrologic Monitoring [b]	X	X	X			

[a] Plot locations to be established in select wetlands during the Year 1 Post Construction Monitoring period however, plot sampling will not occur during the first year.

[b] Monitoring of hydrology at select locations using shallow monitoring wells.

Source: Wetland and Waterbody Restoration and Post-Construction Monitoring Plan, Appendix V

5.8.7.11 Post-Construction Wetland Performance Standards

Enbridge proposes wetland restoration would be considered successful based on the following variables, depending on the overall WRAM rating (Low/Low Invasive; Medium; High and Medium with High FQI):

- **Native vs. Non-native species cover, based on timed-meander surveys:**
    - Relative vegetation cover of native, non-native plant species should be at least 70 percent; 80 percent; 90 percent;
    - Relative vegetation areal cover of non-native species should not be greater than 30 percent; 20 percent; 10 percent of total cover or no greater than 15 percent; 10 percent; 5 percent non-native species coverage as compared to pre-construction conditions.

- **Invasive Species:** No introduction by the Project of any new invasive plant species (as listed in ch. NR 40, Wis. Adm. Code) that were not previously documented within the Project workspace. No spread by the Project of existing invasive plant populations to previously uninfected areas along the Project workspace.

- **Life Form Cover:** This metric will not be used to directly measure success or failure but instead used to guide any prescribed adaptive management measures for temporary workspace areas within previously PFO/PSS wetlands. This assumes that these systems will be dominated by graminoids with interrupted to continuous cover (50 percent to 100 percent), where forb cover is rare to patchy (5 percent to 50 percent).

- **Maximum Unvegetated Area:** No bare areas greater than 100 square feet as observed while traversing the wetland. Exceptions: vernal pools, drainage channels in floodplain forests, and sparsely-vegetated concave surfaces in hardwood swamps.

- **Relative Areal Cover of Hydrophytes, based on timed-meander surveys:** Relative areal coverage of hydrophytes should be at least 51 percent for low, at least 75 percent for medium and high.

- **Elevations:** Wetland topography is restored as near as practicable to baseline conditions and/or similar to the topography of adjacent undisturbed wetland areas. Baseline topographic conditions shall be informed from pre- and Year 1 post-construction LiDAR surveys; there is no evidence of adverse changes to baseline hydrology and drainage.

- **Wetland hydrology monitoring:** The in-trench and downgradient well water table elevations are within 20 percent of the up-gradient water table elevations and exhibit similar fluctuations as compared to the reference monitoring well water table elevation changes.

Enbridge states they would “work closely with the DNR and the USACE to determine success or identify if additional restoration is required if performance standards are not reached after the planned monitoring is completed, or if an issue is identified during the monitoring period that may affect restoration success. [Further,] [p]ost-construction restoration activities [would] be adaptive, based on the results of monitoring, changing site conditions (e.g., land use), and geared toward the final goal of restoring pre-construction characteristics of the resource (i.e., vegetation and hydrology). In determining whether corrective action is needed, Enbridge [would] evaluate the potential resource impacts from conducting the additional restoration compared to taking no action with continued monitoring.” Additional information on post-construction restoration, corrective actions, and reporting can be found in Section 6 of Enbridge’s plan (Appendix V).

5.8.8 Wetland Mitigation

Enbridge states they would provide compensatory wetland mitigation for unavoidable Line 5 relocation project-related impacts, which would include temporary loss of wetland cover, permanent conversion of wetland type, and permanent wetland fill. Enbridge calculated proposed mitigation ratios for the proposed Line 5 relocation project based on the type and amount of wetland impact and past projects completed by Enbridge. The DNR’s most current version of Enbridge’s Mitigation Ratio Table (received via email on February 2, 2024) is found in Table 5.8-24.

Table 5.8-24 Wetland Mitigation Ratio Table

Wetland Type	Mitigation Ratio Proposed for High Value Wetlands	Mitigation Ratio Proposed for Low or Low-invasive & Medium Value Wetlands
Emergent		
Temporal loss during construction	0.06	0.03
Permanent loss; wetland converted to non-wetland	1.5	1.2
Scrub-shrub		
Temporal loss during construction	0.25	0.06
Permanent conversion of wetland type (maintained corridor)	0.60	0.5
Permanent loss; wetland converted to non-wetland	1.5	1.5
Forested		
Temporal loss during construction	0.5	0.25
Permanent conversion of wetland type (maintained corridor)	0.70	0.6
Permanent loss; wetland converted to non-wetland	2.0	2.0

Enbridge has proposed using the USACE and DNR-approved Compensatory Mitigation Banks and possibly the Wisconsin Wetland Conservation Trust in-lieu fee program to compensate for unavoidable wetland impacts. Potential wetland mitigation bank credits may be available in the Poplar River and Bluff Creek Mitigation Banks. Enbridge is currently working on finalizing their Compensatory Wetland Mitigation Strategy with coordination from the USACE and DNR.

5.9 Ecological Landscapes, Natural Communities, & Plants

5.9.1 Ecological Landscapes & Land Type Associations

Geophysical and ecological characteristics along Enbridge's proposed Line 5 relocation route and route alternatives can be described broadly by the different ecological landscapes present in the area. The ecological landscapes are defined by their different ecological attributes and facilitate pertinent ecosystem management perspectives relative to the different natural communities, key habitats, aquatic features, and native plants and animals found in each (DNR, 2015b). An ecological landscape incorporates the physical and biotic environment, as well as social conditions. Enbridge's proposed Line 5 relocation route and route alternatives cross three ecological landscapes: Superior Coastal Plain, North Central Forest, and Northwest Sands (Section 3.4.2.4; Figure 3.4-2). The three ecological landscapes have general topographic, geologic, hydrologic, and ecologic characteristics that differentiate them from other regions of the state.

Ecological landscapes can be broken into land type associations that depict ecological units at a more detailed scale according to the classification scheme of the National Hierarchical Framework of Ecological Units (Cleland et al., 1997). These nested units can be useful for understanding local and site-specific ecological information.

5.9.1.1 Superior Coastal Plain

The Superior Coastal Plain Ecological Landscape encompasses 1,416 square miles (905,929 acres), representing 2.5% of the area of the state (DNR, 2015c). The majority of Enbridge's proposed Line 5 relocation route, RA-01, and RA-02 would cross this ecological landscape (Figure 3.4-2). RA-03 would be located entirely outside of the Superior Coastal Plain.

The Superior Coastal Plain is a gently sloping region of lacustrine clay that is inclined northward toward Lake Superior. The plain is dissected by many deeply incised streams and several large rivers that generally flow toward Lake Superior from south to north. Historically, the region was nearly entirely forested and was dominated by forests of eastern white pine (*Pinus strobus*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), white birch (*Betula papyrifera*), balsam poplar (*Populus balsamifera*), quaking aspen (*Populus tremuloides*), and northern white cedar (*Thuja occidentalis*). The Superior Coastal Plain flora includes at least 16 plant species that occur in no other Wisconsin ecological landscape (DNR, 2015c).

As a result of lake levels changing with retreat of the last phase of glaciation, the mouths of many of the streams entering Lake Superior are submerged, creating freshwater estuaries. Sandspits are also a feature along the Lake Superior coastline. The sandspits separate the waters of the lake from coastal lagoons and wetlands. Natural communities associated with these areas include marshes, sedge meadows, and fens, but shrub swamps, conifer swamps, and bogs are also present (DNR, 2015c). Along the Lake Superior shoreline, large peatlands can be associated with these drowned river mouths and sandspits. One of the largest of these is along the Bad River. Lake Superior coastal wetlands support a wealth of rare plant life, including species that are more abundant here than in any other ecological landscape, and the unique array of coastal sandscapes and associated microhabitats support many rare and geographically restricted plants (DNR, 2015c). Several large peatlands occur at inland sites away from the lake. These include the Blueberry Swamp west of the Bois Brule River in Douglas County and the Bibon Swamp in the upper White River drainage (one of the largest wetlands in northern Wisconsin, about 15 square miles).

Forested uplands and open grasslands are the predominant land cover types in the Superior Coastal Plain (Figure 5.9-1). Aspen and birch forests, which are generally managed for pulp, presently occupy about 40 percent of the ecological landscape. Approximately 33 percent of the ecological landscape is non-forested and most of the open lands are grass covered resulting from plowing or use as pasture. Floristically rich, mesic sugar maple-basswood forests occur on high terraces associated with a few of the large rivers in the Superior Coastal Plain (DNR, 2015c).

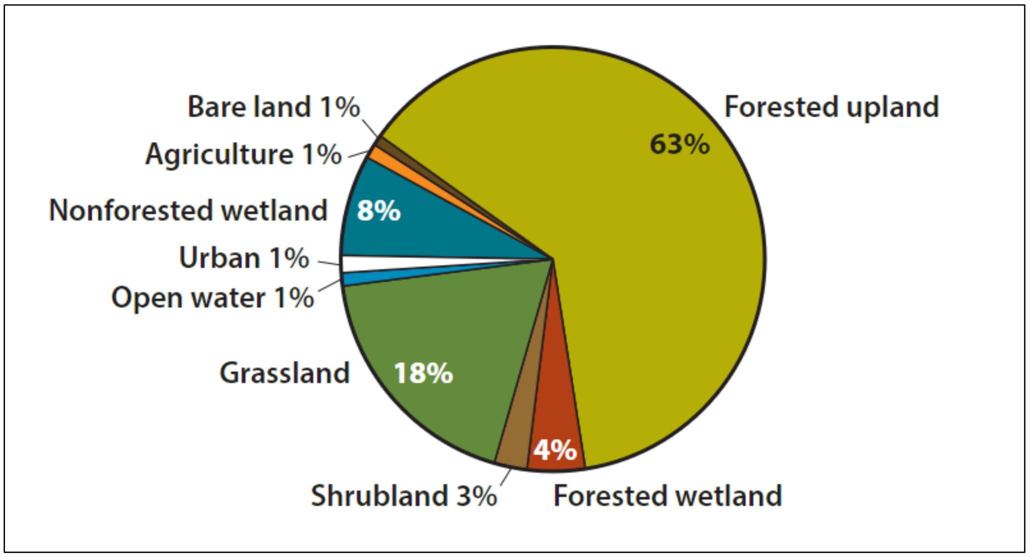


Figure 5.9-1 Categories of land use in the Superior Coastal Plain Ecological Landscape.
Source: DNR, 2015

Within the Superior Coastal Plain, Enbridge's proposed relocation route would cross through two land type associations: the Ashland Lake-Modified Till Plain and the Iron Gogebic Dissected Lake Bench (DNR 2011). The Ashland Lake-Modified Till Plain's characteristic landform pattern is undulating modified lacustrine moraine with deep V-shaped ravines. Soils are predominantly somewhat poorly drained clay loam over calcareous clay till or loamy lacustrine soils (Section 5.6.2). Common forest habitat types include associations of balsam fir, red maple (*Acer rubrum*), and black snakeroot (*Sanicula marilandica*) and associations of sugar maple (*Acer saccharum*), black snakeroot, and partridgeberry (*Mitchella repens*) (DNR 2011).

The Iron Gogebic Dissected Lake Bench's characteristic landform pattern is undulating modified lacustrine moraine with deep V-shaped ravines. Soils are predominantly somewhat poorly drained silt loam over calcareous silty clay loam till or loamy lacustrine (Section 5.6.2). Common forest habitat types include associations of balsam fir, red maple, and black snakeroot, associations of sugar maple, black snakeroot, and partridgeberry, associations of sugar maple, sweet cicely (*Osmorhiza claytonii*), and blue cohosh (*Caulophyllum thalictroides*), and hydromesic (DNR 2011).

The DNR's Natural Heritage Working List documented 62 rare animals including three mammals, 28 birds, four herptiles, two fishes, and 25 invertebrates within the Superior Coastal Plain Ecological Landscape. These include two federally listed endangered species, five state-listed endangered species, five state-listed threatened species, and 52 Wisconsin special concern species (DNR, 2015). Rare species in the vicinity of Enbridge's proposed Line 5 relocation route and route alternatives are discussed in Sections 5.9.4, 5.10.7, 5.10.8 and 5.10.9.

5.9.1.2 North Central Forest

The North Central Forest Ecological Landscape encompasses 9,543 square miles (6,107,516 acres), representing 17 percent of the area of the state of Wisconsin (DNR, 2015). The southernmost and the easternmost sections of Enbridge's proposed Line 5 relocation route and RA-01 would extend into the North Central Forest Ecological Landscape (Figure 3.4-2). Roughly 60 percent of the length of RA-02 and 85 percent of the length of RA-03 would traverse this ecological landscape (Figure 3.4-2).

The North Central Forest Ecological Landscape is characterized by end moraines and ground moraines with bedrock-controlled areas. The Penokee Range (Section 5.5.1.3) forms the northwestern boundary of this ecological landscape. Kettle depressions are widespread and steep; bedrock-controlled ridges are found in the northern portion of the landscape. Rivers and streams are widely distributed throughout the landscape.

Historically, the vegetation in the North Central Forest Ecological Landscape was primarily mesic hemlock-hardwood forest dominated by eastern hemlock (*Tsuga canadensis*), sugar maple, and yellow birch (*Betula alleghaniensis*). Harvesting of hemlock to supply the tanning industry was common and reduced the species to a minor forest component. Today northern mesic hardwood forest is the dominant community (Figure 5.9-2), and is composed of sugar maple, American basswood (*Tilia americana*), and red maple (Section 5.9.1.2). Forests presently cover approximately 75 percent of the North Central Forest Ecological Landscape (Figure 5.9-2). Northern mesic forest and northern white cedar swamp support the largest numbers of rare plant species found in habitats in this ecological landscape (17 and 11 species, respectively)(DNR, 2015d).

Wetlands are common, accounting for 22 percent of the land cover in the North Central Forest (Figure 5.8-2), with both forested and non-forested wetlands being common. Wetland types include northern wet-mesic forest dominated by either northern white cedar or black ash (*Fraxinus nigra*), northern wet forest dominated by black spruce (*Picea mariana*) or tamarack (*Larix laricina*), non-forested wetlands including bogs, fens, muskegs, alder thickets, sedge meadows, and marsh.

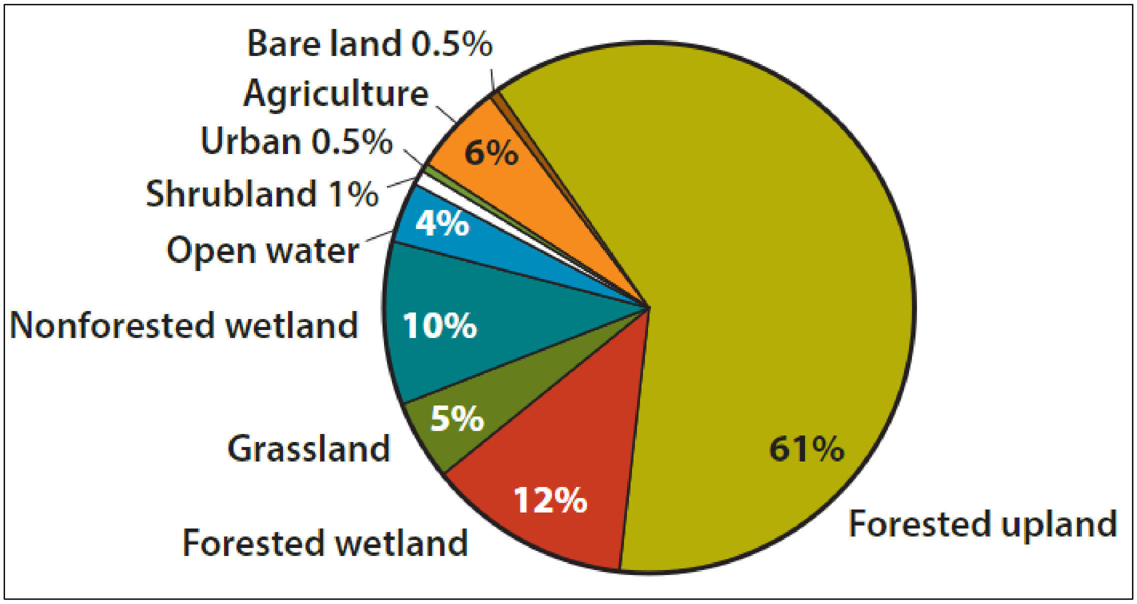


Figure 5.9-2 Categories of land use in the North Central Forest Ecological Landscape.
Source: DNR, 2015

In the North Central Forest Ecological Landscape, Enbridge's proposed Line 5 relocation route would cross through two land type associations: the Penokee/Gogebic Iron Range and the Gurney/Ontonagon Spillway. The Penokee/Gogebic Iron Range's characteristic landform pattern is hilly bedrock-controlled moraine. Soils are predominantly well-drained, sandy loam over acid sandy loam till or igneous/metamorphic bedrock (Section 5.6.2). Common forest habitat types include associations of sugar maple, eastern hemlock, and wild lily-of-the-valley; associations of sugar maple, eastern hemlock, and spinulose shield fern (*Dryopteris spinulosa*); and associations of sugar maple, sweet cicely, and blue cohosh, and forested lowland (DNR, 2013).

The Gurney/Ontonagon Spillway's characteristic landform pattern is undulating outwash and lake plain with old beaches and dunes common. Soils are predominantly excessively drained, loamy sand over outwash or loamy lacustrine (Section 5.6.2). Common forest habitat types include associations of white pine, red maple, and blueberry (*Vaccinium angustifolium*); associations of white pine, red maple, blueberry, and wild sarsaparilla (*Aralia nudicaulis*); associations of red maple, balsam fir, and black snakeroot; associations of sugar maple, eastern hemlock, and wild lily-of-the-valley; associations of sugar maple and wild sarsaparilla; associations of eastern hemlock, wild lily-of-the-valley, and goldthread (*Coptis groenlandica*); and wetlands (DNR, 2013)

The North Central Forest is important for many wildlife species, especially forest birds and large, wide-ranging forest mammals (e.g., black bear [*Ursus americanus*), gray wolf [*Canis lupus*], fisher [*Martes pennanti*], American marten [*Martes americana*], and bobcat [*Lynx rufus*]). The North Central Forest is in one of the continent's most important breeding regions for forest birds (Green, 1995; Cutright, Harriman, and Howe, 2006), especially species that require large blocks of unfragmented forested habitat, such as many neotropical migrant songbirds and forest raptors.

5.9.1.3 Northwest Sands

The Northwest Sands Ecological Landscape encompasses 1,956 square miles (1,251,723 acres), which is 3.5% of the area of the state of Wisconsin (DNR, 2015e). About 15% of the length of RA-03 would cross this ecological landscape. In Bayfield County, Enbridge's Ino Pumping Station is located within the Northwest Sands (Figure 3.4-2).

The Northwest Sands Ecological Landscape is an area of glacial outwash having two main geomorphological zones: an outwash plain and a glacial lake spillway that originated in a predecessor of Lake Superior. Historically, the vegetation was dominated by barrens and dry forests of jack pine (*Pinus banksiana*) and scrub oak (*Quercus ilicifolia*). White pine and red pine (*Pinus resinosa*) forests also occurred. Current forests include oak dominated, pine dominated, and aspen-birch forests. Forty-six vascular plant species inhabiting the Northwest Sands are included on the Wisconsin Natural Heritage Working List, including four that are listed as Wisconsin endangered, nine as Wisconsin threatened, and 33 as Wisconsin special concern (DNR, 2015e). The generally north-south orientation of major river corridors, such as the St. Croix and Bois Brule, and the relatively unbroken condition of the forests that border them, makes them important for migratory birds and other animals.

Enbridge's Ino Pumping Station is located within the Bayfield Rolling Outwash Barrens land type association along the northeastern end of the Northwest Sands. Characteristic landforms include collapsed outwash plain with lakes common. Soils are mainly excessively drained sand over glacial outwash (Section 5.6.2). Common forest habitat types include associations of white pine, red maple, blueberry, and sessile bellwort (*Uvularia sessilifolia*); associations of white pine, oak, and wintergreen (*Gaultheria procumbens*); associations of white pine, red maple, blueberry, wild sarsaparilla, and hairy Solomon's seal (*Polygonatum pubescens*); and associations of white pine, oak, wintergreen, and New Jersey tea (*Ceanothus americanus*).

5.9.1.4 Challenges Revegetating Sandy Soils

Sandy soils, which are often associated with more droughty soils that are moderately well to excessively drained, are present within the proposed route. Enbridge estimated the proposed Line 5 relocation project would affect approximately 108.7 acres of droughty soil. Coarse soils drain water more quickly away from the root zone, causing faster-onset drought in these areas. The drier soils contain less water to aid in the germination and eventual establishment of new vegetation, which could make them more difficult to revegetate. Clearing, grading, and equipment movement could amplify the effects of droughty soils and reduce revegetation success. During both temporary and final stabilization, vegetation establishment could be challenging in droughty soils (Section 5.9.1.5). Depending on the weather conditions at the time of restoration, droughty soils could make revegetation much more difficult, causing local soil erosion. Erosion from droughty soils also removes nutrients and organic matter, which reverts slopes to a more highly disturbed state and further reduces water-holding capacity.

Mitigation strategies for droughty soils include watering, mulching, and re-seeding. Watering would be unlikely due to the progressive restrictions in equipment access post-restoration, outlined in Enbridge's EPP and other construction materials. Mulching would improve water retention characteristics during the plant establishment phase but would not help retain water in deeper soils as grasses used for restoration increase their root depth. Restoration of organic matter, which would ultimately improve the stability of these slopes in the long-term, typically takes decades, and accumulations could easily be lost from extreme erosion events; this would increase the long-term risk of erosion after vegetation restoration in these areas.

Because termination of coverage under the Construction Site General Permit requires documentation of uniform perennial vegetation of at least 70 percent density, it would be unlikely that droughty soils would pose a high long-term risk. However, if an area has poor water-retention capacity and remains droughty after closure of the permit, it could be susceptible to later erosion if additional droughts occur. Drought vulnerability effects interact with the cumulative effects of climate change, which are discussed more fully in Chapter 7. Warmer summer temperatures and more intermittent rainfall will both contribute to drought and soil water depletion past the wilting point, the point at which plants begin to wilt due to lack of water. This trend will likely exacerbate drought, especially in sandy soils.

5.9.1.5 Effects on Ecological Landscapes

Enbridge's proposed Line 5 relocation route and route alternatives would not significantly alter the landforms in the Superior Coastal Plain, North Central Forest, or Northwest Sands ecological landscapes. The nature of the pipeline project does not include largescale manipulation of existing topography. Only limited grading in construction workspaces would be used for installation of the proposed pipeline. Work zone topography would be restored as close as possible to pre-construction conditions as part of restoration efforts consistent with Enbridge's EPP (Appendix D).

Enbridge's proposed Line 5 relocation route and route alternatives would not significantly alter the interconnected nature of Lake Superior and the Superior Coastal Plain. The Lake would continue to have a strong influence on the climate, soils, and hydrology of the region.

The generally sandy nature of the soils in uplands of the Northwest and the clayey nature of the soils along much of Enbridge's proposed relocation route would not be significantly changed by installation of the proposed pipeline. Excavated soils would be backfilled into the excavation trench and covered with topsoil segregated from the site as detailed in Enbridge's EPP (Appendix D). Subsoil compaction on equipment travel areas would be alleviated using a deep tillage device or chisel plow. Section 19 of Enbridge's EPP (Appendix D) indicates that "should uneven settling or documented surface drainage problems occur following completion of pipeline construction and restoration, Enbridge will take appropriate steps to remedy the issue."

The Lake Superior coastal estuaries and extensive, inland peatlands are not in proximity to Enbridge's proposed Line 5 relocation route or route alternatives and are unlikely to be directly affected by pipeline construction. Coastal wetlands would, however, be susceptible to indirect effects from sedimentation or petroleum spills that could occur upstream (Section 6.4.4). A direct effect of construction would be the permanent changes in the landscapes resulting from the conversion of wooded or scrubby areas within Enbridge's proposed relocation route corridor to permanent herbaceous vegetation. A new open corridor cutting through contiguous forest stands along the proposed 41-mile route would contribute to habitat fragmentation for various plant and animal species. Loss of forested uplands and wooded wetlands, however, would generally not be considered to significantly impact the ecological landscapes because of the large existing areas of these types of resources within each landscape. At present, large-scale losses of these habitat types are not planned and the proposed route would not likely have significant cumulative impacts on habitat loss in the affected landscapes.

Northern Wisconsin, including the three ecological landscapes, has experienced impacts from regional and global climate change (Section 7.4). As discussed in Chapters 7 and 8, the GHG emissions from Enbridge's relocation of Line 5 along the proposed route or route alternatives would increase slightly. Relative to the statewide, national, and global GHG emissions, these increases would minimally contribute to changes in regional climate.

5.9.2 Natural Communities & Other Land Cover Types

Natural communities are interactive assemblages of plants, animals, and other organisms; their physical environment; and the natural processes that affect them. They are defined by the assemblage of plant and animal species that live together in a particular area, at a particular time. The DNR's Natural Heritage Inventory tracks all of Wisconsin's natural communities that are deemed significant because of their undisturbed condition, size, what occurs around them, or other reasons. Figure 5.9-3 and Figure 5.9-4 depict selected natural upland and wetland communities along Enbridge's proposed Line 5 relocation route and route alternatives. The sections that follow briefly describe each of these natural communities. Section 5.7.8.1 describes flowing water natural communities.

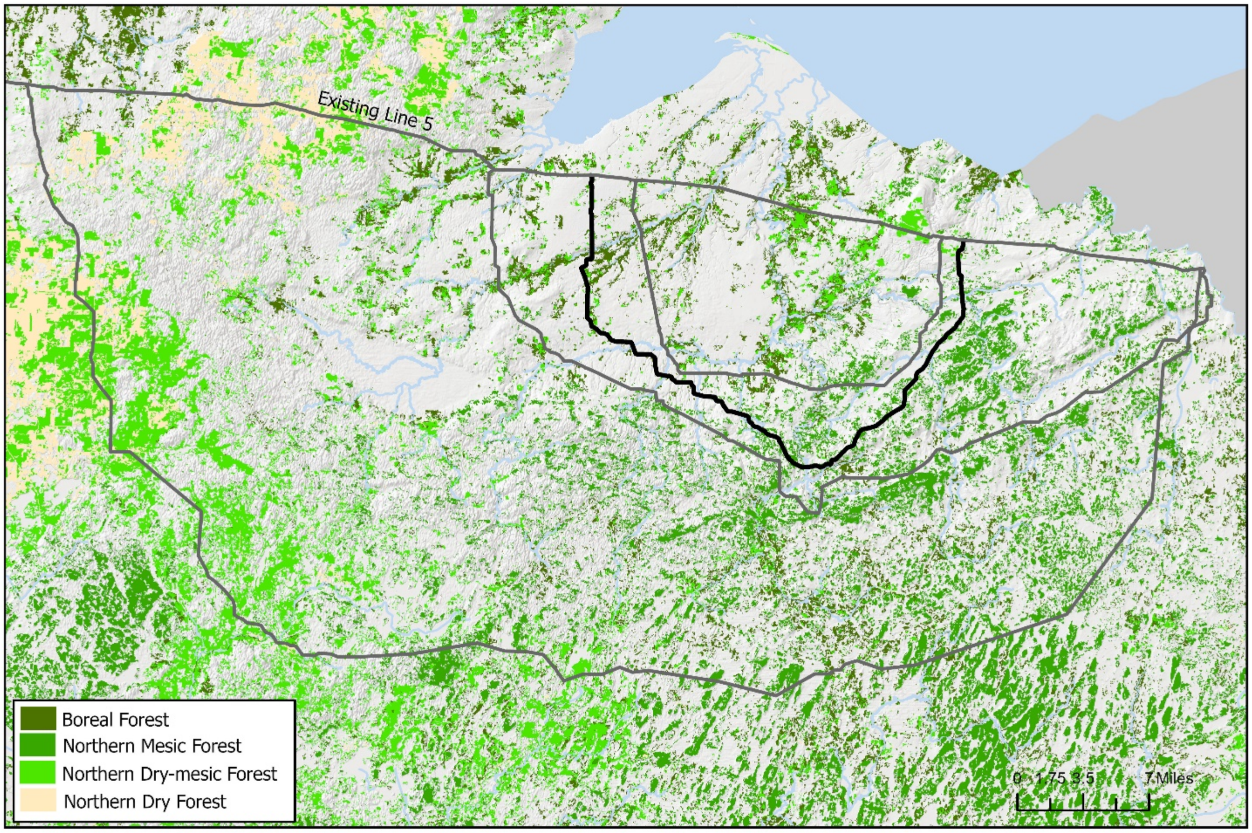


Figure 5.9-3 Select forested upland natural communities along Enbridge's proposed Line 5 pipeline relocation route and route alternatives.
Data Source: DNR

5.9.2.1 Boreal Forests

Boreal forests are mature upland forest stands dominated by white spruce and balsam fir, often mixed with paper birch, northern white cedar, eastern white pine, eastern hemlock, balsam-poplar, and quaking aspen. Common understory herbs include large-leaved aster (*Eurybia macrophylla*), blue-bead lily (*Clintonia borealis*), Canada mayflower (*Maianthemum canadense*), wild sarsaparilla, and bunchberry (*Cornus canadensis*). Stands in northwest Wisconsin are mostly associated with the Lake Superior clay plain. The boreal forest in Wisconsin is transitional between the mixed deciduous-conifer forests to the south and the spruce-fir dominated forests of Canada, so tree species richness is often greater here than in the boreal forests farther north.

5.9.2.2 Northern Mesic Forests

Northern mesic forests form the matrix for most of the other community types found in northern Wisconsin. They are found primarily north of the climatic Tension Zone on loamy soils of glacial till plains and moraines deposited by the Wisconsin glaciation. Sugar maple is dominant or co-dominant in most stands, regardless of their age or origin. Historically, eastern hemlock was the second most important species, sometimes occurring in nearly pure stands with eastern white pine. Both conifer species are greatly reduced in today's forests. Other important tree species are yellow birch, although yellow birch reproduction has become scarce in most stands, American basswood, and white ash (*Fraxinus americana*),. Characteristic subcanopy trees include balsam fir, ironwood (*Carpinus caroliniana*), and American elm (*Ulmus americana*). The shrub layer includes species such as alternate-leaved dogwood (*Cornus alternifolia*), beaked hazelnut (*Corylus cornuta*), leatherwood (*Dirca palustris*), American fly honeysuckle (*Lonicera canadensis*), prickly gooseberry (*Ribes cynosbati*), red elderberry (*Sambucus racemosa*), and maple-leaved arrow-wood (*Viburnum acerifolium*). Historically, Canada yew (*Taxus canadensis*) was an important shrub, but it is now absent from nearly all of its previous range, mostly due to deer browse. The ground layer varies from sparse and species-poor in hemlock stands with wood ferns (*Dryopteris intermedia*), blue-bead lily (*Clintonia borealis*), club-mosses (*Lycopodium* spp., *Dendrolycopodium* spp., etc.), and Canada mayflower to lush and species-rich with fine spring ephemeral displays of species like large-flowered trillium (*Trillium grandiflorum*), Dutchman's-breeches (*Dicentra cucullaria*), spring beauty (*Claytonia virginica*), and trout lilies (*Erythronium* spp.). Other characteristic species include white baneberry (*Actaea pachypoda*), downy Solomon's-seal (*Polygonatum pubescens*), wild sarsaparilla, rose twisted stalk (*Streptopus roseus*), starflower (*Trientalis borealis*), maidenhair fern (*Adiantum pedatum*), and lady fern (*Athyrium filix-femina*).

5.9.2.3 Northern Dry Mesic Forests

Northern dry-mesic forest is typically found on irregular glacial topography or in areas with mixed glacial features (e.g., pitted outwash interspersed with remnant moraines). Soils are loamy sands or sands, and less commonly, sandy loams, although some are in areas where bedrock is close to the surface. Eastern white pine and red pine are typically dominant, sometimes mixed with northern red oak (*Quercus rubra*), red maple, and occasionally, sugar maple. Paper birch, quaking aspen, and big-toothed aspen (*Populus grandidentata*) can also be present. Common understory shrubs include hazelnuts (*Corylus* spp.) and blueberries (*Vaccinium angustifolium* and *V. myrtilloides*), as well as low-growing species such as wintergreen and partridgeberry. Among the dominant herbs are wild sarsaparilla, Canada mayflower, and cow-wheat (*Melampyrum lineare*). Areas of northern dry-mesic forest that were historically dominated by red and white pines were considered the great "pineries" before the historical cutover period. Today, the extent of red and white pine is greatly decreased, while red maple, sugar maple, aspen (*Populus* spp.), and oaks (*Quercus* spp.) have increased. Historically, fire disturbance of low to moderate intensity and frequency was key to maintaining northern dry-mesic forests.

5.9.2.4 Northern Dry Forests

Northern dry forests most commonly occur on large, continuous glacial outwash or lake plain landforms. On these extensive dry plains, historic fires were large, intense, and less likely to be halted by wetlands, hills, or mesic soils, creating ideal conditions for establishment of this community type. Northern dry forest occurs on nutrient-poor sites with excessively drained sandy or rocky soils. Dominant trees of mature stands include jack pine, red pine, and northern pin oak (*Quercus ellipsoidalis*). Large acreages of this forest type were cut and burned during the historical cutover period. Much of this land was then colonized by paper birch or quaking aspen or converted to pine plantations starting in the 1920s. Today's forests have a greatly reduced component of pines and a greater extent of aspen, red maple, and oaks compared to historic conditions. Common understory shrubs are hazelnuts, early blueberry (*Vaccinium angustifolium*), and brambles (*Rubus* spp.). Common herbs include bracken fern (*Pteridium aquilinum*), starflower (*Trientalis borealis*), barren-strawberry (*Waldsteinia fragarioides*), cow-wheat, trailing arbutus (*Epigaea* *repens*), and members of the shinleaf family (*Chimaphila umbellata, Pyrola* spp.). Vast acreages of cut-over land were also planted to pine or naturally succeeded to densely stocked dry forests.

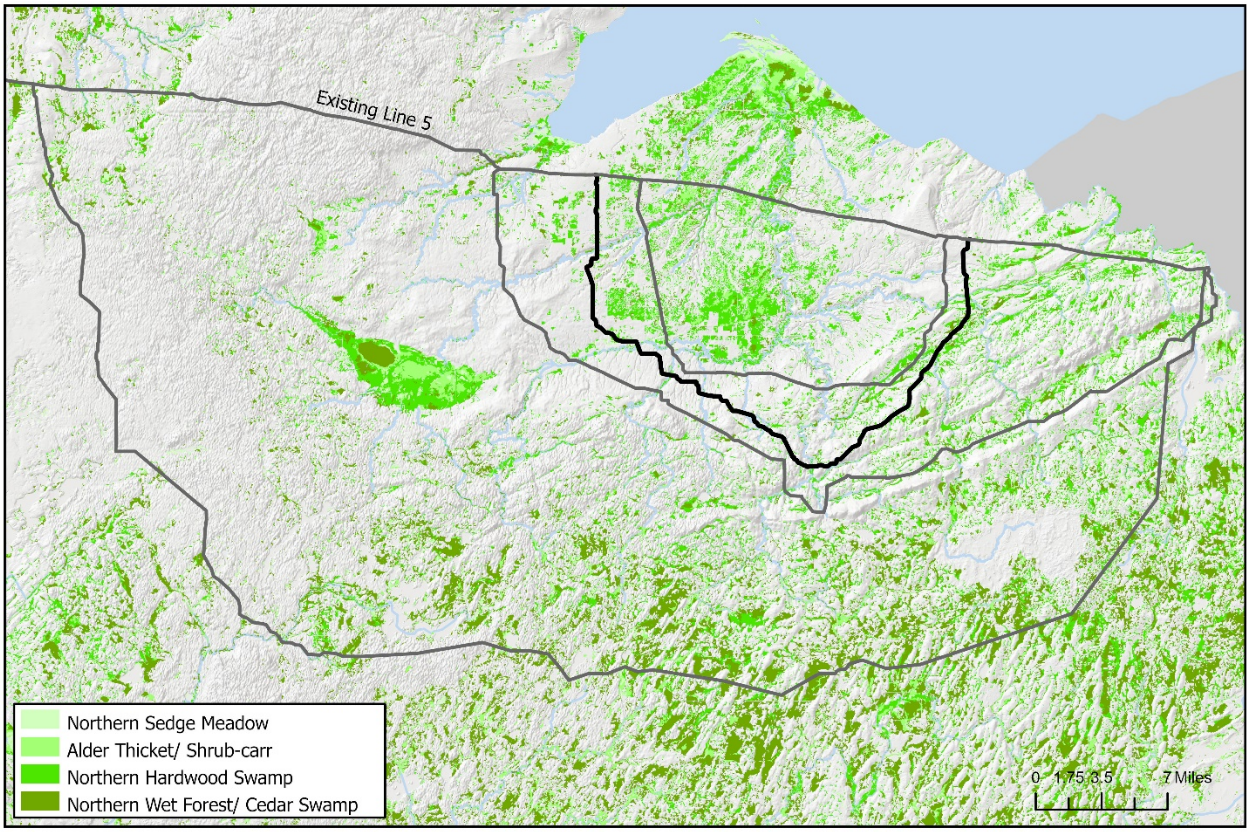


Figure 5.9-4 Select wetland natural communities along Enbridge's proposed Line 5 pipeline relocation route and route alternatives.
Data Source: DNR

5.9.2.5 Northern Sedge Meadows

This open wetland community is dominated by sedges and grasses and occurs primarily in northern Wisconsin. There are several common, fairly distinctive subtypes including tussock meadow, dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*); broad-leaved sedge meadow, dominated by the robust lake and common yellow lake sedges (*Carex lacustris* or *C. utriculata*); and wire-leaved sedge meadow, dominated by woolly sedge (*Carex lasiocarpa*) or few-seeded sedge (*Carex oligosperma*). Frequent associates include northern blue flag (*Iris versicolor*), marsh fern (*Thelypteris palustris*), marsh bellflower (*Campanula aparinoides*), manna grasses (*Glyceria* spp.), panicled aster (*Symphyotrichum lanceolatum*), and wool-grass (*Scirpus cyperinus*). Sphagnum mosses are either absent or they occur in scattered, discontinuous patches. Sedge meadows occur on a variety of landforms and in several ecological settings that include depressions in outwash or ground moraine landforms in which there is groundwater movement and internal drainage, on the shores of some drainage lakes, and on the margins of streams and large rivers. Soils of northern sedge meadows range from neutral to strongly acidic.

5.9.2.6 Alder Thickets

Alder thicket is a minerotrophic wetland community dominated by tall shrubs, especially speckled alder (*Alnus incana*). Shrub associates may include red-osier dogwood (*Cornus sericea*), nannyberry (*Viburnum lentago*), cranberry viburnum (*Viburnum opulus*), wild currants (*Ribes* spp.), and willows (*Salix* spp.). Among the characteristic herbaceous species are Canada bluejoint grass (*Calamagrostis canadensis*), orange jewelweed (*Impatiens capensis*), asters (*Symphyotrichum lanceolatum, S. puniceum,* and *Doellingeria umbellata*), boneset (*Eupatorium perfoliatum*), rough bedstraw (*Galium asprellum*), marsh fern (*Thelypteris palustris*), arrow-leaved tear-thumb (*Persicaria sagittata*), and sensitive fern (*Onoclea sensibilis*). This community type is sometimes a seral stage between northern sedge meadow and northern conifer swamp or northern hardwood swamp, but occurrences can be stable and persist at given locations for long periods of time. Alder thicket often occurs as a relatively stable community along streams and around lakes but can occupy large areas formerly covered by conifer swamps that were logged during the historic cutover period or where water tables rose. Stands of alder that originated following logging or wildfire will usually revert to forest, although on heavy, poorly drained soils, forest regrowth can be problematic owing to “swamping” effects. Groundwater seepage is an important attribute of alder thickets. Seepage areas are often indicated by the presence of skunk cabbage (*Symplocarpus foetidus*), marsh marigold (*Caltha palustris*), swamp saxifrage (*Micranthes pensylvanica*), American golden saxifrage (*Chrysosplenium americanum*), and marsh pennywort (*Hydrocotyle americana*).

5.9.2.7 Northern Hardwood Swamps

Northern hardwood swamps are deciduous forested wetlands that occur along lakes, streams, or in insular basins in poorly drained morainal landscapes. This community occurs across the state but is most common in the northern ecological landscapes. The dominant tree species is black ash, but in some stands red maple, yellow birch, and American elm are also important. Some sites may also have a minor conifer component of northern white cedar or balsam fir. The tall shrub, speckled alder (*Alnus incana*), may be locally common. The herbaceous flora is often diverse and may include many of the same species found in alder thickets. Typical species are marsh marigold, swamp raspberry (*Rubus pubescens*), common skullcap (*Scutellaria galericulata*), orange jewelweed, many sedges (*Carex* spp.), and groundwater-loving species like bristle-stalked sedge (*Carex leptalea*), American golden saxifrage (*Chrysosplenium americanum*), and swamp saxifrage. Soils may be mucks or mucky sands. Northern hardwood swamps are characterized by relatively constant water levels, often with a groundwater component, and dominance by deciduous hardwood species, especially black ash. Relatively stable water levels lead to saturated soils that inhibit organic matter decomposition and the development of peat. Northern hardwood swamps have many similarities with northern wet-mesic forests (cedar swamps), especially as both black ash and northern white cedar can be canopy associates in both communities.

5.9.2.8 Northern Wet Forests

Northern wet forest encompasses a group of weakly minerotrophic to strongly acidic, conifer-dominated peatlands located mostly north of the Tension Zone. The dominant trees are black spruce and tamarack. Jack pine is a significant component in some areas. This community forms primarily in kettle depressions or partially filled basins on glacial outwash landforms, moraines, and till plains, where the water table is near the surface or where drainage is somewhat impeded. The community also occurs along the margins of lakes and low-gradient streams. On the wetter side of the moisture gradient, this community tends to grade into muskeg, open bog, or poor fen. On the drier side, the spruce-tamarack swamps may grade into nutrient-rich swamp forests of northern white cedar or black ash, if a source of nutrient-enriched groundwater is present. In much of the type’s current range, the adjacent uplands are still forested, most often with second-growth stands of northern hardwoods, pine, or aspen. A minerotrophic moat (or “lagg”) may occur at the upland-wetland interface, and can support a diverse assemblage of tall shrubs, swamp hardwoods, and “rich” swamp conifers such as northern white cedar.

5.9.2.9 Ephemeral Ponds

Ephemeral ponds are topographic depressions with impeded drainage, usually in forest landscapes, that hold water for part of the growing season following snowmelt and spring rains but typically dry out by mid-summer. Ephemeral ponds provide critical breeding habitat for some invertebrates and amphibians. Ephemeral ponds also provide feeding, resting, and breeding habitat for songbirds and a source of food for many mammals. Wetland plants commonly found in this community include yellow water crowfoot (*Ranunculus flabellaris*), mermaid weed (*Proserpinaca palustris*), Canada bluejoint grass, floating manna grass (*Glyceria septentrionalis*), spotted cowbane (*Cicuta maculata*), smartweeds (*Polygonum* spp.), orange jewelweed, and sedges.

5.9.2.10 Cold-water Streams

Cold-water streams are best described as flowing waters with maximum water temperatures typically below 72° F during the summer. The watersheds of cold-water streams are usually less than 100 square miles, and the streams have mean annual flow rates of less than 50 cubic feet per second. Cold-water streams contain relatively few fish species and are dominated by trout and sculpins.

5.9.2.11 Natural Community Modeling

While the DNR has a general understanding of the distribution of natural communities across the landscape, neither Enbridge’s proposed Line 5 relocation route nor the route alternatives have been extensively surveyed to determine the natural communities present in the area. To address concerns raised in public hearing comments and written comments on the Draft EIS, the DNR attempted to develop models to predict where representative communities would most likely occur along the different ROWs. In consultation with the GLIFWC and tribal resource agency staff, DNR biologists selected an array of plants that reflect typical community compositions and include variation in ecological needs. DNR biologists compiled occurrence data from the Global Biodiversity Information Facility (GBIF) for each species. The GBIF data were combined with various environmental variables and Maxent software was used to model species niches and distributions. This software applies a machine-learning technique called maximum entropy modeling. From a set of environmental grids and georeferenced occurrence localities, the model expresses a probability distribution where each grid cell has a predicted suitability of conditions for the species. With certain assumptions about the input data and biological sampling efforts that led to the occurrence records, the model outputs can be interpreted as predicted probability of presence. Individual outputs for each species were combined to predict community distributions. The GBIF data were thinned to avoid spatial autocorrelation (cases where a model might incorrectly suggest areas of suitability where there happen to be more records) and the final models were trimmed to display the highest 80% area of predicted presence. Unfortunately, the resulting models performed poorly when compared to known plant and natural community distributions (i.e., predicted communities in areas they are not or would not be). As a result, the DNR chose not to use the model outputs in its analysis.

5.9.2.12 Effects on Natural Communities

Natural communities may contain rare or declining species and the DNR recommends their protection be incorporated into project design as much as possible. The acreages of natural community types that would be affected by the ROWs and temporary workspaces for Enbridge’s proposed Line 5 relocation route and route alternatives are summarized in Table 5.9-1 and Table 5.9-2. Table 5.9-3 and Table 5.9-4 provide acreages for other land cover types crossed by the route alternatives.

Table 5.9-1 Acreage of natural community types crossed by the permanent ROW in Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed	RA-01	RA-02	RA-03
Length of pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Upland natural community type				
Boreal forest	10.5	15.1	16.4	18.6
Northern mesic forest	38.4	10.9	50.7	87.0
Northern dry-mesic forest	7.5	5.6	8.1	78.4
Northern dry forest	1.3	0	0.4	47.6
Total	**57.7**	**31.6**	**75.6**	**231.6**
Wetland natural community type				
Northern sedge meadow	0.8	0.7	0.4	2.5
Alder thicket/Shrub-carr	0.6	0.8	1.3	10.2
Northern hardwood swamp	16.7	21.3	28.1	57.3
Northern wet forest/cedar swamp	2.7	6.5	8.6	83.8
Total	**20.8**	**29.3**	**38.4**	**153.8**

Table 5.9-2 Acreage of natural community types crossed by the temporary workspace in Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed	RA-01	RA-02	RA-03
Length of pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Upland Natural Community Type				
Boreal Forest	12.9	21.4	23.7	25.6
Northern mesic forest	64.7	15.3	72.2	122.3
Northern dry-mesic forest	14.6	7.8	10.8	109.4
Northern dry forest	3.7	0	0.5	67.0
Total	**95.9**	**44.5**	**107.2**	**324.3**
Wetland natural community types				
Northern Sedge Meadow	1.0	1.0	0.6	3.6
Alder Thicket/ Shrub-Carr	0.5	1.5	1.9	14.7
Northern Hardwood Swamp	18.8	27.2	38.2	78.9
Northern Wet Forest/Cedar Swamp	2.5	8.6	11.8	117.0
Total	**22.8**	**38.3**	**52.5**	**214.2**

The permanent loss of 152 acres of deciduous, coniferous, and mixed forest cover along Enbridge's proposed route, 132 acres along RA-01, 259 acres along RA-02, and 580 acres along RA-03 (Table 5.8-3) could indirectly affect a variety of plant and animal species by reducing and fragmenting available habitat. The loss of forest cover in temporary workspaces along the route alternatives ranges from 184 acres along RA-01 to 811 acres along RA-03, with 258 acres of loss along Enbridge's proposed Line 5 relocation route (Table 5.9-4).

Table 5.9-3 Acres of other land cover types in the permanent ROW of Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed	RA-01	RA-02	RA-03
Length of pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Forest				
Deciduous forest cover	127	102	221	324
Coniferous forest cover	21	27	32	232
Mixed forest cover	4	3	6	24
Total	**152**	**132**	**259**	**580**
Crops & grassland				
Crop rotation	35.6	12.5	22.9	1.0
Hay	25.8	20.7	30.1	2.4
Pasture	10	7.6	26.9	4.7
Grassland (non-pasture)	12.6	9.2	7.7	9.4
Total	**84**	**50**	**87.6**	**17.5**

Table 5.9-4 Acres of other land cover types in the temporary workspace of Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed	RA-01	RA-02	RA-03
Length of pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Forest				
Deciduous forest cover	220	142	307	452
Coniferous forest cover	32	38	45	325
Mixed forest cover	6	4	9	34
Total	**258**	**184**	**361**	**811**
Crops & grassland				
Crop rotation	101.4	17.3	32.3	1.4
Hay	69.9	28.3	40.6	3.4
Pasture	24	10.3	38.9	6.6
Grassland (non-pasture)	38.3	13.0	11.1	13.1
Total	**233.6**	**68.9**	**122.9**	**24.5**

The DNR’s June 10, 2024, Endangered Resources Review identified NHI Elemental Occurrences (EOs) for one terrestrial natural community (Boreal Forest) within one mile of Enbridge’s proposed Line 5 relocation route and two aquatic natural communities (Ephemeral Pond and Stream–slow, hard, cold) within two miles of the project. Effects from the proposed pipeline relocation on these three high-quality natural community EOs would not be anticipated:

- The DNR’s Endangered Resources Review determined the mapped boreal forest EO would not be crossed by Enbridge’s proposed Line 5 relocation route or route alternatives.

- The DNR’s Endangered Resources Review determined the mapped ephemeral pond EO is not present within or adjacent to Enbridge’s proposed Line 5 relocation route.

- The DNR's Endangered Resources Review determined a stream-slow, hard, cold natural community would be crossed by Enbridge's proposed pipeline relocation. Enbridge proposes crossing this natural community via HDD, so direct impacts would not be expected. Enbridge would implement invasive species and site restoration BMPs per Enbridge's EPP (Appendix D).

As noted elsewhere, much of Enbridge's proposed route, route alternatives, and vicinity has not been surveyed for high-quality natural communities due to being primarily on private land and Iron County Forest. Although Iron County Forest is public land, comprehensive surveys of natural communities have not been conducted there. Thus, there could be additional, undocumented high-quality natural communities along or near Enbridge's proposed project.

There are many cold-water streams, including trout streams, present in the three-county area. Possible impacts to these natural communities are discussed in Section 5.7.8. In general, cold-water streams that would be crossed by the proposed pipeline relocation would be temporarily impacted during construction from local disturbance and sedimentation. Adverse effects would be mitigated by implementing construction in accordance with Enbridge's EPP (Appendix D) along with state and federal permit conditions. In areas where cold-water streams are located within forested habitats, tree cover in the permanent ROWs would be permanently removed, possibly resulting in incremental increases in local water temperature.

5.9.3 State Natural Areas

Wisconsin State Natural Areas (SNAs) protect outstanding examples of Wisconsin's native landscape of natural communities, significant geological formations, and archeological sites. These areas are significant for scientific research, education, and preservation of genetic and biological diversity and provide some of the last refuges for rare plants and animals. Sites are considered for potential SNA designation in one or more of the following categories:

- Outstanding natural community.
- Critical habitat for rare species of plants or animals.
- Ecological benchmark reference area.
- Significant geological or archaeological feature.
- Exceptional site for natural area research and education.

SNAs include lands owned by the state, private conservation organizations, municipalities, other governmental agencies, educational institutions, and private individuals. Once secured by purchase or agreement, sites are formally "designated" as SNAs and become part of the SNA system. Designation confers a level of land protection through state statutes, administrative rules, and guidelines. A higher level of protection is afforded by the legal "dedication" of SNAs through Articles of Dedication, a special kind of perpetual conservation easement.

While most SNAs are open to the public, access may vary according to individual ownership policies. Public use restrictions could apply due to public safety or to protect endangered or threatened species or unique natural features. Lands could be temporarily closed due to specific management activities.

Six SNAs are in proximity to or crossed by Enbridge's proposed Line 5 relocation route and route alternatives. Each of these is briefly described in the sections that follow.

5.9.3.1 Copper Falls State Natural Area

The DNR owns Copper Falls SNA (No. 399), which is located approximately two miles from Enbridge's proposed Line 5 relocation route. The site features northern dry and dry-mesic forests along the shores of the meandering Bad River in Ashland County. On the low terraces of the river are two oxbows, which support dry-mesic forest dominated by large white pine, sugar maple, red maple, and white ash. Other tree species include hemlock, white cedar, paper birch, red oak, balsam fir, and white spruce. Ground flora includes beaked hazelnut (*Corylus cornuta*), American fly honeysuckle (*Lonicera canadensis*), wintergreen, partridgeberry, velvet-leaf blueberry (*Vaccinium myrtilloides*), and many species of ferns. A sugar maple-hemlock forest, which has not been disturbed since at least 1916, occurs along the steep slope of the west side of the river. Birds include blackburnian (*Setophaga fusca*), black-and-white (*Mniotilta varia*), Nashville (*Leiothlypis ruficapilla*), northern parula (*Setophaga americana*), and Canada (*Cardellina canadensis*) warblers, ovenbird (*Seiurus aurocapilla*), American redstart (*Setophaga ruticilla*), blue-headed vireo (*Vireo solitarius*), hermit thrush (*Catharus guttatus*), and common raven (*Corvus corax*). The area was designated a SNA in 2003.

5.9.3.2 White River Boreal Forest State Natural Area

The DNR owns the White River Boreal Forest SNA (No. 670), which is located approximately 2.8 miles east of Enbridge's proposed Line 5 relocation route along the White River in Ashland County. White River Boreal Forest SNA has good quality boreal forest and mesic floodplain terrace communities. The boreal forest occurs on the narrow ridge-tops and steep clay slopes along the White River. The White River Boreal Forest SNA helps to maintain a connection between the Bibon Swamp and White River Breaks SNAs. Along the river terraces is mesic floodplain forest with many southern species, including sugar maple, basswood, green ash (*Fraxinus pennsylvanica*), and white spruce. Ground flora includes cut-leaf toothwort (*Cardamine concatenate*), Virginia spring beauty (*Claytonia virginica*), yellow trout-lily (*Erythronium americanum*), Dutchman's breeches (*Dicentra cucullaria*), and false rue anemone (*Isopyrum biternatum*). Rare plants and animals are present including black-billed cuckoo (*Coccyzus erythropthalmus*), Cape May warbler (*Dendroica tigrina*) and wood thrush (*Hylocichla mustelina*). The area was designated a SNA in 2013.

5.9.3.3 White River Breaks State Natural Area

The DNR owns the White River Breaks SNA (No. 671), which is located approximately 3.0 miles west of Enbridge's proposed Line 5 relocation route in Bayfield County along the steep banks and level floodplain of the White River. The steep clay bluffs contain a mix of forested and non-forested areas with species such as red pine, white pine, northern white cedar, and paper birch present. Open areas contain characteristic clay seepage bluff species such as showy lady's-slipper orchid (*Cypripedium reginae*). Other plants include buffaloberry (*Shepherdia canadensis*), speckled alder (*Alnus incana*), Canada goldenrod (*Solidago canadensis*), pearly everlasting (*Anaphalis margaritacea*), and golden sedge (*Carex aurea*). The mesic floodplain terrace tree species include river birch, black ash, northern white cedar, white spruce, balsam fir, and quaking aspen. The ground layer includes wood anemone (*Anemone nemorosa*), large leaf aster (*Eurybia macrophylla*), and Canada mayflower, large-flowered trillium (*Trillium grandiflorum*), northern green orchid (*Platanthera aquilonis*), blue-flag iris (*Iris versicolor*), golden ragwort (*Senecio aureus*), and northern bedstraw (*Galium boreale*). The area was designated a SNA in 2013.

5.9.3.4 Lake Two Pines State Natural Area

The Lake Two Pines SNA (No. 669) is located within the DNR's White River State Fishery Area in Bayfield County, approximately one-half mile west of Enbridge's proposed Line 5 relocation route in Ashland County. The area was designated a SNA in 2013 and provides a diverse mix of upland forest, active springs, and open and forested wetland communities. There is a high-quality dry-mesic forest near the north and west shores of Lake Two with a mixed canopy of hardwoods and conifers. Large diameter red and white pines dominate the canopy with sugar maple, red maple, and paper birch. The shrub and ground layer include beaked hazelnut, early low blueberry, wintergreen, wild sarsaparilla, Canada mayflower, roughleaf ricegrass (*Oryzopsis asperifolia*), sweet cicely, and Pennsylvania sedge (*Carex pensylvanica*). Areas of northern sedge meadow are present along the springs and spring runs. Tussock sedge, blue joint grass, and sweet gale (*Myrica gale*) are common along the edges while lake sedge and broad-leaf cattail dominate the center of the meadow. Breeding birds present include ovenbird, scarlet tanager, blackburnian warbler, Nashville warbler, northern parula, and black-throated green warbler.

5.9.3.5 Sajdak Springs State Natural Area

The Sajdak Springs SNA (No. 171) is located within the DNR's White River State Fishery Area in Bayfield County, approximately one-half mile west of Enbridge's proposed Line 5 relocation route in Ashland County. It was designated as a State Natural Area in 1981 and features a series of soft water springs originating from a north-facing moraine that feeds a small trout stream. Aspen, maple, white cedar, and alder make up the canopy of this natural area. The stream has open marshy banks dominated by horsetail (*Equisetum* spp.), great bulrush, scarlet pimpernel (*Anagallis arvensis*), and round-leaved monkeyflower (*Mimulus glabratus*). Additional species include blue-joint grass, angelica (Angelica), purple-fringed orchid (*Platanthera psycodes*), spotted jewelweed, marsh marigold, water hemlock (*Cicuta douglasii*), cow parsnip (*Heracleum maximum*), and Michigan lily (*Lilium michiganense*). A sugar maple-aspen forest dominates the surrounding uplands. The understory contains thimbleberry (*Rubus parviflorus*), wild sarsaparilla, wild ginger (*Asarum canadense*), large-leaved aster, drooping woodreed (*Cinna latifolia*), round-lobed hepatica, false Solomon's seal, and miterwort (*Mitella*).

5.9.3.6 Island Lake Hemlocks State Natural Area

The DNR-owned Island Lake Hemlocks SNA (No. 595), which features one of the oldest (250-plus-year-old) and most intact old-growth hemlock-hardwood stands in northern Wisconsin, a habitat that is extremely rare in today's landscape. The "island" is situated within an extensive conifer-shrub swamp and includes 10-acres of undisturbed, old-growth hemlock and yellow birch with some trees reaching 30 inches in diameter. Scattered throughout the SNA are kettle depressions containing small stands of swamp hardwoods and mixed conifer swamp. Hemlock regeneration is notable along the edges of some of these wetter areas. Balsam fir is common in canopy gaps as saplings and small trees, but mixed thickets of hemlock-fir saplings occur on the western and southern edges. An open bog/muskeg is present within the site's interior and small ephemeral ponds are found in areas with a perched water table. Resident bird species include the blackburnian warbler, black-throated green warbler, chimney swift, pileated woodpecker, and golden-crowned kinglet. Island Lake Hemlocks and the surrounding area is also critical habitat for a state-endangered species that has a breeding population in the central part of Iron County. Island Lake Hemlocks was designated a SNA in 2009.

5.9.3.7 Bearsdale Creek & Hyatt Springs State Natural Area

The U.S. Forest Service owns the Bearsdale Creek and Hyatt Springs SNA (No. 471), which was designated a SNA in 2007. This site is also recognized by the U.S. Forest Service as an established Research Natural Area. The site supports a unique wet-mesic forest grading into a hardwood swamp dominated by bur oak, basswood, and black ash. Bearsdale Creek passes through the stand and might act as its flood source contributing rich alluvial soils. An upland northern mesic forest is dominated by bur oak and basswood with sugar maple, green ash, and black cherry. A very rich, diverse understory includes wood nettle (*Laportea canadensis*), wild leek, bloodroot (*Sanguinaria canadensis*), bottlebrush grass (*Elymus hystrix*), ostrich fern, and American starflower (*Trientalis borealis*). The northern hardwood swamp is dominated by black ash, bur oak, and box elder (*Acer negundo*) with a thick understory of prickly ash (*Zanthoxylum americanum*), hawthorne (*Crataegus monogyna*), and hops (*Humulus lupulus*). The site is seasonally flooded. Situated on rough knobs and kettle topography is a mature, second-growth dry-mesic forest dominated by red and white pines. Canopy associates include red maple, red oak, paper birch, bigtooth aspen (*Populus grandidentata*), black cherry (*Prunus serotina*), and balsam fir. Pine reproduction is generally sparse, though pockets of sapling white pine occur. The shrub layer is moderate to dense with beaked hazelnut, serviceberry and *Rubus* spp. Characteristic herbs include bracken fern, winterberry, large-leaved aster, early low blueberry, velvet-leaf blueberry, narrow-leaved cow-wheat and lycopods. There has been little to no disturbance in this stand since the historical cut-over period. The spring runs and ponds (including Hyatt springs, Shunenberg Creek, and Bearsdale Creek) are small, hard-water and landlocked. They emanate from springs and flow in a westerly direction, then disappear in the fine sands. All support small populations of minnows and brook trout.

5.9.3.8 Effects on State Natural Areas

Enbridge's proposed Line 5 relocation route would be located over one-half mile south of the Copper Falls SNA and would not be expected to have direct effects on the SNA. RA-01 would cross Copper Falls SNA and would directly affect 6.8 acres. Many of the temporary effects discussed for other resources would occur within the SNA if RA-01 would be constructed. There would be no direct effects on Copper Falls SNA from RA-02 and RA-03, which are not located in proximity to the SNA. Indirect effects, long term effects, and cumulative effects would not be anticipated from any of the route alternatives except RA-01. However, there could be indirect effects from sediment transport caused by erosion during construction or if a petroleum spill occurs upstream.

The White River Boreal Forest SNA is located approximately 2.8 miles east of Enbridge's proposed Line 5 relocation route and 0.1 miles east of RA-01. RA-02 and RA-03 are not near White River Boreal Forest SNA. Direct effects to the White River Boreal Forest SNA would not be anticipated from the route alternatives. However, there could be indirect, long-term, or cumulative effects from sediment transfer caused by erosion during construction or if an HDD inadvertent release or petroleum spill occurs on the White River upstream.

Direct effects on the White River Breaks SNA would not be anticipated from Enbridge's proposed Line 5 relocation route or route alternatives. The White River Breaks SNA is located approximately 3.0 miles west of the proposed route and 1.6 miles east of RA-02. Routes RA-01 and RA-03 are not near White River Breaks SNA. However, there could be indirect, long-term, or cumulative effects from sediment transfer caused by erosion during construction or if an HDD inadvertent release or a petroleum spill occurs on the White River upstream.

Lake Two Pines SNA and Sajdak Springs SNA are located within the DNR's White River State Fishery Area. Direct effects on these two SNAs would not be anticipated from Enbridge's proposed Line 5 relocation route or route alternatives. However, there could be indirect, long-term, or cumulative effects from sediment transfer caused by erosion during construction or if an HDD inadvertent release or a petroleum spill occurs on the White River upstream.

RA-03 would cross 1.8 acres of the Island Lake Hemlocks SNA and 4.5 acres of the Bearsdale Creek and Hyatt Springs SNA and would have direct effects associated with pipeline construction and operations.

5.9.4 Federal & State Endangered, Threatened, & Special Concern Plants & Lichens

Approximately 1,800 species of native plants have been identified in Wisconsin. Fifty-eight are listed as threatened by the DNR and 72 are listed as endangered. Three of these plants are also listed by the federal government as threatened and 3 are listed as federally endangered. The DNR completed an Endangered Resources Review (Section 5.9.4.1) as part of the overall environmental review of Enbridge's proposed Line 5 relocation project. This review primarily included state-listed species documented in the NHI database but also included known records of federally listed species in the proposed project area and nearby vicinity. The USACE reviewed species that are federally listed and consulted with the USFWS (Section 5.9.4.1). This section describes the rare plant species within proximity of Enbridge's proposed Line 5 relocation route. Sections 5.10.8 and 5.10.9 discuss endangered and threatened species of wildlife.

5.9.4.1 Endangered Resources Review & USFWS Consultation

In October 2019, Enbridge conducted an initial Endangered Resources Review for its proposed Line 5 relocation route. The DNR completed its latest Endangered Resource Review renewals in June 2024. Twenty-nine endangered resources on the NHI Working List, including five plants and two lichens (Table 5.9-5), were identified as having a known occurrence within one mile for terrestrial and wetland species or two miles for aquatic species of the proposed Line 5 relocation route. The NHI Working List is made up of species known or suspected to be rare in the state along with natural communities and geological features native to Wisconsin. It includes species legally designated as threatened or endangered, as well as species in the advisory special concern category. Per s. 29.604, Wis. Stat., state-listed plants are only protected on public lands and therefore, avoidance would only be required when on these types of properties although the DNR would encourage Enbridge to protect plants elsewhere.

The following sections describe these plant species within proximity of Enbridge's proposed Line 5 relocation route (Table 5.9-5). The NHI records along the alternative routes will not be discussed in detail. However, there were 14 state-listed species for RA-01, 36 state-listed species for route RA-02, and 38 state-listed species for route RA-03 (Enbridge, 2020e).

Independent of this EIS, consultation under Section 7 of the Endangered Species Act (Section 1.4.1.8) is required for Enbridge's proposed Line 5 relocation project because of the need for an Individual Permit authorization from the USACE. In accordance with Section 7, the USACE as the federal action agency, in coordination with the USFWS, must ensure that any action authorized, funded, or carried out, in whole or in part, by the agency does not jeopardize the continued existence of a federally listed threatened or endangered species or result in the adverse modification of the designated critical habitat of a federally listed species. If a proposed action is likely to adversely affect a listed species or designated critical habitat, the USACE must submit a request for formal consultation to comply with Section 7. The USFWS would then issue a Biological Opinion as to whether the federal action (i.e., filling of wetlands) would likely jeopardize the continued existence of a listed or proposed species or result in the destruction or adverse modification of designated or proposed critical habitat.

The USACE generated an official list of federally listed threatened and endangered species using the USFWS Information for Planning and Consultation tool. The official species list identified seven listed species, including one plant, Fassett's locoweed. Fassett's locoweed did not come up in the DNR's Endangered Resources Review. The USACE initiated informal consultation with the UWFWS for the project in October 2020.

Table 5.9-5 Rare plants and lichens recorded from within Enbridge's proposed relocation route ROW and surrounding area.

Species	State status	Federal status
Fassett's locoweed (*Oxytropis campestris* var. *chartacea*)		THR
Butternut (*Juglans cinerea*)	SC	
Sweet colt's-foot (*Petasites sagittatus*)	THR	
Braun's holly-fern (*Polystichum braunii*)	THR	
Torrey's bulrush (*Schoenoplectus torreyi*)	SC	
Vasey's pondweed (*Potamogeton vaseyi*)	SC	
Fringed rosette lichen (*Physcia tenella*)	SC	
Yellow specklebelly (*Pseudocyphellaria holarctica*)	SC	

THR = Threatened
SC = Special Concern

5.9.4.2 Fassett's Locoweed

Fassett's locoweed is a federally threatened species. It is a perennial in the pea family that grows on gentle slopes in sand-gravel shorelines around groundwater-fed, shallow lakes that are subject to water level fluctuations. The plant depends on a large seed bank and the open habitat (above the water line) provided when lake levels are low for long-term population maintenance (USFWS, 2003). Botanical field surveys by Enbridge's consultants along the proposed Line 5 relocation route did not detect Fassett's locoweed. Detailed evaluation of the alternative route corridors would require botanical field surveys to identify the presence or absence of the species. However, neither the proposed route nor the route alternatives would be located adjacent to inland lake environments. Impacts to Fassett's locoweed are not anticipated from implementation of either Enbridge's proposed route or the route alternatives. In February 2021, the USFWS provided concurrence regarding the USACE's "no effect" determination for Fassett's locoweed. If the species were to be identified during construction or future botanical surveys, Enbridge would need to consult with the USFWS.

5.9.4.3 Butternut

Butternut, a Wisconsin special concern plant, prefers sandy loam soils and is found in mesic hardwood and riparian hardwood forests, where it grows in association with basswood, American elm, sugar maple, northern red oak, Virginia springbeauty (*Claytonia virginianica*), and blue-stemmed goldenrod (*Solidago caesia*). Ashland County is one of only three counties where butternut has been documented in Wisconsin. Blooming occurs April to June and fruiting occurs in October. Enbridge conducted surveys for butternut in 2019 and identified occurrences of the tree approximately 0.4 miles outside of the proposed project area. The DNR's Endangered Resources Review determined that the plants are outside the proposed project workspace and that there would be no impacts to this species.

5.9.4.4 Sweet Colt's-foot

Sweet colt's-foot, a Wisconsin threatened plant, is found in cold marshes and swamp openings, often forming large clones. Associated species include Canada blue joint grass (*Calamagrostis canadensis*), meadow willow (*Salix petiolaris*), speckled alder (*Alnus rugosa*), red osier dogwood (*Cornus stolonifera*), tussock sedge (*Carex stricta*), and clustered bur-reed (*Sparganium glomeratum*). This species can hybridize with golden palms colt's-foot (*Petasites palmatus*). Blooming occurs throughout May; fruiting occurs throughout June. Enbridge identified this species during 2019, 2022, and 2023 field surveys on public land. A proposed access road currently overlaps with the population of sweet colt's-foot that was identified during the field survey. Enbridge would modify the access road to avoid the plant population in this location. As all proposed work will be avoiding known plants on public lands, no impacts are expected.

5.9.4.5 Braun's Holly-Fern

Braun's holly-fern is a Wisconsin threatened plant found in hardwood or mixed conifer-hardwood forests near ravine bottoms of the North Central Forest Ecological Landscape, and occasionally the Superior Coastal Plain. In addition, the fern occurs in areas of cold air drainage, on gentle to moderately steep rocky forested slopes, and at the bases of moist cliffs. An individual Braun's holly-fern was observed during 2019 surveys on private land outside of Enbridge's proposed project workspace. Although not required because the plant was identified on private land, the DNR has recommended that measures be implemented to avoid or minimize take of this species at this location.

Enbridge originally conducted surveys for the Braun's holly-fern on public lands during the 2020 field season. No observations were recorded within the MP range of the survey. As a result, the DNR concluded there would be no effects on Braun's holly-fern on public lands within the surveyed area. Following these surveys, an additional incidental detection of this species occurred within the general area; therefore, Enbridge voluntarily expanded its survey effort to include surveys along its proposed Line 5 relocation route across all public lands. The results of these surveys, which were conducted during the 2022 and 2023 field seasons, included seven individual Braun's holly-fern observations on public land. As take of these individuals cannot be avoided, Enbridge anticipates applying for an incidental take permit/authorization (Section 1.4.3.14).

5.9.4.6 Torrey's Bullrush

Torrey's bulrush, a Wisconsin special concern plant, occurs on wet, sandy soils along the shores of shallow lakes and lagoons, primarily in northwest Wisconsin. Associated species include three-way sedge (*Dulichium arundinaceum*), seven-angled pipewort (*Eriocaulon septangulare*), common reed (*Phragmites australis*), creeping crowfoot (*Ranunculus reptans*), Baltic rush (*Juncus balticus*), common spikerush (*Eleocharis smallii*), nodding beggarticks (*Bidens cernua*), water pepper (*Polygonum hydropiper*), three-square bulrush (*Scirpus pungens*), hardstem bulrush (*S. acutus*), and broadleaf arrowhead (*Sagittaria latifolia*). Blooming occurs from late June through late July, fruiting occurs throughout August. The optimal identification period for this species is early July through August. The DNR's Endangered Resources Review determined there is no habitat within Enbridge's proposed Line 5 relocation ROW, and therefore, no impacts would be expected.

5.9.4.7 Vasey's Pondweed

Vasey's pondweed is a state special concern species found in bays of large soft-water lakes as well as rivers and ponds. Associated species include *Elodea canadensis*. Blooming occurs throughout July and fruiting occurs in early August through early September. The optimal identification period for this species is throughout August. Suitable aquatic habitat for the Vasey's pondweed may be present within the proposed ROW. This species is likely sensitive to water quality and if suitable habitat would be impacted, avoidance and minimization efforts could include site surveys to confirm presence/absence, avoiding or minimizing work in areas of occupied habitat, and implementation of erosion and siltation control measures. The aquatic habitat for this species will be crossed via HDD, avoiding direct impacts to this waterbody.

5.9.4.8 Fringed Rosette Lichen

Fringed rosette lichen, a Wisconsin special concern species, is found most often on bark toward the base of the trees but occasionally on rock. Associated species include black ash and red maple. The upper surface is white to grey-green, often with tiny blocks spots. Branches are linear with long-ciliate tips, cilia grade from translucent to white to black. Suitable habitat for fringed rosette lichen may be present within or immediately adjacent Enbridge's proposed Line 5 relocation ROW. Although not protected under the state endangered species law, the DNR has recommended that measures to reduce impacts on the fringed rosette lichen be implemented.

5.9.4.9 Yellow Specklebelly

A foliose lichen, yellow specklebelly has a tan or brownish lichen body with small reticulate ridges on the upper surface. On the ends of the lobes of mature specimens, round patches of bright yellow powdery granules of algae and fungus can be found. This Wisconsin special concern species is found in habitats that are moist, shady, and often foggy. Substrates for this lichen are varied, including mossy rocks and a variety of trees, especially northern white cedar in mature hardwood and conifer forests. When found on trees, this lichen usually occurs three to four feet above the ground and is at least partially shaded by the tree on which it is growing. Suitable habitat for yellow specklebelly may be present within or immediately adjacent Enbridge's proposed Line 5 relocation ROW. Although not protected under the state endangered species law, the DNR has recommended that measures to reduce impacts on the yellow specklebelly be implemented.

5.10 Wildlife

The principal habitats that occur along Enbridge's proposed Line 5 relocation route and route alternatives are, in order of decreasing frequency of occurrence, deciduous and coniferous forests, grasslands, agricultural lands, emergent wetlands, developed and urban areas, barrens, and open water. Each of these habitats supports specific types of wildlife and a diverse range of fauna occur throughout the three-county project area. The following summary of wildlife-habitat relationships is based on the habitat descriptions and geographic distributions from DNR (1997).

Mammalian species typical of Wisconsin's deciduous forests include, but are not limited to, eastern chipmunk (*Tamias striatus*), eastern gray squirrel (*Sciurus carolinensis*), porcupine (*Erethizon dorsatum*), gray wolf (*Canis lupus*), gray fox (*Uroncyon cineroargenteus*), and white-tailed deer (*Odocoileus virginianus*). Some of these species, as well as others such as red squirrel (*Tamiasciurus hudsonicus*), fisher (*Martes pennanti*), and black bear (*Ursus americanus*), also inhabit northern Wisconsin's coniferous forests. Other species, like least chipmunk (*Neotamias minimus*), American marten (*Martes americana),* and snowshoe hare (*Lepus americanus*), are more associated with coniferous forests but can be observed using northern hardwoods. The structural diversity of the northern forests provides a variety of habitats that can support raptors like northern goshawk (*Accipiter gentilis*), red-shouldered hawk (*Buteo lineaus),* and sharp-shinned hawk (*Accipiter striatus*); migratory birds like American woodcock (*Scolopax minor),* thrushes (Turdidae), vireos (Vireonidae), and warblers (Parulidae); and resident birds like ruffed grouse (*Bonasa umbellus),* northern cardinal (*Cardinalis cardinalis*), nuthatches (*Sitta* spp.), and woodpeckers (Picidae). Section 5.9.2 provides descriptions of various forested natural communities found in the region.

Mammals typical of northern Wisconsin's agricultural lands, shrub-scrub areas, grasslands, or areas of mixed habitats include, but are not limited to, moles (Talpidae), shrews (Soricidae), bats (Vespertilionidae), mice and voles (Cricetidae), jumping mice (Dipodidae), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), woodchuck (*Marmota monax*), eastern cottontail (*Sylvilagus floridanus*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), weasels (*Mustela* spp.), badger (*Taxidea taxus*), Virginia opossum (*Didelphis virginiana*), coyote (*Canis latrans*), and red fox (*Vulpes vulpes*). These areas also support numerous bird species like northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), killdeer (*Charadrius vociferus*), sharp-tailed grouse (*Tympanuchus phasianellus*), and eastern bluebird (*Sialia sialis*).

Emergent wetlands and open water in northern Wisconsin provide habitat for a variety of aquatic wildlife, including, but not limited to, mammals like muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), and river otter (*Lontra canadensis*); birds such as herons and egrets (Ardeidae), swallows (Hirundinidae), dabbling ducks (Anatidae), diving ducks like canvasback (*Aythya valisineria*), and red-winged blackbird (*Agelaius phoeniceus*); and reptiles and amphibians such as painted turtle (*Chrysemys picta*), snapping turtle (*Chelydra serpentina*), eastern garter snake (*Thamnophis sirtalis*), and mudpuppy (*Necturus maculosus*). Forested wetlands provide additional habitat for terrestrial mammals such as bobcat (*Lynx rufus*) and mink (*Neovison vison*); birds like barred owl (*Strix varia*), great horned owl (*Bubo virginianus*), wood duck (*Aix sponsa*), and rose-breasted grosbeak (*Pheucticus ludovicianus*); and amphibians such as red-backed salamander (*Plethodon cinereus*), spring peeper (*Pseudacris crucifer*), and wood frog (*Lithobates sylvaticus*). Section 5.9.2 provides descriptions of various wetland natural communities found in the region.

5.10.1 General Effects of Construction on Wildlife

Effects on wildlife during construction and operation of any of Enbridge's pipeline relocation route alternatives could include disturbance from noise and human activity and associated stress and loss of breeding success, direct mortality during construction and operation, and habitat alteration, loss, and fragmentation. This section provides a general overview of these types of short-term and long-term direct and indirect effects.

Construction noise and human activity would cause displacement of mobile wildlife species including birds and mammals along the pipeline route. Initial clearing and grading activities could injure or kill smaller, less mobile animals such as amphibians, reptiles, and small mammals that cannot easily escape. Larger and more mobile animals would likely disperse from the construction ROW and immediate surrounding area during construction. These species may encounter added hardships from displacement and exert extra energy finding new denning/resting locations, having to forage for food and water outside their normal home ranges, and defending themselves in territorial disputes and against predators.

Displaced individuals may temporarily occupy adjacent, undisturbed areas. This could increase vulnerability or mortality due to increased competition and territorial disputes with other individuals in those areas. Some individuals may return to previously occupied areas after construction has been completed and habitat has become reestablished; however, this could not occur in forested areas where trees and woody vegetation would be cleared for construction and inspection purposes. In these areas, permanent habitat effects would occur.

Initial clearing and grading activities could damage or destroy wildlife burrows, dens, and nests. The intensity of effects would depend on the species and the time of year that construction was carried out. Rabbit warrens and rodent burrows would likely be destroyed during construction if they occur within the construction ROW, and construction could subsequently render these areas unsuitable for burrowing animals due to soil compaction. These animals, which are generally abundant and adaptable, would likely move to adjacent areas and reconstruct burrows in these areas, although increased competition for space and territorial disputes could occur.

During construction, the ROWs and pipeline construction corridors can be temporary barriers to wildlife movements. Small mammals that attempt to cross the cleared ROW could fall into the pipeline trench and be stranded, and they could be predated upon by coyotes, foxes, avian predators, etc. The DNR proposes to require trenches to be sloped where started and ended to allow ramps for wildlife to escape.

Habitats would be altered until they are reestablished (in the case of grasslands) or would be permanently lost (in the case of forest lands), resulting in temporary to permanent displacement of some wildlife species. Loss of forested upland and wetland habitat in the permanent ROW would represent permanent effects. Along the western portion of Enbridge's proposed Line 5 relocation route, fragmentation of forested and shrub wetlands would be lower because a portion of the proposed corridor would be collocated with an existing utility corridor and more of the route would be sited in or adjacent to roadways and existing farm fields. Fragmentation of forested and shrub wetlands would be anticipated to be greater along the eastern end of the proposed route where the pipeline would pass through larger blocks of intact and contiguous forest. Individuals occupying these habitats would be forced to relocate elsewhere. However, forested habitats are abundant in the ecological landscapes crossed by Enbridge's proposed relocation route and route alternatives, and the loss of these forested habitats would represent small fractions of the available forest resources in the region.

The effects to wildlife associated with habitat fragmentation vary depending on the species. Some species require large tracts of similar habitats (low interspersion), whereas others use a variety of habitats at different times of the year or different life stages and require multiple habitat types near one another (high interspersion). For example, many bird species, like neotropical migrants, have low interspersion requirements and feed and reproduce most successfully in continuous tracts of mature forest habitat. Other bird species, like ruffed grouse, have high interspersion preferences and use a variety of different habitats for food, cover, and reproduction. The creation of Enbridge's proposed new pipeline corridor would result in more edge and "edge affect" where changes in community structure occur at the boundary of two or more habitats. As the edge effects increase, the boundary habitat benefits species with high interspersion preferences. Forest interior birds would be negatively affected by fragmentation.

After construction, maintained ROWs could be used as travel corridors by some edge-adapted species, big game animals, predators, and humans. Increased human use could lead to increased wildlife disturbances and hunting pressure (Hinkle et al., 2002), particularly in areas along the ROW that are perceived to no longer be private property. Maintained ROWs would increase fragmentation and eliminate travel corridors for species that use forested cover for daily travel or migratory purposes. Small populations are more susceptible to extirpation than large populations, especially if immigration and emigration are limited. Protection and enhancement of corridors can provide buffers against potential negative effects associated with climate change (Travers, Härdtle, and Matthies, 2021).

The effects on resident birds are anticipated to be like those on migratory birds. Pipeline construction in agricultural areas where farming practices already constitute a regular disturbance are not likely to have permanent effects on bird species. Construction activities in agricultural areas could result in indirect effects on adjacent habitats, although these areas generally would already be affected by farming activities on a regular basis. Generally, pipeline construction and operations in agricultural areas would not have long-term or cumulative effects.

During operation, pipeline monitoring would include low-level helicopter flights and ground-based inspections, which could cause periodic disturbance to wildlife within and near the ROW (Section 5.1.6). Removal of woody vegetation or pipeline repairs would result in effects like those for construction, although the extent and duration of the effects would likely be much shorter. Various disturbance events create habitat for shrubland species, so effects in these areas are generally expected to be less than in forested lands. Some species that use open or shrubland habitats could benefit from the habitat conditions created by the proposed route in the maintained ROW. Land travel for repair or monitoring increases the risk of introducing invasives species that could negatively affect grasslands and adjacent woodlands.

5.10.2 Wildlife Habitat Modeling

While the DNR has a fair understanding of the general distribution and relative abundance of many wildlife species, Enbridge's proposed Line 5 relocation route and route alternatives have not been extensively surveyed for wildlife (with a few exceptions like surveys for targeted species like bald eagles and wood turtles). To address concerns raised in public comments on the Draft EIS, the DNR developed occupancy models for representative species of mammals, birds, amphibians, and reptiles to predict where the species would most likely occur along the different ROWs. These models were derived from known distributions and what is known about the kinds of habitats each species is most associated with.

DNR biologists selected an array of species to include variation in ecological needs among major taxa groups (e.g., waterbirds, raptors, and passerine birds). DNR biologists compiled occurrence data from the Global Biodiversity Information Facility (GBIF) for each species. The GBIF data were thinned to avoid spatial autocorrelation (cases where a model might incorrectly suggest areas of suitability where there happen to be more records). The GBIF data were combined with various environmental variables and Maxent software was used to model species niches and distributions. This software applies a machine-learning technique called maximum entropy modeling. From a set of environmental grids and georeferenced occurrence localities, the model expresses a probability distribution where each grid cell has a predicted suitability of conditions for the species. With particular assumptions about the input data and biological sampling efforts that led to the occurrence records, the output can be interpreted as predicted probability of presence. The resulting models generally showed good performance, except for some overfitting to urbanized areas, which DNR biologists considered when interpreting the models visually. The final models were trimmed to display the highest 80% area of predicted presence.

The models are not intended to be interpreted as the actual, realized limit of habitat for these species. Unlike plants, wildlife move through their environment constantly and have varying tendencies to prefer one small area over others through different life stages and daily needs such as thermoregulation, foraging, breeding, rearing young, and taking shelter. The model results provide an idea of the areas most likely to provide excellent habitat for these species based upon their known distributions and what is known from the kinds of habitats they are most often found in and associated with. Sections 5.10.3to 5.10.6 highlight representative taxa and the anticipated effects from pipeline construction and operations.

5.10.3 Select Mammals & Effects

Seventy-five species of mammals have been reported from Wisconsin, including six that have been introduced to the state and four that have become extirpated (Watermolen, 2011). Significant works dealing with life history, ecology, distribution, and status of Wisconsin mammals include Jackson (1961), Jones and Birney (1988), Kurta (1995), and Long (2008). The DNR conducts recurrent wildlife surveys that focus primarily on population status information, harvest summaries, population analyses, hunter/trapper surveys, and winter track counts, as well as analysis of wildlife damage claims and nuisance complaints. Semi-annual Wildlife Survey Reports for each survey effort provide current information for scientifically defensible management decisions. The DNR has obtained considerable information on furbearers, small game species, large game species, and a variety of non-game species through these surveys. The DNR also tracks rare mammal observations; observations of American marten (*Martes americana*), gray wolf (*Canis lupus*), Canada lynx (*Lynx canadensis*), mountain lion (*Puma concolor*), and moose (*Alces alces*) are tabulated and summarized annually.

While a considerable amount is known about the general distribution and relative abundance of many mammals, Enbridge's proposed Line 5 relocation route and route alternatives have not been extensively surveyed for mammals. For this EIS, DNR biologists modeled predicted habitat occupancy for four small mammals for which the DNR has limited information: American water shrew, northern flying squirrel, snowshoe hare, and woodland jumping mouse. These species generally appear to occupy relatively few acres of habitat within the permanent ROWs or temporary workspaces in Enbridge's various route alternatives (Table 5.10-1). Of these four species, the woodland jumping mouse would be the species most likely to be affected by Enbridge's proposed Line 5 relocation.

Table 5.10-1 Acres of habitat along Enbridge's proposed Line 5 relocation route and route alternatives where modeled mammal species are likely to occur.

Species	Proposed	RA-01	RA-02	RA-03
American water shrew (*Sorex palustris*)				
Within permanent ROW			0.024	0.057
Within temporary workspace	0.038		0.069	0.081
Total	**0**	**0**	**0**	**0**
Northern flying squirrel (*Glaucomys sabrinus*)				
Within permanent ROW			0.214	1.240
Within temporary workspace	0.229		0.212	2.185
Total	**0**	**0**	**0**	**3**
Snowshoe hare (*Lepus americanus*)				
Within permanent ROW		0.098	0.444	2.559
Within temporary workspace	0.201	0.195	0.835	4.364
Total	**0**	**0**	**1**	**7**
Woodland jumping mouse (*Napaeozapus insignis*)				
Within permanent ROW	0.753	0.515	0.706	2.067
Within temporary workspace	0.858	0.847	1.211	3.092
Total	**2**	**1**	**2**	**5**

5.10.3.1 American Water Shrew

The American water shrew, a state special concern species, is strongly associated with moving, high quality cold streams with abundant overhanging vegetation on margins. These shrews are also sometimes associated with lakes, ponds, and other aquatic habitats. They rely on riparian and connected aquatic habitats for movement and are rarely found far from these habitats. Primary food items include aquatic invertebrates, fish, and amphibian larvae. Breeding typically occurs between February and August and two to three litters may be reared every season. They occasionally use beaver dens as nesting sites and are active year-round. Due to their reliance on aquatic invertebrates for food, water shrew presence is a reliable indicator of aquatic system health.

Although the DNR's modeling did not predict the presence of American water shrews along Enbridge's proposed Line 5 relocation route or route alternatives (Table 5.10-1) suggesting limited direct effects to this species, the loss of 44 acres of wetland natural community types along the proposed ROW (Tables 5.9-1 and 5.9-2) could indirectly affect water shrew populations as a result of riparian habitat loss. Water shrews would be affected indirectly if sediment discharges or spilled petroleum reduced the macroinvertebrate community in their aquatic habitats.

5.10.3.2 Northern Flying Squirrel

The northern flying squirrel, a state special concern species, occurs in Bayfield, Ashland, and Iron counties. Primary habitat of this species is boreal forest, particularly consisting of coniferous species in wet or moist areas. Further, presence of this species is known to be associated with downed woody debris, a diverse understory, and standing dead and living trees. This species feeds on various fungi such as mushrooms and truffles in addition to lichens, acorns, nuts, fruits, tree buds, and insects among other less common food items. Mating occurs between March and May and offspring are typically reared in the nest until September and will stay near the nest for an additional couple of months before becoming fully independent. Nests are either used woodpecker cavities, natural cavities within trees, or constructed. Constructed nests are almost always found within conifer species.

Although the DNR's modeling predicted the occurrence of northern flying squirrel on only three acres of ROW and temporary workspace along RA-03 (Table 5.10-1), suggesting limited direct effects, the loss of 152 acres of forest cover along Enbridge's proposed route (Table 5.9-3), including 10.5 acres of boreal forest and 38.4 acres of northern mesic forest habitats (Table 5.9-1), could indirectly affect this species by reducing and fragmenting available habitat. RA-01 would affect slightly less modeled flying squirrel habitat and forest cover (0 and 132 acres, respectively). Greater acreages of forest cover would be lost with RA-02 (259 acres) and RA-03 (580 acres) (Table 5.9-3).

The northern flying squirrel is a species of greatest conservation need in Wisconsin. It's also a protected wild animal under s. NR 10.02, Wis. Adm. Code. As this species is heavily reliant upon intact areas of healthy forest, especially areas with more mature characteristics, preventing intrusion or logging of mature or intact boreal and coniferous forests is important to retaining populations of the northern flying squirrel. Fragmentation of habitat could severely limit movement and access to appropriate habitat. Land conversion and clearing of trees eliminates required habitat for this species, as it is primarily arboreal. Further, actions which disrupt terrestrial fungal networks or lichen growth (brush clearing, soil disturbance, tilling) could limit important foraging options.

5.10.3.3 Snowshoe Hare

The generally solitary snowshoe hare is associated most commonly with dense coniferous or mixed forests, especially those with dense undergrowth which is important for cover. Edges and transitional areas near these kinds of forests such as coniferous swamp and alder fens are also used by this species for foraging. Diets include vegetation, berries, buds, twigs, and bark depending on seasonal availability. Home ranges are generally between 3 and 10 hectares. Breeding typically occurs between late February through August, with offspring born typically between May and late August. Nests are typically depressions in dense undergrowth or hollow logs.

Although the DNR's modeling predicted the occurrence of snowshoe hare on only one acre of ROW and temporary workspace on RA-02 and on only seven acres along RA-03 (Table 5.10-1), suggesting limited direct effects, the loss of 152 acres of forest cover along Enbridge's proposed route (Table 5.9-3), including 10.5 acres of boreal forest and 38.4 acres of northern mesic forest habitats (Table 5.9-1), could indirectly affect this species by reducing and fragmenting available habitat. RA-01 would affect slightly less modeled snowshoe hare habitat and forest cover (0 and 132 acres, respectively). Greater acreages of forest cover would be lost with RA-02 (259 acres) and RA-03 (580 acres) (Table 5.9-3).

Populations can be threatened by clearing of closed, dense forest habitat in addition to fragmentation, degradation, and elimination of ground vegetation or ground cover vegetation. Snowshoe hare home ranges are typically multiple hectares, so fragmentation and direct conflict with road crossings and agriculture can directly limit movement and increase mortality. Extensive clearing, burning, or other land alteration which diminishes or removes undergrowth or dense vegetation will severely limit nesting and cover options for this species, and will likely displace them. This species is known to avoid open areas such as prairies, grasslands, and open forest, where predation risk from more generalist predators such as coyotes is greater.

5.10.3.4 Woodland Jumping Mouse

The woodland jumping mouse, a state special concern species, is most commonly associated with coniferous and deciduous forests with abundant ground vegetation used for cover and foraging. Home ranges are generally small (less than a square hectare at maximum) and diet consists of underground fungi, invertebrate larvae, seeds, and berries. Breeding typically occurs between May through August, and offspring born three to four weeks after. Hibernation generally begins in September or October, and emergence in April or May. Snow cover is used for insulation during harsher winter months, and absence of snow is associated with increased mortality during hibernation. In their comments on the Draft EIS, the GLIFWC noted that GLIFWC staff have observed woodland jumping mice on the Bad River Floodplain where Enbridge's proposed reroute would cross the Bad River near Mellen.

Of the four mammal species that the DNR modeled, the woodland jumping mouse would be the species most likely to be affected by Enbridge's proposed Line 5 relocation. The DNR's modeling predicted the occurrence of woodland jumping mouse on two acres of ROW and temporary workspace along Enbridge's proposed relocation route, on one acre along RA-01, on two acres along RA-02, and on five acres along RA-03 (Table 5.10-2), suggesting direct effects. While these acreages of direct impact appear to be relatively minor, the loss of 152 acres of forest cover along Enbridge's proposed route (Table 5.9-3), including 10.5 acres of boreal forest and 38.4 acres of northern mesic forest habitats (Table 5.9-1), could indirectly affect this species by reducing and fragmenting available habitat. RA-01 would affect slightly less modeled woodland jumping mouse habitat and forest cover (1 and 132 acres, respectively). Greater acreages of forest cover would be lost with RA-02 (259 acres) and RA-03 (580 acres) (Table 5.9-3).

Loss or conversion of forested habitat with undergrowth could be especially detrimental to this species given their small home ranges and their reluctance to disperse far from these ranges. Loss of herbaceous groundcover through introduction of competing invasive species, burning, clearing, or other natural or artificially induced changes to this vegetative layer is likely to significantly increase predation risk by eliminating cover, and decrease fertility as proper cover and nesting areas are lost. Continued changes in precipitation patterns exacerbated by climate change could alter persistent snowfall throughout the range of this species and could increase winter mortality by preventing these mice from using cavities in the snow layer to insulate themselves from harsh winter conditions.

5.10.3.5 Gray Wolf

The gray wolf has one of the most extensive ranges of any mammal (Nowak, 1983). In the Midwest, Minnesota, Wisconsin, and Upper Michigan currently have breeding wolf populations (USFWS, 2020b). Wisconsin's gray wolves occur primarily in the forested areas of the northern and central regions of the state. Gray wolves are considered generalist carnivores (Mech and Peterson, 2003). Their diet consists primarily of medium to large ungulates, but they are also highly opportunistic predators based on the availability of food in time and location. In the Great Lakes Region, white-tailed deer, moose, beaver, elk, and snowshoe hare are their primary prey, with white-tailed deer generally comprising about 70 to 90 percent of the prey biomass consumed (DelGiudice et al., 2009). As a top predator, gray wolves play an important role in every ecosystem they inhabit. In particular, wolves help control herbivore populations (such as deer and beaver) and, in turn, can influence grazing stress and the behavior and population dynamics of the prey species. Wolves are also culturally significant to the Ojibwe people living in the region (Section 4.2.1.16).

Wolves can persist on most any large landscape so long as prey populations remain adequate, and rates of human-caused mortality remain sufficiently low (Fuller, 1995). Research continues to show how adaptable wolves are and the variety of factors which play into the habitats they are willing and able to use. Both gray wolf density and habitat occupancy are highest in the northern third to half of Wisconsin, and density is highest in north central Wisconsin and the counties bordering Lake Superior. The wolf's core range overlaps almost the entirety of the Ceded Territories (Figure 4.1-5 and Figure 5.10-1). The DNR's most recent estimates indicate a statewide wolf population abundance of 1,007 individuals and an estimated 283 packs (DNR, 2023a). These figures include an estimate of 826 wolves in the Ceded Territories, including 39 wolves on the Bad River, Lac Courte Oreille, Lac du Flambeau, Menominee, Red Cliff, and Stockbridge-Munsee reservations (DNR, 2023a). Figure 5.10-1 depicts the estimated density of gray wolves along Enbridge's proposed Line 5 relocation route and route alternatives. DNR staff observed gray wolf tracks just downstream of Enbridge's proposed Potato River crossing during site visits in November 2023.

In November 2020, the USFWS published a final rule that removed the gray wolf from the endangered species list effective January 2021. In February 2022, however, the final delisting was vacated. As a result, gray wolves in the lower 48 states outside of the Rocky Mountains are protected under the Endangered Species Act. While the gray wolf was listed as an endangered species during the USACE's 2020 effects determination (Section 5.10.8.4), the USACE reevaluated potential project-related effects to the species after the final delisting rule was vacated. The USACE sought additional information from other federal, tribal, and state species experts about the locations of known gray wolf packs in the vicinity of Enbridge's proposed relocation Line 5 route, and the feasibility and guidance for conducting surveys of den and rendezvous sites to inform the assessment of potential project-related effects. A review of the Bad River Natural Resources Department's Wolf Plan indicated the Potato River pack may be in the vicinity of a portion of the proposed project route. The DNR no longer maintains maps of wolf territories and recommended the USACE review state depredation maps to identify potential wolf territories. The USACE's review of the DNR wolf depredation database from 2013 to 2023 revealed there was one probable wolf depredation in the vicinity of the proposed project route over the 10-year period in 2020 (2020-Iron County Investigation Report No. RHL 123-2020). A tribal wildlife expert indicated that locating and mapping potential wolf dens in the absence of collared wolves to pinpoint potential den locations is extremely difficult. Monitoring of gray wolves during the construction of Line 3 in Minnesota revealed construction activities had no apparent effect on wolves, including two packs that had dens within one-quarter mile of the pipeline corridor (one was next to the construction workspace and had pups). Wolves also regularly use the existing pipeline and powerline corridors, roads, and trails as travel routes. Based on these considerations, the USACE requested USFWS affirm the USACE's February 2021 "may affect, not likely to adversely affect" determination for this species. Concurrence with the USACE finding remains pending as of the date of this publication.

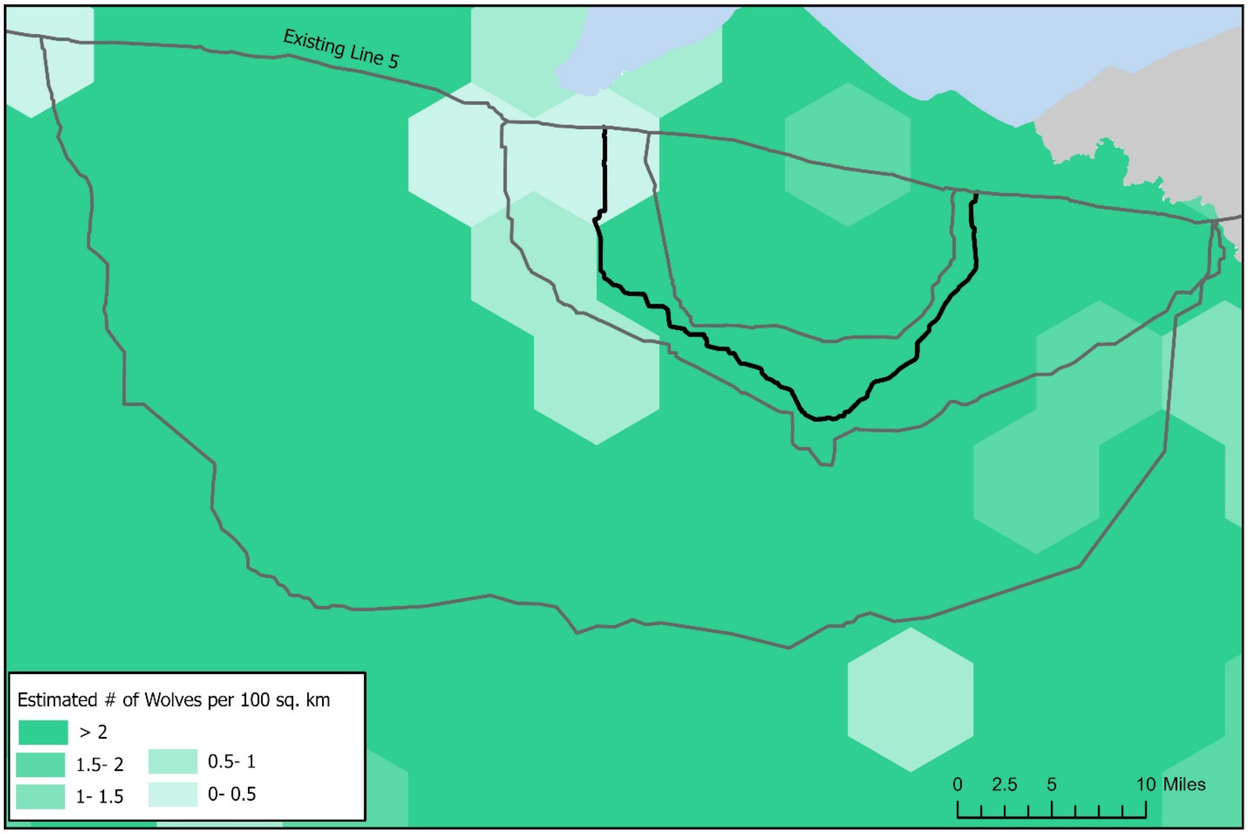


Figure 5.10-1 Estimated density of gray wolves across pack-occupied range along Enbridge's proposed Line 5 relocation route and route alternatives, winter 2022-2023.
Note: Individual wolves may occur anywhere in the state. For the latest information on wolf population abundance, see the DNR's annual wolf monitoring reports available on the DNR website.
Source: DNR

Temporary effects from pipeline construction on wolves likely include avoidance of the disturbed area by wolves due to noise and human presence, along with potential shifts in movement behavior and howling. Indirect effects could include a decrease in available prey animals as they also would alter their behavior in response to human presence, noise, and an altered habitat. Post construction, wolves would likely use the ROW as an "easy access" means of movement through the forest (Randy Johnson, personal communication). The DNR detected a total of 32 gray wolf mortalities during its most recent monitoring period (April 2022-April 2023). Sources of mortality included 21 (66%) wolves killed by vehicle collisions and eight (25%) killed illegally. The cause of death could not be determined for three wolves (9%). Increased human use of the pipeline ROW corridor could lead to increased wildlife disturbances and hunting pressure (Hinkle et al., 2002), particularly in areas along the ROW that are perceived to no longer be private property.

5.10.3.6 Beaver

As one of the animals most influential in changing its local environment, beavers can be considered a keystone species; one which can have significant effects on the habitats, diets, and physiology of wildlife and vegetation through their actions. By constructing dams, beavers can significantly alter flow, water quality, vegetation, water levels, and wetland extent. In doing so, beavers can help to provide appropriate moist habitat for dozens of other species that require these conditions along with emergent vegetation. Even so, their ability to alter landscapes can also lead to direct conflict with human infrastructure and agriculture. Enbridge plans to remove beaver dams along the ROW alignment (Appendix Z).

Though populations are secure in Wisconsin, beavers and many other species dependent on wooded areas are continuing to experience declines in area due to increased conversion of forest habitat to agricultural land or urban areas. For a generally secure area of habitat, a riparian corridor of around one kilometer and a woodland buffer of 50 meters on either side of the corridor is thought to be able to sustain one beaver family. Human interaction is one of the few direct causes of mortality for beavers through trapping, as potential predators such as wolves typically select ungulates preferentially. Beavers are also culturally significant to the Ojibwe people living in the region (Section 4.2.1.18). Section 6.4.4.19 discusses the potential effects of an oil spill on beavers.

5.10.4 Select Birds & Effects

The Wisconsin Breeding Bird Atlas is a comprehensive field survey that documents the distribution and abundance of birds breeding across the state. The atlas provides a baseline dataset for measuring future changes in bird populations and identifying the conservation needs of breeding birds. Results from the most recent Breeding Bird Atlas show more than 134 species nest in Bayfield and Ashland counties, and more than 120 species nest in Iron County. Many other species migrate through the region in spring and fall. Significant works dealing with the life history, ecology, distribution, and status of Wisconsin birds include Tessen (1989), Robbins (1991), Temple et al. (1997), and Cutright, et al. (2006). Verch's (1988) book covers the avifauna of Chequamegon Bay and Temple and Harris's (1985) monograph document the birds of the Apostle Islands.

While a considerable amount is known about the general distribution, relative abundance, and habitat needs of most birds, Enbridge's proposed Line 5 relocation route and route alternatives have not been extensively surveyed for birds outside of what was required for the Endangered Resources Review. For this EIS, DNR biologists modeled predicted habitat occupancy for one raptor, two waterfowl, one upland game bird, and several passerines of interest. Three of these, black-backed woodpecker, Canada jay, and evening grosbeak have experienced substantial population declines in the recent past. The modeled species generally appear to occupy relatively few acres of habitat within the permanent ROWs or temporary workspaces in the various route alternatives (Table 5.9-2). Of these species, black-backed woodpecker, evening grosbeak, and ruffed grouse would be the species most likely to be directly affected by Enbridge's proposed Line 5 relocation route and route alternatives. The following sections briefly discuss each of the modeled species, as well as some additional birds of special interest. Sections 5.10.8and 5.10.9discuss federal and state endangered and threatened bird species, respectively.

Table 5.10-2 Acres of habitat along Enbridge's proposed Line 5 relocation route and route alternatives where modeled bird species are likely to occur.

Species	Proposed	RA-01	RA-02	RA-03
American goshawk (*Accipiter atricapillus*)				
Within permanent ROW	0.540	0.116	2.471	2.647
Within temporary workspace	2.420	0.256	3.585	3.481
Total	**3**	**0**	**6**	**6**
Black-backed woodpecker (*Picoides arcticus*)				
Within permanent ROW		0.018		10.205
Within temporary workspace		0.147		11.847
Total	**0**	**0**	**0**	**22**
Canada jay (*Perisoreus canadensis*)				
Within permanent ROW			0.323	0.825
Within temporary workspace			0.383	1.506
Total	**0**	**0**	**1**	**2**
Common merganser (*Mergus merganser*)				
Within permanent ROW				
Within temporary workspace	0.30			
Total	**0**	**0**	**0**	**0**
Evening grosbeak (*Hesperiphona vespertina*)				
Within permanent ROW	1.967	6.314	10.895	14.992
Within temporary workspace	6.634	8.743	17.967	26.002
Total	**9**	**15**	**29**	**41**
Ruffed grouse (*Bonasa umbellus*)				
Within permanent ROW	0.144	1.280	1.198	13.954
Within temporary workspace	0.934	2.499	1.925	24.228
Total	**1**	**4**	**3**	**38**
Wood duck (*Aix sponsa*)				
Within permanent ROW		0.086		
Within temporary workspace		0.076		
Total	**0**	**0**	**0**	**0**

5.10.4.1 American Goshawk

American goshawk[1] requires extensive, intact forest for breeding and hunting. The range occupied during nesting season can be upwards of 80 acres, with a preference for denser canopy cover. Nests are usually created in the largest, oldest trees in dense, mature stands and are most strongly associated with northern mesic and boreal forests. In Wisconsin, goshawks use deciduous trees significantly more often for nesting than coniferous species, primarily yellow birch, aspens, sugar maples, and white birch. Egg laying and incubation (clutches of two to four eggs) occurs primarily within April and lasts between 28 and 38 days.

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[1] Until 2023, this species was formerly known as the Northern goshawk (*Accipiter gentilis)* and was considered the same species as what is now the Eurasian goshawk, which has remained *A. gentilis*. Data for this species from the United States remain valid as the species split was determined based upon genetic, morphological, and geographic separation.

Nesting and fledging season for this species is generally March through July. Goshawk diets include primarily small mammals and other birds including red squirrels, eastern chipmunks, hares, crows, and ruffed grouse.

The Migratory Bird Treaty Act protects the American goshawk with significant restrictions regarding direct effects. Wisconsin lists American goshawk as a special concern species based on their restricted range, loss of habitat, and declining population. Reliance on mature, healthy, and extensive stands of interior forest space is crucial to persistence of this species as they avoid disturbed and open spaces. Goshawks require interior deciduous tree species which are established and offer variation in potential nesting sites. Considering these requirements, maintaining well connected and intact stands of mature deciduous forest, and avoiding nesting and breeding seasons if undertaking any sort of habitat interference are high priorities. The nesting period for this species is mid-March through July.

Although the DNR’s modeling predicted the occurrence of American goshawk on only three acres of the proposed ROW and temporary workspace and on only six acres along RA-02 and RA-03 (Table 5.10-2), suggesting limited direct effects, the loss of 152 acres of forest cover along Enbridge’s proposed route (Table 5.9-3), including 10.5 acres of boreal forest and 38.4 acres of northern mesic forest habitats (Table 5.9-1) could indirectly affect this species by reducing and fragmenting available habitat. RA-01 would affect slightly less modeled goshawk habitat and forest cover (0 and 132 acres, respectively). Greater acreages of forest cover would be lost with RA-02 (259 acres) and RA-03 (580 acres) (Table 5.9-3).

The effects of Enbridge’s proposed project on the American goshawk were considered in the DNR’s Endangered Resources Review (Section 5.10.9.6).

5.10.4.2 Black-backed Woodpecker

The black-backed woodpecker is a state species of special concern and a species of greatest conservation need. This species is strongly associated with closed boreal, coniferous, and tamarack forest among other similar habitats. The black-backed woodpecker is a post-fire specialist and will search for wood-boring beetles and other invertebrates in burned trees. As with other woodpecker species, the black-backed woodpecker creates and nests within its own cavities made in dead and dying trees. These cavities can play a role in allowing other bird species and small mammals to recolonize areas after fire. This species tends to pair in April and excavate nests in May. The black-backed woodpecker does not typically migrate but will occasionally relocate towards burned areas for foraging.

Due to a strong association with only limited, closed forest types and its dependence on burned areas, maintenance of continuous, mature stands of pine, tamarack, and boreal forests is crucial to supporting populations of this species. This is especially true considering the species does not tend to travel or migrate any significant distance over its lifetime. Maintaining downed woody debris and dead or dying trees and leaving burned trees supports this species by retaining foraging options. Maintaining connected areas of undisturbed forest is important to allow for movement, courtship, breeding, locating nesting sites, and reducing human interference. Removal of trees or snags along the proposed ROW would eliminate potential nest sites.

The DNR’s modeling predicted the occurrence of black-backed woodpecker on no acres of permanent ROW or temporary workspace on Enbridge’s proposed relocation route or RA-02 and on only 0.15 acres along RA-01 (Table 5.10-2), suggesting limited direct effects to this species. Modeling, however, indicated its likely presence on 22 acres of permanent ROW or temporary workspace along RA-03. The permanent loss of 152 acres of forest cover along Enbridge’s proposed route (including 10.5 acres of boreal forest habitat), 132 acres of forest cover (including 15.1 acres of boreal forest habitat) along RA-01, 259 acres of forest cover (including 16.4 acres of boreal forest habitat) along RA-02, and 580 acres of forest cover (including 18.6 acres of boreal forest habitat) along RA-03 (Table 5.9-1and Table 5.9-4) could indirectly affect this species by reducing and fragmenting available habitat.

The effects of Enbridge's proposed project on the black-backed woodpecker were considered in the DNR's Endangered Resources Review (Section 5.10.9.8).

5.10.4.3 Canada Jay

The Canada jay, a state special concern species, is strongly associated with coniferous boreal forests and is found only in the northern half of Wisconsin in associated forested habitats. This species is most strongly dependent on trees such as black spruce, white spruce, balsam fir, and jack pine. Canada jays rely on these trees to store food through winter months in bark and lichen crevices. Their diets are widely varied, ranging from seeds, berries, smaller birds, and various arthropods. Nest building and chick rearing typically start in March, and eggs are incubated for an average of 18 days. Nesting tree species are usually mature individuals of black spruce, white spruce, or balsam fir with nest construction comprising twigs and bark from these same trees in addition to moth cocoons and feathers.

As a species directly reliant upon specific tree species for nesting and storing food through the winter, a reduction in coverage or encroachment into these habitats is likely to directly affect survivability of this species when required tree species are reduced or removed entirely. Preserving larger, more mature stands of spruce and balsam fir are important to retain appropriate habitat for this species which spends the whole year within the same habitat.

The DNR's modeling predicted the occurrence of Canada jay on no acres of permanent ROW or temporary workspace along Enbridge's proposed relocation route or RA-01 and on only 1 acre along RA-02 and two acres along RA-03 (Table 5.10-2), suggesting limited direct effects to this species. The permanent loss of coniferous forest cover along the route alternative ROWs ranges from 21 acres along Enbridge's proposed Line 5 relocation route to 232 acres along RA-03 (Table 5.9-3). This would include loss of 10.5 to 18.6 acres of boreal forest habitat (Table 5.9-1). The loss of coniferous forest cover in temporary workspaces along the route alternatives ranges from 32 acres along Enbridge's proposed Line 5 relocation route to 325 acres along RA-03 (Table 5.9-4). This would include loss of 12.9 to 25.6 acres of boreal forest habitat (Table 5.9-1). These losses could indirectly affect Canada jay by reducing and fragmenting available habitat.

The effects of Enbridge's proposed project on the Canada jay were considered in the DNR's Endangered Resources Review (5.10.9.11).

5.10.4.4 Common Merganser

Common mergansers breed throughout much of Alaska and Canada, with northern Minnesota and northern Wisconsin being at the southern edge of their breeding range. Common mergansers generally occupy shallow but clear rivers and lakes, with a fairly high productivity of fish, in forested country (Kear, 2005). They can often be found in open or emergent wetlands and along shorelines with unconsolidated bottoms but avoid dense marshes and muddy waters. Common mergansers feed mainly on fish, amphibians, crustaceans, mollusks, and other invertebrates obtained by diving underwater. Common mergansers require hardwood trees with holes excavated by woodpeckers or natural cavities for nesting, making mature forest critical breeding habitat (Kear, 2005). When natural tree-nesting sites are unavailable, common mergansers will use artificial nest boxes or may nest among tree roots in undercut banks or in dense scrub (Johnsgard, 1978; Kear, 2005). Female common mergansers lay an average of 9 to 12 eggs. Flocks are usually small but may combine into big concentrations sometimes at large reservoirs. In smaller streams, common mergansers are present in pairs or smaller groups. Eastern North American birds move south in small groups to wherever ice-free conditions exist on lakes and rivers. Currently, accurate population information does not exist for common mergansers. Populations, however, are generally thought to be stable.

The DNR's modeling predicted the occurrence of common merganser on no acres of permanent ROW or temporary workspace along Enbridge's proposed relocation route or route alternatives (Table 5.10-2). While its modeled absence in the ROW suggests there would be limited direct effects to common mergansers, sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect river habitats that mergansers use. For example, DNR staff observed common mergansers swimming on the White River downstream of Enbridge's proposed HDD crossing in July 2023.

5.10.4.5 Evening Grosbeak

The evening grosbeak is most strongly associated with coniferous and mixed forests, typically of spruce and fir species. They are primarily herbivorous, specializing on buds and seed, but also transition to eating insects in summer months when spruce budworms are more abundant. In northern Wisconsin, they are year-round residents. Nesting begins in late spring, with nests constructed at high points of selected nesting trees.

According to Partners in Flight, the evening grosbeak has experienced one of the steepest population declines in the last 50 years of all North American land birds. The evening grosbeak is a special concern species in Wisconsin and the IUCN lists it as globally vulnerable. Population decline in this species is most likely attributed to parallel losses and disturbances in forests across its range. Pesticide use has also potentially been detrimental to insect populations that grosbeaks rely upon during summer months. Retaining large, connected areas of intact coniferous and mixed forests is important to retain and bolster populations of this species.

The DNR's modeling predicted the occurrence of evening grosbeak on nine acres of permanent ROW or temporary workspace on Enbridge's proposed relocation route, on 15 acres along RA-01, on 29 acres along RA-02, and 41 acres along RA-03 (Table 5.10-2), suggesting the potential for direct effects to this species if present during construction. The permanent loss of 152 acres of deciduous, coniferous, and mixed forest cover along Enbridge's proposed route, 132 acres of forest cover along RA-01, 259 acres of forest cover along RA-02, and 580 acres of forest cover along RA-03 (Table 5.9-4) could indirectly affect this species by reducing and fragmenting available habitat. The loss of forest cover in temporary workspaces along the route alternatives ranges from 184 acres along RA-01 to 811 acres along RA-03, with 258 acres of loss along Enbridge's proposed Line 5 relocation route (Table 5.9-4). These losses could also indirectly affect evening grosbeak by reducing or fragmenting habitat.

The effects of Enbridge's proposed project on the evening grosbeak were considered in the DNR's Endangered Resources Review (5.10.9.4).

5.10.4.6 Ruffed Grouse

Ruffed grouse is one of the most popular and widely distributed upland game birds in Wisconsin. Ruffed grouse do not migrate and can be commonly found within most of northern Wisconsin in forested areas with dense underbrush. Ruffed grouse are considered a habitat specialist and thrive in young, early successional forests, typically aspen-dominated stands. While not solely dependent on aspen forest communities, ruffed grouse show a strong association with quaking aspen and bigtooth aspen, especially in the northern part of their range (Rusch et al., 2000). Other major habitats include mixed oak, northern hardwood, oak-hickory, mixed hardwood, and mixed conifer-hardwood forests (Fearer and Stauffer, 2004; Scott et al., 1998). Examples of conifer communities occupied include eastern white pine, red pine, jack pine, and spruce-fir communities (Naylor, 1994; N. D. Martin, 1960). In the northern portions of its range, ruffed grouse occur in boreal forests (Rusch et al., 2000). The Iron County Forest has a designated ruffed grouse management area. Ruffed grouse primarily eat plant material such as buds, berries, and seeds but also forage for insects and other invertebrates. During nesting season females may travel extensively to find mates and appropriate nesting sites in hollows such as covered stumps, trunks, and overhangs. As ground-dwelling nesters, ruffed grouse face many threats from predation at all stages of life, primarily from foxes and weasels.

The DNR’s modeling predicted the occurrence of ruffed grouse on only one acre of permanent ROW or temporary workspace on Enbridge’s proposed relocation route, on four acres along RA-01, on three acres along RA-02, and 38 acres along RA-03 (Table 5.10-2), suggesting the potential for some direct effects to this species if present during construction. The permanent loss of 152 acres of forest cover along Enbridge’s proposed route, 132 acres of forest cover along RA-01, 259 acres of forest cover along RA-02, and 580 acres of forest cover along RA-03 (Table 5.9-4) could indirectly affect this species by reducing and fragmenting available habitat. The loss of forest cover in temporary workspaces along the route alternatives ranges from 184 acres along RA-01 to 811 acres along RA-03, with 258 acres of loss along Enbridge’s proposed Line 5 relocation route (Table 5.9-4). Habitat connectivity is also vital to maintaining ruffed grouse populations since activity and movement during the mating season increases significantly. The permanent losses of forest cover could indirectly affect ruffed grouse by reducing or fragmenting habitat. Conversely, the removal of trees from temporary workspaces could spur regrowth of aspen in these areas, creating some young, early successional forests that could benefit ruffed grouse in the short-term.

5.10.4.7 Wood Duck

Once in significant decline due to loss of wet forest habitat and hunting, this species has rebounded with human intervention. As cavity breeders, wood ducks rely upon wet hardwood forests for arboreal nesting sites, and frequently use artificial nesting boxes to raise young as well. Nesting sites are usually within or next to waterbodies. Pairing and courtship behavior occurs between fall and winter, with breeding and nesting following in the spring months. Newly hatched chicks leave the nest within days, and generally enter adjacent wetland or aquatic habitat immediately. Diets consist of plant material in addition to invertebrates, seeds, and acorns.

The species is susceptible to loss of hardwood swamp, wetland, and pond habitats. Though nesting boxes are supportive for populations, they are generally less beneficial than natural woody cavities and logs. Co-occurrence with beavers has been shown to support wood duck populations by expanding appropriate wetland area by damming. Enbridge’s proposed beaver management or control activities could affect wood ducks.

The DNR’s occupancy modeling predicted the occurrence of wood duck on no acres of permanent ROW or temporary workspace along Enbridge’s proposed relocation route or route alternatives (Table 5.10-2) suggesting there would not be direct effects on this species. However, as with other cavity nesting species, the permanent loss of 152 acres of forest cover along Enbridge’s proposed route (including 10.5 acres of boreal forest habitat), 132 acres of forest cover (including 15.1 acres of boreal forest habitat) along RA-01, 259 acres of forest cover (including 16.4 acres of boreal forest habitat) along RA-02, and 580 acres of forest cover (including 18.6 acres of boreal forest habitat) along RA-03 (Table Table 5.9-1and Table Table 5.9-4) could indirectly affect this species by reducing and fragmenting available habitat and eliminating potential nesting sites. Sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect river habitats that wood ducks use.

5.10.4.8 Bald Eagles & Golden Eagles

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the federal Bald and Golden Eagle Protection Act (Section 1.4.1.10). A permit is required to disturb or destroy nests of bald eagles or golden eagles under the Act.

Bald eagles occupy nests in all 72 Wisconsin counties, with north central Wisconsin having one of the highest densities of nesting bald eagles anywhere in North America. In a recent DNR statewide survey, 39 nests were found in Iron County, 44 nests were documented in Bayfield County, and 65 were observed in Ashland County (DNR, 2019c). Bald eagles live near rivers, lakes, and marshes where they can find fish, their staple food. Habitats include estuaries, large lakes, reservoirs, rivers, and some seacoasts (USFWS, 2015a). In winter, bald eagles congregate near open water in tall trees for spotting prey and night roosts for sheltering. In spring, they build large nests in large trees near rivers or coasts and remain with young until they disperse. Bald eagles mate for life, often returning to and enlarging their nests year after year. Generally, egg-laying begins at the end February in the Midwest with clutch sizes ranging from one to three eggs. Eaglets make their first flights about 10 to 12 weeks after hatching and fledge (leave their nests) within a few days after that first flight. The time between egg laying and fledging is approximately four months, although young birds usually remain in the vicinity of the nest for several weeks after fledging since they are almost completely dependent on their parents for food until they disperse from the nesting territory approximately six weeks later (USFWS, 2007). There is a potential for bald eagles to be present in and around the ROWs of any of Enbridge's route alternatives year-round.

Golden eagles migrate to Wisconsin each winter from their nesting territory in northern Canada. Most occupy the bluff lands of the Driftless Area in southwestern Wisconsin and along the Mississippi River, where they hunt rabbits, squirrels, and larger game like wild turkey on "goat prairies," the sparsely forested, southern-facing sides of the bluffs (National Eagle Center, 2020). Golden eagles are unlikely to nest along Enbridge's proposed project route or route alternatives, but small numbers may pass through the region during spring and fall migrations.

In 2020 and 2023, Midwest Natural Resources, Inc. conducted aerial nest surveys to identify bald eagle nests in the vicinity of Enbridge's proposed Line 5 pipeline relocation route. The 2020 survey located one active bald eagle nest within the buffered survey area (1,000 feet of ROW and access road center lines). Enbridge's contractors reviewed the NHI database prior to the 2023 flight to determine if new nest locations had been documented following the 2020 survey. No new records were identified. The 2023 survey documented three new bald eagle nest locations. The nest observed in 2020 was no longer active and a second nest built in the same tree was also no longer active. The other two nests, one active and one inactive, were located outside of the 1,000-foot buffer. Enbridge submitted the survey results to the DNR (Appendix AA).

Bald eagles may respond in a variety of ways when disturbed by human activities. For example, during the nest building period, eagles may inadequately construct or repair their nest, or may abandon the nest, both of which can lead to failed nesting attempts. During the incubation and hatching period, human activities may startle adults or cause them to flush from the nest, which can damage eggs or injure young when adults abruptly leave. Prolonged absences of adults from nests can jeopardize eggs or young since eggs may overheat or cool and fail to hatch or young nestlings may die from hypothermia or heat stress. Older nestlings may be startled by loud or intrusive human activities and prematurely jump from the nest before they are able to fly or care for themselves (USFWS, 2015a).

Bald eagles are not as sensitive to human disturbance during migration and winter as they are while nesting. However, wintering eagles congregate at specific sites year-after-year for purposes of feeding and sheltering. Eagles rely on these established roost sites because of their proximity to sufficient food sources. Permanent landscape changes could destroy these important areas and displace bald eagles. Depending on the proximity of other suitable roost or foraging areas and the condition of the affected eagles, loss of these areas can harm eagles. In addition, construction noise and human activities near or within communal bald eagle roost sites could prevent bald eagles from feeding or taking shelter.

These disturbances could violate the Bald and Golden Eagle Protection Act prohibition against disturbing eagles and a permit may be needed. To reduce the potential for effects on bald eagle nests and important winter foraging areas, the DNR recommends that bald eagle surveys be carried out in areas of suitable habitat within one mile of the proposed route prior to construction. In the event that bald eagle nests or important winter foraging areas are identified, Enbridge would consult with the USFWS for recommendations on how to avoid disturbance and determine whether a permit is required. Enbridge has proposed implementing activity buffers around active bald eagle nests.

5.10.4.9 Migratory Birds

Almost all birds, including their nests and eggs, native to the United States are protected under the Migratory Bird Treaty Act (Section 1.4.1.9). Nonnative species such as European starlings, rock (feral) pigeons, house sparrows, and mute swans as well as non-migratory upland gamebirds such as grouse, turkey, and quail are not protected under the Migratory Bird Treaty Act (USFWS, 2020c; USFWS, 2015b). There are 284 native bird species for which Wisconsin provides important breeding, wintering, or migratory habitat (DNR, 2005). In Wisconsin, birds protected under the Migratory Bird Treaty Act include most of those listed in association with forests, wetlands, and agricultural land (DNR 2005).

Migratory bird concentration sites are important locations where birds stop for resting and feeding as they fly between their breeding and wintering grounds. These areas also can be locations where large numbers of migrating birds become concentrated due to prevailing winds and or water barriers (DNR, 2020k). The Superior Coastal Plain Ecological Landscape has several migratory bird concentration sites in the vicinity of Enbridge's proposed Line 5 relocation route. Chequamegon Bay attracts large numbers of waterfowl, other waterbirds, and shorebirds. The spring raptor migration is significant along the south shore of Lake Superior. Significant concentrations of migratory birds occur at the mouth of the Bad River (DNR, 2015b). The DNR's Endangered Resources Review determined that Enbridge's proposed Line 5 relocation route would not cross any documented migratory bird concentration sites.

Four Important Bird Areas have been designated by the Wisconsin Bird Conservation Partnership in the region. These areas do not have any legal status or regulatory requirements, but rather serve as a guide to help bird populations ("Wisconsin Important Bird Areas," n.d.). The four Important Bird Areas within Enbridge's project area are:

- **Lower Chequamegan Bay** – Includes Whittlesay Creek National Wildlife Refuge and the South Shore State Fish and Wildlife Area both of which are in Bayfield County. Lower Chequamegen Bay host the oldest of Wisconsin's four active common tern colonies and is an important migratory staging and stopover site.

- **Kakagon and Bad River Wetlands –** Includes the most extensive and least disturbed coastal wetlands communities in the Great Lakes Region along with the forest corridors of the Bad, White, Potato, and Marengo rivers. This is popular migratory bird concentration area and includes species like yellow rail, Virginia rail, northern harrier, sedge wren, Le Conte's sparrow, northern waterthrush, Blackburnian warbler, and golden-winged warbler.

- **Penokee Range –** Two large rivers, the Potato and the Montreal rivers carve through the steep terrain of the Penokee-Gogebic Iron Range. This range provides core habitat for the black-throated blue warbler. Other prominent birds use this area for breeding including veery, wood thrush, Canada warbler, golden-winged warbler along Alder Creek, and Nashville warbler and Lincoln's sparrow.

- **Apostle Island National Lakeshore –** The Apostle Island which are designated by the National Park Service as a National Lakeshore are in Lake Superior a few miles north of the mouth of the Kakagon and Bad Rivers. The Apostle Islands National Lakeshore includes 21 of the 22 islands that make up the Apostle Islands and it also includes Long Island, which is off the Chequamegon Spit. According to the NPS, Long Island is made of sand and fluctuates from being an island and reconnecting with Chequamegon Spit and the island is significant in that it provides nesting grounds for the endangered piping plover.

Section 6.4.4.18discusses potential effects of an oil spill on these areas.

The Superior Coastal Plain Ecological Landscape also overwinters species that are seen far less often in most other parts of Wisconsin. Notable species include gyrfalcon (*Falco rusticolus*), great gray owl (*Strix nebulosa*), Northern hawk owl (*Surnia ulula*), boreal owl (*Aegolius funereus*), and Hoary Redpoll (*Acanthis hornemanni*). Irruptive species such as Bohemian waxwing (*Bombycilla garrulus*), pine grosbeak (*Pinicola enucleator*), evening grosbeak (*Coccothraustes vespertinus*), red crossbill (*Loxia curvirostra*), white-winged crossbill (*Loxia leucoptera*), and common redpoll (*Acanthis flammea*) are observed here in large numbers at times (DNR, 2015b).

Under the Migratory Bird Treaty Act, a federal depredation permit from the USFWS is required to destroy an active bird nest (one with eggs or chicks present). Depredation and control orders allow the take of specific species of birds protected under the Migratory Bird Treaty Act for specific purposes without a depredation permit. However, the construction of an oil pipeline does not fall within any of these categories. The fragmentation and conversion of wooded habitats to open grassland habitats as part of pipeline construction and operation could directly and indirectly affect a range of bird species. Sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect river habitats that birds use.

5.10.4.10 Wading Birds & Waterfowl

Due to their close relationships with and dependence on aquatic environments for food, breeding, mating, rearing young, and for cover, wading birds and waterfowl are inherently susceptible to alterations in their preferred habitats such as wetlands, riparian corridors, bogs, ponds, lakes, and other waterbodies. Construction actions have the possibility to both permanently and temporarily remove appropriate habitat for these birds by removing vegetation, macroinvertebrates dependent on that vegetation, and other prey items which would also be displaced or directly killed by construction effects such as amphibians, reptiles, macroinvertebrates, and other arthropods. Disruption or loss of habitat for waterfowl or wading birds which migrate can disrupt breeding, movement, navigation, and feeding opportunities. Through the process of construction, introduced invasive plants or toxins could alter or degrade wetland and pond environments in ways detrimental to the life processes of these birds. Sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect river habitats that these birds use.

5.10.5 Select Amphibians & Effects

Wisconsin hosts 18 species of amphibian, 16 of which can be found within Ashland, Bayfield, and Iron counties (Table 5.10-3). Some species, like the American toad, are habitat generalists and occur nearly ubiquitous, while others, like the four-toed salamander, are less common and associated with only specific habitats. Significant works dealing with the life history, ecology, distribution, and status of Wisconsin amphibians include Vogt (1981), Casper (1996), and Kapfer and Brown (2022).

Due to their unique physiology, amphibians absorb water through their skin and rely upon moist environments to complete their lifecycles, maintain proper water balance, and regulate temperature. This unique trait means they are excellent indicators of environmental conditions and are therefore very sensitive to changes in water parameters or introduction of pollutants and other chemicals.

Table 5.10-3 Amphibian species reported from Ashland, Bayfield, and Iron counties.

Species	Ashland	Bayfield	Iron
American toad (*Anaxyrus americanus*)	X	X	X
Gray Treefrog (*Hyla versicolor*)	? [1]	X	?
Spring Peeper (*Pseudacris crucifer*)	X	X	X
Boreal chorus frog (*Pseudacris maculata*)	X	X	?
American bullfrog (*Lithobates catesbeianus*)	?	X	X
Green Frog (*Lithobates clamitans*)	X	X	X
Northern leopard frog (*Lithobates pipiens*)	X	X	X
Mink frog (*Lithobates septentrionalis*)	X	X	X
Wood frog (*Lithobates sylvaticus*)	X	X	X
Blue-spotted salamander (*Ambystoma laterale*)	X	X	X
Spotted salamander (*Ambystoma maculatum*)	X	X	X
Eastern tiger salamander (*Ambystoma tigrinum*)		X	
Four-toed salamander (*Hemidactylium scutatum*)	X	X	X
Eastern red-backed salamander (*Plethodon cinereus*)	X	X	X
Mudpuppy (*Necturus maculosus*)	X	X	X
Eastern newt (*Notophthalmus viridescens*)	X	X	

[1] A "?" indicates that the species has been observed in the county, but a voucher specimen has not been preserved.

While some information about the general distribution and relative abundance of amphibians is available, Enbridge's proposed Line 5 relocation route and route alternatives have not been extensively surveyed for amphibians. For this EIS, DNR biologists modeled predicted habitat occupancy for four amphibians: blue-spotted salamander, eastern red-backed salamander, four-toed salamander, and mink frog. These species generally appear to occupy relatively few acres of habitat within the permanent ROWs or temporary workspaces in Enbridge's various route alternatives (Table 5.10-4). Of these species, the blue-spotted salamander would be the species most likely to be affected by Enbridge's proposed Line 5 relocation. The following section briefly discuss each of the modeled species, as well as some additional amphibians of special interest.

Table 5.10-4 Acres of habitat along Enbridge's proposed Line 5 relocation route and route alternatives where modeled amphibian species are likely to occur.

Species	Proposed	RA-01	RA-02	RA-03
Blue-spotted salamander (*Ambystoma laterale*)				
Within permanent ROW	0.899	4.087	7.621	33.180
Within temporary workspace	2.065	5.473	13.960	52.549
Total	**3**	**10**	**22**	**86**
Eastern red-backed salamander (*Plethodon cinereus*)				
Within permanent ROW				0.785
Within temporary workspace				1.031
Total	**0**	**0**	**0**	**2**
Four-toed salamander (*Hemidactylium scutatum*)				
Within permanent ROW			0.202	11.095

Within temporary workspace	0.102		0.414	15.670
Total	**0**	**0**	**1**	**27**
Mink frog (*Lithobates septentrionalis*)				
Within permanent ROW	0.059	1.804	0.023	0.351
Within temporary workspace	0.022	2.829	0.189	0.740
Total	**0**	**5**	**0**	**1**

5.10.5.1 Mink Frog

Found only in the northern half of Wisconsin, this species has been vouchered from each of the three counties where Enbridge's Line 5 relocation route is proposed. Preferred habitat for this species is generally forested permanent wetlands and streams with significant aquatic vegetation, including bogs, lakes, and ponds. Habitat type is thought to be generally the same throughout the season. Adults emerge in late April to May and begin mating between June and July. Females attach egg masses to submerged vegetation, and hatch between 4-13 days, depending on temperature. Mink frog larvae overwinter and metamorphose the following year. There is likely little movement between habitats, and both larvae and adults overwinter below the ice of their aquatic environments.

The DNR's modeling did not predict the occurrence of mink frogs on Enbridge's proposed ROW or temporary workspaces or along RA-02. The modeling predicted mink frogs would occur on five acres along RA-01 and on one acre along RA-03 (Table 5.10-4), suggesting potential direct effects in these areas. It is likely mink frogs occur at additional sites along the routes, but the habitat parameters used in the DNR's model were primarily terrestrial features that did not account for the cold-water, seepage streams that mink frogs often occupy. In fact, DNR staff observed mink frogs at waterbody crossings on the western stretches of the proposed route (e.g., Bay City Creek) during fieldwork in 2023.

The mink frog is a Species of Greatest Conservation Need and a species of special concern in Wisconsin. Most population and occupancy data for this species is based upon limited call surveys, with varying confidence in areas of abundance. Even so, available information points to a marked decrease in occurrence at resampled sites since the 1980's. Due to their reliance and relationship with permanent and semi-permanent wetland and waterbodies, actions that disturb eliminate, or degrade these habitats in northern Wisconsin will likely have a direct effect on the populations of this special concern species. Their reliance on submerged vegetation for reproduction also emphasizes the need for a habitat with a healthy, undisturbed aquatic environment.

5.10.5.2 Wood Frog

The wood frog is found throughout most of Wisconsin, being most common in the northern half of the state and having fewer records in the southwestern extreme. They are strongly associated with wooded, moist habitats and use forest floor wood and leaf debris. Gibbs 1998b found that wood frogs are not found in areas with less than 30% forest coverage. They are one of the earliest breeding frogs in the state, starting to breed between late March and April and lasting only a few weeks. Breeding typically occurs in fishless ephemeral ponds, where females cluster their egg clutches together in a communal area. Juveniles metamorphose in summer and will disperse out into wooded habitats in October to overwinter.

The general threats to amphibians such as pollution, habitat degradation, and fragmentation are applicable to this species. However, since they are so strongly associated with moist forest habitats, one of the highest concerns for this species is loss of these kinds of habitats, especially those which contain fishless waterbodies, and ephemeral and permanent ponds. Additionally, due to their short active breeding period, highly impactful actions during early Spring have the potential to greatly disturb their mating season and reduce future population numbers. This species is known to disperse among wetland areas and have a high rate of population “turnover,” the culmination of demographic patterns such as birth, death, dispersal, and migration. Therefore, movement between subpopulations is known to be important to keep numbers stable. Habitat fragmentation such as agricultural areas and roads greatly affect the ability of this species to maintain viable populations. This species is known to habitually avoid non-wooded areas.

5.10.5.3 Treefrogs, Spring Peeper, & Boreal Chorus Frog

Gray treefrogs and Cope’s gray treefrogs have specialized toepads that allow them to take advantage of forested environments, where they can often be found in proximity to open wet grassland areas. They typically prefer breeding ponds without predatory fish. To date, there are more confirmed gray treefrog occurrences from the three-county area (Bayfield, and likely Ashland and Iron counties) than there are for Cope’s gray treefrog (Bayfield County). Gray treefrogs were observed in a wooded wetland at the Silver Creek HDD site by DNR staff during June 2023 site visits.

Spring peepers occur throughout most of Wisconsin and are active from late March through November. Although technically a type of treefrog, spring peepers rely more on ephemeral ponds or sedge meadow wetlands for breeding, often in wet forested areas. Outside the breeding season, the species uses moist forested habitats and leaf litter in proximity to ephemeral wetlands or waterbodies. During winter, spring peepers burrow underground. There is a stronger correlation of this species with hardwood and mixed forests over coniferous forests.

With exception of the northeastern part of the state, boreal chorus frogs occur throughout most of Wisconsin. Primary habitat for this species can range from grassland and wetland habitats to moist deciduous and boreal forests. Chorus frogs also use wetland edges of forests, swamps, marshes, and small waterbodies. Breeding typically occurs in fishless, shallow emergent (or permanent) wetlands with limited forest cover. There does not appear to be a distinct variation in habitat type between breeding and nonbreeding seasons. Chorus frogs are among the earliest active frogs in the state, and in the north begin activity around late March through mid-April, with breeding season continuing through June.

Although the DNR did not model the probable occurrences of these species, it is known that they occur throughout the region and are relatively abundant in wetland habitats. In addition to the primary conservation concerns for amphibians such as pollution and habitat loss, these species are known to be negatively affected by habitat fragmentation, which can affect their movements to and from arboreal and wet grassland and breeding sites; these species are found more often in unfragmented habitats and are negatively associated with impervious areas such as concrete, roads, and urban areas. At the same time, all four species can inhabit developed areas where access between necessary habitat components is maintained.

The potential for Enbridge’s proposed route to cross 44 acres of wetland habitats along the ROW and temporary workspaces, RA-01 to cross 68 wetland acres, RA-02 to cross 91 wetland acres, and RA-03 to cross 368 wetland acres (Table 5.9-1and Table 5.9-2) suggests both direct and indirect effects to these species through the likely loss of breeding habitat and fragmentation. In addition, disturbance that would allow establishment of invasive plants could also affect these species. Maerz et al. (2010) found that presence of species like reed canary grass (*Phalaris arundinaceae*) and the common reed (*Phragmites australis*) have been shown to significantly increase mortality compared to native vegetation.

5.10.5.4 Blue-spotted Salamander

Ideal habitat for the blue-spotted salamander tends to be northern hardwood and coniferous forests, and breeding typically occurs in these and other habitats associated with ephemeral wetlands. Downed, woody debris and moist microenvironments are common resting locations for this and other salamander species. This species is noted as being able to tolerate drier conditions than most other salamanders found in Wisconsin. This species emerges from hibernation around March to April and begins to actively seek out wetlands for breeding. As adults, this species preys upon pill bugs, slugs, earthworms, and other invertebrates, and in turn are prey to shrews, raccoons, snakes, wading birds, and other small vertebrates. As aquatic larvae, they prey upon mosquito larvae and other aquatic invertebrates and are preyed upon by dragonfly naiads, diving beetles, and other carnivorous aquatic invertebrates.

Of the four amphibian species that the DNR modeled, the blue-spotted salamander would be the species most likely to be affected by Enbridge's proposed Line 5 relocation. DNR's modeling predicted the occurrence of blue-spotted salamander on three acres of ROW and temporary workspace along Enbridge's proposed relocation route, on 10 acres along RA-01, on 22 acres along RA-02, and on 86 acres along RA-03 (Table 5.10-4), suggesting potentially significant direct effects. In addition, the loss of 152 acres of forest cover along Enbridge's proposed route (Table 5.9-3), including 10.5 acres of boreal forest and 38.4 acres of northern mesic forest habitats (Table 5.9-1), could indirectly affect this species by reducing and fragmenting available habitat. RA-01 would affect slightly more blue-spotted salamander habitat and forest cover (10 and 132 acres, respectively). Greater acreages of forest cover would be lost with RA-02 (259 acres) and RA-03 (580 acres) (Table 5.9-3).

Threats to this species include habitat fragmentation, human disturbance, and pollution of aquatic and terrestrial habitats. There is an exceptionally long list of environmental contaminants that can contribute to lethal and sublethal effects on amphibians, especially due to their permeable skin. Lefcort et al. (1997) found that for *Ambystoma* salamanders exposed to oil, excessive silt, and a water mold experience "reduced growth, earlier metamorphosis, and increased susceptibility to the water mold *Saprolegnia parasitica.*" Sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect wetland habitats that these salamanders use.

5.10.5.5 Four-toed Salamander

The smallest salamander species found in Wisconsin, four-toed salamanders, are more common in the northern third of the state and have been vouchered in all three counties in the three-county area. This species, as with other species in the family Plethodontidae, lack lungs. Four-toed salamanders are most strongly associated with mesic forests with bogs and creeks. They lay eggs within sphagnum moss on edges of ephemeral waterbodies, and newly emerged aquatic larvae mature in three to eight weeks. In northern Wisconsin, the earliest emergence dates have been recorded as mid-June. Within Wisconsin, this species is considered a special concern species and a Species of Greatest Conservation Need.

Because of the unique conditions required for egg laying, and a need for both forested and aquatic habitats, this species is more restricted in their potential habitat than some other salamanders in the state and contributes to their special status. In Bayfield County, high quality hardwood forest habitat of this species was found to include stands of balsam fir, sugar maple, northern red oak, and paper birch. Consequently, areas of high predicted presence of most of these species was modelled to be present in Bayfield and Ashland counties. This species is known to re-use breeding sites, which contributes to its sensitivity of habitat disruption, especially of moist sphagnum sites. The primary threat to this species is habitat degradation and fragmentation.

The DNR's modeling did not predict the occurrence of four-toed salamanders on the ROW or temporary workspaces along Enbridge's proposed relocation route or RA-01 (Table 5.10-4). The modeling predicted occurrence at one acre along RA-02, and on 27 acres along RA-03 (Table 5.10-4), suggesting potentially direct effects from those route alternatives. In addition, the loss of 152 acres of forest cover along Enbridge's proposed route (Table 5.9-3), including 10.5 acres of boreal forest and 38.4 acres of northern mesic forest habitats (Table 5.9-1), could indirectly affect this species by reducing and fragmenting available habitat. RA-01 would affect slightly less forest cover (132 acres), while greater acreages of forest cover would be lost with RA-02 (259 acres) and RA-03 (580 acres) (Table 5.9-3).

5.10.5.6 Eastern Red-backed Salamander

Found primarily in the northern half of Wisconsin, this species respires solely through their skin which imposes adherence to moist forested habitats. Ideal forests are mesic and wet-mesic northern hardwood forests and conifer swamps, where they burrow among ground leafy and woody debris. Juveniles develop directly without an intermediate aquatic phase making this species entirely terrestrial. Humid terrestrial environments made up of damp leaf litter, branches, and decomposing woody material are ideal micro-habitats. Drying conditions require the salamanders to burrow more deeply to find moist conditions. Bergeson (2001) discovered that areas of downed woody debris of eastern hemlock and sugar maple are positively correlated with the presence of this species.

The DNR's modeling did not predict the occurrence of four-toed salamanders on the ROW or temporary workspaces along Enbridge's proposed relocation route, RA-01, or RA-02 (Table 5.10-4). The modeling predicted occurrence on only two acres along RA-03 (Table 5.10-4), suggesting potentially direct effects from construction would be limited. However, the loss of 152 acres of forest cover along Enbridge's proposed route (Table 5.9-3), particularly the loss of 38.4 acres of northern mesic forest habitats (Table 5.9-1), could indirectly affect this species by reducing and fragmenting available habitat. RA-01 would affect slightly less forest cover (132 acres), while greater acreages of forest cover would be lost with RA-02 (259 acres) and RA-03 (580 acres) (Table 5.9-3).

Like many other salamander species, eastern red-backed salamanders do not disperse far from one location, meaning any disruption in habitat is likely to have significant negative effects on population health and habitat quality. This is exemplified by population declines through the species' entire range. Secondarily, intrusion of subsurface and surface contaminants or those that persist in the aquatic environment are likely to impart negative physiological and reproductive effects on this species due to their connection to damp microenvironments and their limited ability to disperse far from their breeding sites.

5.10.5.7 Mudpuppy

Mudpuppies are entirely aquatic and retain external gills as adults. They are most active at night and emerge from hides (logs, rock crevices, and holes) to forage for small fish and invertebrates. This species is active year-round, even in iced-over bodies of water. Mudpuppies occur in some of the larger rivers and sloughs in the Bad River watershed. Mating typically occurs in early August, however eggs and fertilization only occurs in the spring, and eggs are typically laid between April and June in clutches stuck to the roofs of underwater cavities made of rock or logs. These hiding areas are necessary habitat for safety and for mating and egg laying. Unlike many other salamander species found within the state, mudpuppies can frequently be found in bodies of water where fish are also present, and even the largest of waterbodies found in the state such as Lake Michigan and Lake Superior.

Further, mudpuppies require cavern-like burrows to hide, breed, and lay eggs, in combination with muddy or detritus-covered waterbody floors. These conditions combined with their entirely aquatic lifestyle mean that undisturbed, natural aquatic habitats are important for this species. Excessive sedimentation can directly affect access to and quality of breeding caverns and submerged vegetation which are sought by this species for cover. Any aquatic contaminants or pollution is likely to impart harmful effects on mudpuppies, making petroleum spills a particular concern. As carnivores with a broad diet including aquatic invertebrates, fish, and other amphibian larvae, environmental and habitat degradation will likely negatively affect fertility and populations of Mudpuppies in affected areas. Sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect river habitats that mudpuppies use.

5.10.6 Select Reptiles & Effects

Wisconsin hosts 36 species of reptiles, 13 of which can be found within Ashland, Bayfield, and Iron counties (Table 5.9-4). Some species, like the common gartersnake, are habitat generalists and occur nearly ubiquitous, while others, like the prairie skink, are less common and associated with only specific habitats. Significant works dealing with the life history, ecology, distribution, and status of Wisconsin reptiles include Vogt (1981), Casper (1996), and Kapfer and Brown (2022).

Table 5.10-5 Reptile species reported from Ashland, Bayfield, and Iron counties.

Species	Ashland	Bayfield	Iron
Prairie skink (*Plestiodon septentrionalis*)		X	
Smooth greensnake (*Opheodrys vernalis*)	X	X	X
Eastern foxsnake (*Pantherophis vulpinus*)	X	X	
Ring-necked snake (*Diadophis punctatus*)	X	X	X
Eastern hod-nosed snake (*Heterodon platirhinos*)	X	X	
Common watersnake (*Nerodia sipedon*)		?	X
Red-bellied snake (*Storeria occipitomaculata*)	X	X	X
Common gartersnake (*Thamnophis sirtalis*)	X	X	X
Snapping turtle (*Chelydra serpentina*)	X	X	X
Painted turtle (*Chrysemys picta*)	X	X	X
Blanding's turtle (*Emydoidea blandingii*)	X	X	
Wood turtle (*Glyptemys insculpta*)	X	X	X
Spiny softshell (*Apalone spinifera*)	X		

While some information about the general distribution and relative abundance of reptiles is available, Enbridge's proposed Line 5 relocation route and route alternatives have not been extensively surveyed for reptiles (with the exception of wood turtles). For this EIS, DNR biologists modeled predicted habitat occupancy for four reptiles: red-bellied snake, smooth green snake, Blanding's turtle, and wood turtle. These species generally appear to occupy relatively few acres of habitat within the permanent ROWs or temporary workspaces in the various route alternatives (Table 5.10-3). Of these species, the red-bellied snake and wood turtle would be the species most likely to be affected by Enbridge's proposed Line 5 relocation. The following section briefly discuss each of the modeled species, as well as some additional reptiles of special interest.

Table 5.10-6 Acres of habitat along Enbridge’s proposed Line 5 relocation route and route alternatives where modeled reptile species are likely to occur.

Species	Proposed	RA-01	RA-02	RA-03
Red-belled snake (*Storeria occipitomaculata*)				
Within permanent ROW	1.694	9.761	11.075	20.163
Within temporary workspace	5.205	14.005	22.289	33.596
Total	**7**	**24**	**33**	**54**
Smooth green snake (*Opheodrys vernalis*)				
Within permanent ROW		0.495		3.248
Within temporary workspace	0.040	0.742		4.495
Total	**0**	**1**	**0**	**8**
Blanding’s turtle (*Emydoidea blandingii*)				
Within permanent ROW		0.020		
Within temporary workspace	0.230	0.072		
Total	**0**	**0**	**0**	**0**
Wood turtle (*Glyptemys insculpta*)				
Within permanent ROW	11.700	24.967	9.729	
Within temporary workspace	20.263	35.637	12.872	
Total	**32**	**61**	**23**	**0**

5.10.6.1 Red-bellied Snake

The smallest snake species in Wisconsin, this species is also well dispersed throughout the state, and is found in each of Bayfield, Ashland, and Iron counties in northern Wisconsin. The dorsal (back) of this species is generally olive-brown, with darker stripes running from head to tail. As their name suggests, they also have red to red-orange bellies, and a few distinctive orange spots on the back of their heads. They specialize is eating slugs, and generally share similar habitats to their prey living among leaf litter and organic debris. They are most active from late-April through October, mate in mid- to late-summer, and give birth the following season to live young. Though extensive habitat use and classification for this species is undocumented, they are generally known to use moist forests, particularly coniferous and wet forests in addition to using edges of wet habitat areas such as bogs, wetlands, and wet prairies. Less commonly, they have been associated with drier prairie ecosystems and open areas in Wisconsin and Illinois. They are also able, to a degree, to take advantage of disturbed areas such as road embankments and near agricultural areas.

The DNR’s modeling predicted the occurrence of red-bellied snakes on seven acres of ROW and temporary workspace along Enbridge’s proposed relocation route, on 24 acres along RA-01, on 33 acres along RA-02, and on 54 acres along RA-03 (Table 5.10-6), suggesting potentially significant direct effects. In addition, the loss of 152 acres of forest cover along Enbridge’s proposed route (Table 5.9-3), including 10.5 acres of boreal forest and 38.4 acres of northern mesic forest habitats (Table 5.9-1), could indirectly affect this species by reducing and fragmenting available habitat. RA-01 would affect slightly more red-bellied snake habitat and forest cover (24 and 132 acres, respectively) than Enbridge’s proposed route. Greater acreages of forest cover would be lost with RA-02 (259 acres) and RA-03 (580 acres) (Table 5.9-3).

Mortality and effects on habitat for this species is less documented than with other species of the state, likely partially owing to the difficulty in consistently encountering this small and cryptically colored snake. One significant cause of mortality based upon field observations is road-associated and agriculture-associated mortality. Roads attract reptiles of many kinds and offer basking opportunities, but this open space is of course very dangerous for small, slow creatures of all kinds. Further, their known associations with wet habitats such as prairies, wetlands, bogs, and edge habitat make them susceptible to population declines when these habitats are affected by human activities such as construction, pollution, degradation, and conversion for agricultural or other development activities. The general concerns for terrestrial wildlife apply to this species as well, including habitat fragmentation, total habitat loss, and degradation.

5.10.6.2 Smooth Green Snake

The smooth green snake is found in Bayfield, Ashland, and Iron counties. The species is mostly dependent upon open, grassy habitats such as wet meadows, prairies, fields, and savannas. This species is most active beginning in late April to early May through late September and early October, and most often mates in late summer. This species along with others in the region, commonly use ant mounds to overwinter, and will communally overwinter with other individuals and other species. Egg laying occurs in early autumn and this species uses rotting logs, rock crevices, or crayfish burrows for nesting. Primary prey includes grasshoppers, crickets, and other arthropods.

The DNR's modeling did not predict the occurrence of green snakes on the ROW and temporary workspace along Enbridge's proposed relocation route or RA-02. It did suggest green snakes likely occur on one acre of land along RA-02 and on eight acres along RA-03 (Table 5.10-6). This suggests there would be limited direct effects to this species from construction. Though considered generally common in Wisconsin, this species is listed as endangered in Iowa and as a Species of Greatest Conservation Need in Illinois. The DNR is currently conducting a statewide population study to better understand population trends and assess current conservation status of this snake in Wisconsin. Given their strong connections to grasslands and prairies, it is likely this species has been strongly affected by agriculture related actions, especially given the rate and extent of grassland and open prairie conversion in the Midwest. The conversion of acres of forest cover along Enbridge's proposed route (Table 5.8-3Table 5.8-3) could indirectly affect this species by creating new open, grassland habitat in the region.

5.10.6.3 Ring-necked Snake

This species is found with a central swath of Wisconsin, with more records from the northern half of the state. These snakes are most active between May and September, mate in June, and lay eggs in June under damp forest debris. They are most common in deciduous forests, and rely upon rocks, logs, and leaf litter to hide. They primarily consume amphibians and various invertebrates. Of the two subspecies, the prairie ring-necked snake (*Diadophus punctatus arnyi*) and northern ring-necked snake (*Diadophus punctatus edwardsii*), only the latter is found in the three county Bayfield, Ashland, and Iron area.

This species is secretive and therefore difficult to survey because they use leaf litter, logs, and rocky areas to hide. The DNR did not model the expected occurrence of this species. Even with little habitat use information available, it is known that this species is sensitive to disturbances in habitat, with fewer being found in and near areas of human land use change. Loss of suitable hiding areas likely directly affects both their ability to lay and protect the few eggs that they produce annually, but also to hide and avoid predators. Roads are also known to be a barrier to dispersal and limiting factor in access to suitable habitat and mating partners. Though not abundant statewide, this species can live in colonies with greater numbers, so they are also susceptible to local extirpations where many individuals live in proximity. The general concerns for terrestrial wildlife apply to this species as well, including habitat fragmentation, total habitat loss, and degradation.

5.10.6.4 Northern Watersnake

Common primarily in southern and western Wisconsin, northern watersnakes are also known from Bayfield and Iron counties. As their name suggests, this species is strongly associated and dependent on permanent and semipermanent waterbodies and wetlands such as ponds, streams, lakes, and rivers. This species typically emerges in April, and mates shortly thereafter, giving birth to live young in August and September. Watersnakes will remain active through October, when they seek out overwintering sites such as natural holes and burrows, occasionally venturing more inland to overwinter in fissures or burrows below the frost line. They generally do not disperse far from shorelines and are known to avoid more heavily forested habitats, or those with abundant tree canopy cover. Accordingly, their diet tends to also be aquatic and is mostly comprised of frogs, fish, and fish eggs. Their preferred habitat between the water-land transition zones lends itself well to thermoregulatory opportunities, in addition to a variety of prey items which change depending on the life stage and size of the snake.

Like most other reptiles, the common watersnake does not have a particularly large range, and in fact tends to be strongly associated with waterbodies and their edges. For these reasons, disruption, degradation, and draining of wetlands and waterbodies is likely to directly affect the presence and abundance of watersnakes, which are positively correlated with wetland size and connectivity (Attum et al., 2007). Intact wetland and waterbody habitats that are sizeable and connected are likely crucial for maintaining this species. Further, due to their close associations with aquatic environments, the watersnake is more susceptible to aquatic pollution and contamination than other reptiles and is known to sequester harmful compounds such as DDT, PCBs, heavy metals, and other harmful environmental contaminants. Aquatic debris such as abandoned fishing gear and trash are known to have harmful and lethal effects on individual snakes. Sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect the river habitats that water snakes use.

5.10.6.5 Blanding's Turtle

Found throughout most of the state, wither fewer or no records in most north central counties, Blanding's turtles are known to occur in Bayfield and Ashland counties, but not Iron County. This species uses a wide range of habitats to forage, find mates, nest, and thermoregulate. In large, connected habitats, the species will use wetlands, still- or slow-moving waterbodies and streams, lakes, and slow rivers. During summer months, they also use terrestrial habitats to move between and to find suitable aquatic habitats. Blanding's turtles typically emerge from overwintering in March, mate in April to early July, and nest between May and July, with hatchlings emerging in August through September. Individuals begin to find overwintering spots in deep waters or soils in October to November. This long-lived (45 to 60 years) species reaches reproductive maturity in 14 to 20 years. Females reuse nesting sites from year to year, though they may not lay eggs every year. This species has temperature dependent sex determination. Clutches frequently fail to produce any offspring, and clutches are often infertile or subject to predation.

The DNR's modeling did not predict the occurrence of Blanding's turtles in the ROWs or temporary workspaces along Enbridge's proposed Line 5 relocation route or any of the route alternatives (Table 5.10-6), suggesting there would be limited direct effects to this species from pipeline construction. The Blanding's turtle is a Special Concern species, Species of Greatest Conservation Need, and protected wild animal. Blanding's turtles have experienced 30 percent to 50 percent population declines in parallel with loss of wetlands and other connected habitats. Their long time to reach reproductive maturity, habitat fragmentation, degradation, and loss, and introduced contaminants combined with low hatching success affect Blanding's turtle populations. Maintaining open and well-drained upland areas in proximity to aquatic habitats is crucial to allowing prime nesting areas to persist; connectivity between preferred aquatic habitats is an important aspect of their movement patterns.

5.10.6.6 Wood Turtle

Wood turtles are known from most of northern and western Wisconsin, including Bayfield, Ashland, and Iron counties. Preferred aquatic habitats for this species tend to be clear, streams and creeks with hard gravel or sandy bottoms. This species is known to be intolerant of anoxic (oxygen poor) waters. Adjacent terrestrial habitats tend to be variably forested with occasional clearings, canopy gaps, and sandy riverbanks. Wood turtles spend more time on land than other Wisconsin turtles and can have large home ranges of multiple acres. They emerge from hibernation in mid-March through April, and breed from May through October. The young hatch in autumn. Overwintering begins in late autumn. Like Blanding's turtles, wood turtles can take more than a decade to reach sexual maturity, which typically occurs between 14 and 18 years. They do not tend to nest every year and have lower fertility rates than other shorter-lived species. Wood turtles are opportunistic feeders and have a wide diet ranging from vegetation and mushrooms to earthworms, insects, mollusks, and even small vertebrates such as mice and amphibians.

In Wisconsin, the wood turtle is listed as threatened and is a Species of Greatest Conservation Need due to substantial loss of habitat and associated population declines. As a long-lived species which reaches sexual maturity at more than a decade, wood turtles are predisposed to significant population declines when reproductive success and hatchling survival is affected by changes in required habitat. These changes can include increased nest predation from urban wildlife, impeded flowing streams or rivers which are required for movement, degraded, fragmented, or converted habitat, and urban encroachment. Wood turtles tend to lay small clutches which have relatively low fertility rates, have high juvenile mortality, and lay typically one clutch of eggs per year. Maintenance and preservation of highly connected riparian corridors and adjacent woodland habitat is a primary interest in protecting this species. Known nesting sites may benefit from enhanced protection from predation and human interference, as wood turtle are highly sensitive to proximity of human activity.

The DNR's modeling predicted the occurrence of wood turtles on 32 acres of ROW and temporary workspace along Enbridge's proposed relocation route, on 61 acres along RA-01, and on 23 acres along RA-02 (Table 5,10-6), suggesting potentially significant direct effects from pipeline construction. In addition, the loss of 152 acres of forest cover along Enbridge's proposed route (Table 5.9-3) could indirectly affect this species by reducing and fragmenting available habitat. Greater acreages of forest cover would be lost with RA-02 (259 acres) and RA-03 (580 acres) (Table 5.9-3). Effects of Enbridge's proposed project on the wood turtle were considered in the DNR's Endangered Resources Review (Section 5.10.9.18). Sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect the river habitats that wood turtles use.

5.10.6.7 Snapping Turtle

Snapping turtles are the largest turtle species found within Wisconsin and have been vouchered from all but Lincoln and Rusk counties. Their unique thick neck, long spiny tail, and large hooked beak make it one of the most recognizable species in the state. They are most strongly associated with permanent and semipermanent waterbodies which are slow moving or still. They're active beginning in April, and generally only leave the water to nest when females emerge and search for suitable locations in sandy or loamy soil in May to June. The search for nesting sites can be a significant undertaking, with records of up to a mile traveled by nesting females. Incubation takes around three months, and although some babies will emerge from the nest in the same year, most often they will overwinter in the nest and emerge the following spring. Snapping turtles seek out overwintering hibernacula in September through October as water temperatures decrease, and they do not tend to surface again until emerging the following spring. Hibernacula generally are beneath logs, overhanging banks, and excavated burrows in mud or vegetation. Prey items are quite varied, and range from vegetation to young birds, fish, crayfish, and even mammals.

The long incubation period required by this species for young to emerge, and the tendency for newly hatched young to overwinter tend to make this species more vulnerable to disturbance in habitats than other species with shorter incubation periods and those which do not overwinter in the nest. The extensive movements of males and females during mating season to find partners and suitable nesting sites means that this species also requires large areas of connected riparian or wetland habitats. Waterbodies with stagnant water or those with low oxygen levels are also detrimental to the overwintering ability for this species, as they remain submerged throughout the winter and require sufficient oxygen to survive the stressful temperatures of winter. Snapping turtle nests near disturbed areas are known to more frequently be destroyed or affected by predation than those in stable, healthy habitats. Further, fragmentation of habitat is known to significantly increase chances of road-related mortality in addition to restriction of movement and reproductive success. Sex is determined by incubation temperature, so habitat alteration that artificially shades or exposes ideal nesting sites is likely to alter sex ratios and decrease population stability. Though considered a common species in Wisconsin, this species is declining in numbers statewide. Sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect the river habitats that snapping turtles use.

5.10.6.8 Spiny Softshell

Spiny softshell turtles occur throughout most of the state but are sparser or absent in the eastern counties. In the north, it has been found in Ashland County. They are most active from May through October and primarily consume invertebrates ranging from crayfish to insects. They are strongly associated with aquatic habitats, and seem to prefer large rivers, streams, and waterbodies while taking advantage of logs and woody debris for basking. In June and July, this species uses sandy banks of rivers and streams to excavate nests and lay eggs, with offspring emerging in August or September.

Due to their strong associations with rivers, streams, and open waterbodies, maintenance of these ecosystems is important to maintaining health populations of this species. The spiny softshell is known to be intolerant of low oxygen levels, so any actions which contribute to eutrophication or depletion of oxygenated water will likely inhibit this species from using that area. Maintaining sandy banks along these riparian habitats is vital for continued nesting and occupation since this substrate is required for incubation of eggs. Since they are almost entirely aquatic, introduction of environmental contaminants into the watershed will affect this species more substantially than for other more terrestrial reptiles. This species is known to accumulate heavy metals from the environment. Presence of introduced plant species like the common reed *Phragmites australis* has been shown to reduce hatching success of this species. Sedimentation from construction activities, inadvertent returns from HDD crossings, or petroleum spills could directly or indirectly affect the river habitats that spiny softshells use.

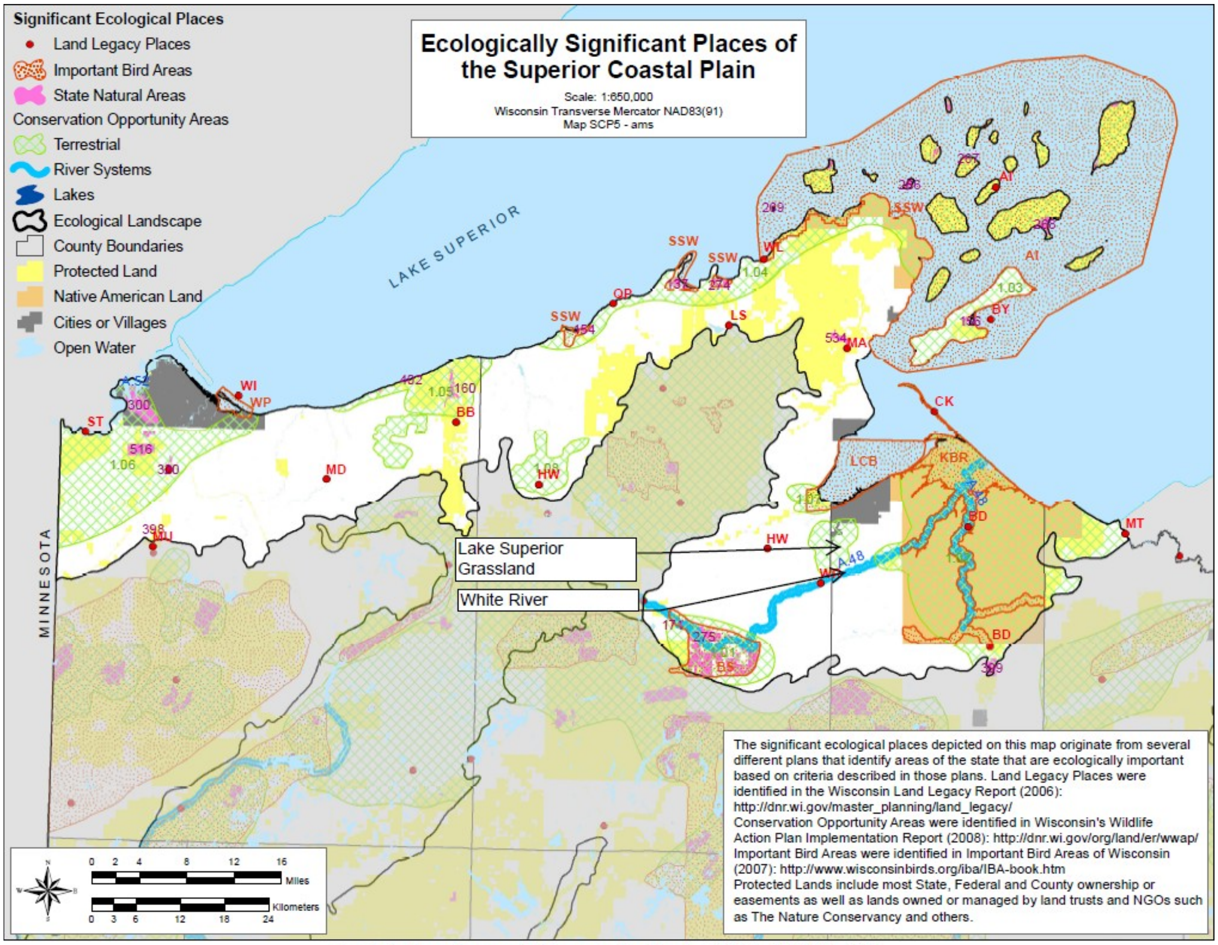
5.10.7 Species of Greatest Conservation Need

Species of Greatest Conservation Need (SGCN) have low and/or declining populations and need conservation action, as defined in the DNR’s Wisconsin Wildlife Action Plan (WWAP) (DNR, 2015a). They include invertebrates like insects, crayfish, snails, and mussels as well as birds, fish, mammals, reptiles and amphibians that are:

- listed as threatened or endangered (Sections 5.10.8and 5.10.9);
- experiencing threats to their life history needs or habitats;
- few or low in abundance or distribution; or
- currently not rare but showing declines in abundance or habitat.

The Wisconsin Wildlife Action Plan identifies habitats or Conservation Opportunity Areas with which SGCN are associated, locations where SGCN occur across the state, and conservation actions that can help keep SGCN from being listed as threatened or endangered in the future. The proposed route passes through a few Conservation Opportunity Areas including the Lake Superior Grasslands (Figure 5.10-2), White-Bad Rivers (Figure 5.10-2), and the Gogebic-Penokee Range (Figure 5.10-3). The Lake Superior Grasslands and the White-Bad Rivers Conservation Opportunity Areas are a part of the Superior Coastal Plain Ecological Landscape (Section 5.8.3.1). The Gogebic-Penokee Range Conservation Opportunity Area is a part of the North Central Forest Ecological Landscape (Section 5.8.3.2). The species, including SGCN, generally associated with the Superior Coastal Plain Ecological Landscape are listed by DNR (2015c).

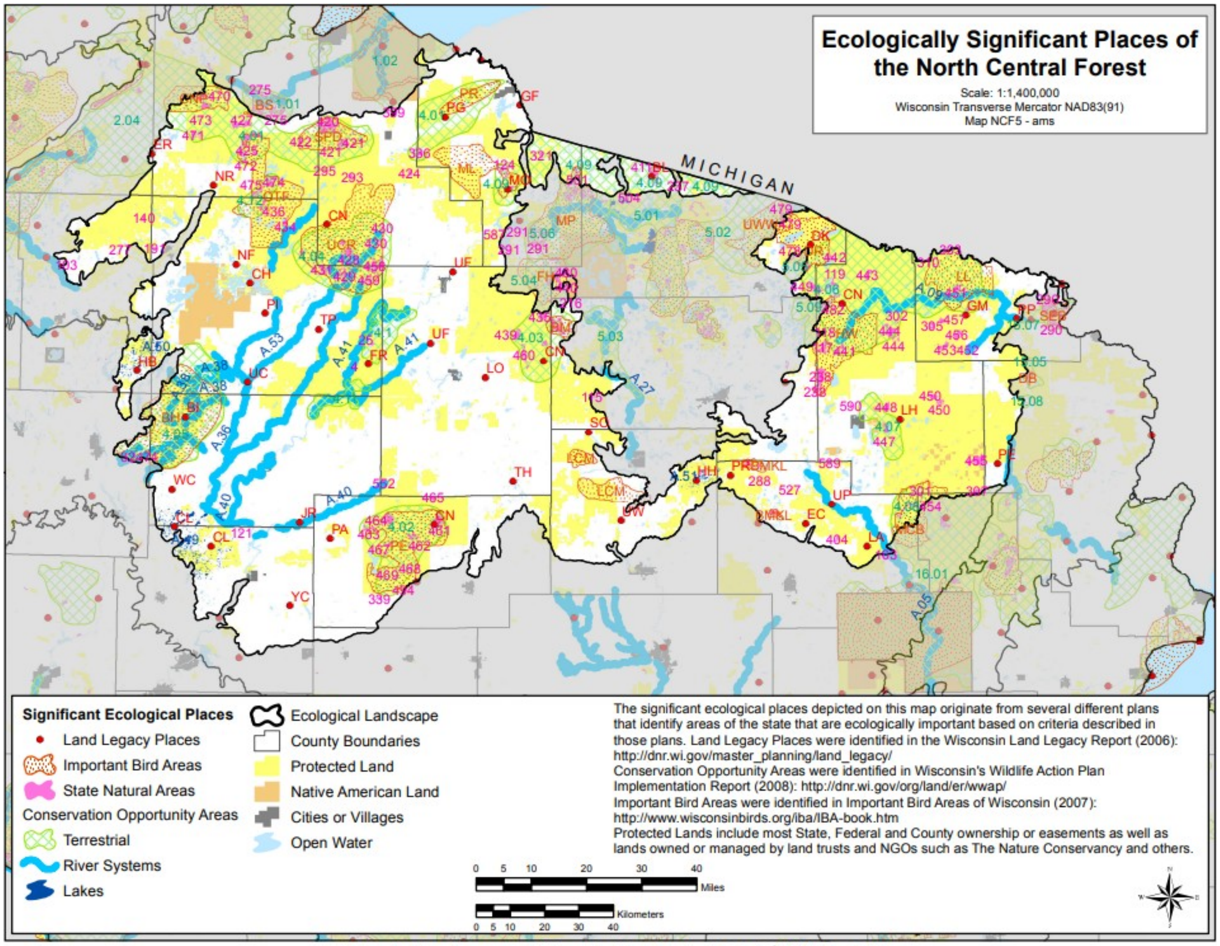
Ways in which the construction of the proposed route could generally affect wildlife are described in Section 5.10.1. Within the Bayfield, Ashland, and Iron county area, there are numerous accounts of species listed as Species of Greatest Conservation Need (Figures 5.10-2 and 5.10-3). Species on this list have small or declining populations and have been assessed by experts for listing as endangered or threatened based on habitat and population trends, distribution, abundance, and other factors. Being a Species of Greatest Conservation Need does not inherently provide protection but is intended to highlight species of particular concern based upon ongoing trends. In comparison, state threatened and endangered listings do offer forms of legal protection. Further, the third category within Wisconsin state protection status, special concern, is also aimed at elevating awareness of certain species which require further study to determine trends. Special concern species do not also inherently receive protection by this listing, however certain special concern species in the category SC/P are protected by s. NR 10.02, Wis. Adm. Code. Table 5.10-7 shows species of greatest conservation need in the three-county area. Table 5.10-8 shows federally listed wildlife species in the project area; Table 5.10-9 shows state listed wildlife species in the project area.



The significant ecological places depicted on this map originate from several different plans that identify areas of the state that are ecologically important based on criteria described in those plans. Land Legacy Places were identified in the Wisconsin Land Legacy Report (2006): http://dnr.wi.gov/master_planning/land_legacy/
Conservation Opportunity Areas were identified in Wisconsin's Wildlife Action Plan Implementation Report (2008): http://dnr.wi.gov/org/land/er/wwap/
Important Bird Areas were identified in Important Bird Areas of Wisconsin (2007): http://www.wisconsinbirds.org/iba/IBA-book.htm
Protected Lands include most State, Federal and County ownership or easements as well as lands owned or managed by land trusts and NGOs such as The Nature Conservancy and others.

Ecological Landscapes of Wisconsin Handbook - 1805.1 ©WDNR, 2011

Figure 5.10-2 Ecologically significant places in the Superior Coastal Plain
Source: Ecological Landscapes of Wisconsin Handbook



The significant ecological places depicted on this map originate from several different plans that identify areas of the state that are ecologically important based on criteria described in those plans. Land Legacy Places were identified in the Wisconsin Land Legacy Report (2006): http://dnr.wi.gov/master_planning/land_legacy/
Conservation Opportunity Areas were identified in Wisconsin's Wildlife Action Plan Implementation Report (2008): http://dnr.wi.gov/org/land/er/wwap/
Important Bird Areas were identified in Important Bird Areas of Wisconsin (2007): http://www.wisconsinbirds.org/iba/IBA-book.htm
Protected Lands include most State, Federal and County ownership or easements as well as lands owned or managed by land trusts and NGOs such as The Nature Conservancy and others.

Ecological Landscapes of Wisconsin Handbook - 1805.1 © WDNR, 2013

Figure 5.10-3 Ecologically significant places in the North Central Forest
Source: Ecological Landscapes of Wisconsin Handbook

Table 5.10-7 Species of Greatest Conservation Need known to occur within Ashland, Bayfield, and Iron counties.

Species	Taxa group	State status	State rank
LeConte's sparrow (*Ammospiza leconteii*)	Bird	SC/M	S2S3B
Long-eared owl (*Asio otus*)	Bird	SC/M	S2B
Upland sandpiper (*Bartramia longicauda*)	Bird	THR	S2B
American bittern (*Botaurus lentiginosus*)	Bird	SC/M	S2S3B
Common goldeneye (*Bucephala clangula*)	Bird	SC/M	S2B,S5N
Red-shouldered hawk (*Buteo lineatus*)	Bird	THR	S3S4B,S1N
Rufa red knot (*Calidris canutus rufa)*	Bird		
Spruce grouse (*Canachites canadensis*)	Bird	THR	S1S2
Swainson's thrush (*Catharus ustulatus*)	Bird	SC/M	S2B
Henslow's sparrow (*Centronyx henslowii*)	Bird	THR	S2S3B
Piping plover (*Charadrius melodus*)	Bird	END	S1B
Black tern (*Chlidonias niger*)	Bird	END	S2B
Evening grosbeak (*Coccothraustes vespertinus*)	Bird	SC/M	S2B,S2N
Olive-sided flycatcher (*Contopus cooperi*)	Bird	SC/M	S2B
Ruby-crowned kinglet (*Corthylio calendula*)	Bird	SC/M	S2S3B
Yellow rail (*Coturnicops noveboracensis*)	Bird	THR	S1B
Least flycatcher (*Empidonax minimus*)	Bird	SC/M	S3B
Brewer's blackbird (*Euphagus cyanocephalus*)	Bird	SC/M	S2S3B
Peregrine falcon (*Falco peregrinus*)	Bird	END	S1S2B
Whooping crane (*Grus americana*)	Bird		
Least bittern (*Ixobrychus exilis*)	Bird	SC/M	S2S3B
Loggerhead shrike (*Lanius ludovicianus*)	Bird	END	S1B
Connecticut warbler (*Oporornis agilis*)	Bird	SC/M	S2B
Canada jay (*Perisoreus canadensis*)	Bird	SC/M	S2S3
Boreal chickadee (*Poecile hudsonicus*)	Bird	SC/M	S2S3B
American woodcock (*Scolopax minor*)	Bird	SC/M	S3S4B
Cerulean warbler (*Setophaga cerulea*)	Bird	THR	S2S3B
Kirtland's warbler (*Setophaga kirtlandii*)	Bird	END	S1B
Common tern (*Sterna hirundo*)	Bird	END	S1B,S2N
Western meadowlark (*Sturnella neglecta*)	Bird	SC/M	S2B
Sharp-tailed grouse (*Tympanuchus phasianellus*)	Bird	SC/H	S1
Golden-winged warbler (*Vermivora chrysoptera*)	Bird	SC/M	S3B
Lake sturgeon (*Acipenser fulvescens*)	Fish	SC/H	S3
American eel (*Anguilla rostrata*)	Fish	SC/N	S2
Shortjaw cisco (*Coregonus zenithicus*)	Fish	SC/H	S1
Least darter (*Etheostoma microperca*)	Fish	SC/N	S3

Species	Taxa group	State status	State rank
Pugnose shiner (*Notropis anogenus*)	Fish	THR	S2
Big brown bat (*Eptesicus fuscus*)	Mammal	THR	S2S4
Northern flying squirrel (*Glaucomys sabrinus*)	Mammal	SC/P	S3
American marten (*Martes americana*)	Mammal	END	S2
Little brown bat (*Myotis lucifugus*)	Mammal	THR	S2S4
Northern long-eared bat (*Myotis septentrionalis*)	Mammal	THR	S1S2
Woodland jumping mouse (*Napaeozapus insignis*)	Mammal	SC/N	S2
American water shrew (*Sorex palustris*)	Mammal	SC/N	S3
Blanding's turtle (*Emydoidea blandingii*)	Reptile	SC/P	S3S4
Wood turtle (*Glyptemys insculpta*)	Reptile	THR	S3
Prairie skink (*Plestiodon septentrionalis*)	Reptile	SC/H	S3
A predaceous diving beetle (*Agabetes acuductus*)	Beetle	SC/N	S3
A predaceous diving beetle (*Agabus leptapsis*)	Beetle	SC/N	S2S3
Hairy-necked tiger beetle (*Cicindela hirticollis rhodensis*)	Beetle	END	S1
Northern barrens tiger beetle (*Cicindela patruela patruela*)	Beetle	SC/N	S2
A minute moss beetle (*Hydraena angulicollis*)	Beetle	SC/N	S2S3
A predaceous diving beetle (*Hygrotus farctus*)	Beetle	SC/N	S2S3
A predaceous diving beetle (*Ilybius angustior*)	Beetle	SC/N	S2S3
A predaceous diving beetle (*Ilybius subaeneus*)	Beetle	SC/N	S1S2
A predaceous diving beetle (*Oreodytes scitulus*)	Beetle	SC/N	S1S2
A flat-headed mayfly (*Maccaffertium pulchellum*)	Mayfly	SC/N	S2S4
A flat-headed mayfly (*Rhithrogena undulata*)	Mayfly	SC/N	S2S3
Yellow bumble bee (*Bombus fervidus*)	Bee	SC/N	S2
Sanderson's bumble bee (*Bombus sandersoni*)	Bee	SC/N	S1S3
Cobweb skipper (*Hesperia metea*)	Butterfly	SC/N	S2
Gray copper (*Lycaena dione*)	Butterfly	SC/N	S2
Chryxus arctic (*Oeneis chryxus*)	Butterfly	SC/N	S3
West Virginia white (*Pieris virginiensis*)	Butterfly	SC/N	S3
Mottled darner (*Aeshna clepsydra*)	Dragonfly	SC/N	S2S3
Zigzag darner (*Aeshna sitchensis*)	Dragonfly	SC/N	S1
Subarctic darner (*Aeshna subarctica*)	Dragonfly	SC/N	S1S2
Alkali bluet (*Enallagma clausum*)	Damselfly	SC/N	S1
Swamp darner (*Epiaeschna heros*)	Dragonfly	SC/N	S2S3
Sphagnum sprite (*Nehalennia gracilis*)	Damselfly	SC/N	S2S3
Extra-striped snaketail (*Ophiogomphus anomalus*)	Dragonfly	END	S2S3
Plains emerald (*Somatochlora ensigera*)	Dragonfly	SC/N	S2S3
Incurvate emerald (*Somatochlora incurvata*)	Dragonfly	END	S2S3

Species	Taxa group	State status	State rank
Speckled rangeland grasshopper (*Arphia conspersa*)	Grasshopper	SC/N	S2S4
Blue-legged grasshopper (*Melanoplus flavidus*)	Grasshopper	SC/N	S2S3
Scudder's short-winged grasshopper (*Melanoplus scudderi*)	Grasshopper	SC/N	S1S2
A stonefly (*Isogenoides frontalis*)	Stonefly	SC/N	S1S2
A stonefly (*Isogenoides olivaceus*)	Stonefly	SC/N	S2S3
A caddisfly (*Brachycentrus lateralis*)	Caddisfly	SC/N	S1S2
A caddisfly (*Psilotreta indecisa*)	Caddisfly	SC/N	S1S2
Elktoe (*Alasmidonta marginata*)	Mussel	SC/P	S3
Purple wartyback (*Cyclonaias tuberculata*)	Mussel	END	S2
Eastern elliptio (*Elliptio complanata*)	Mussel	SC/P	S2S3
Appalachian pillar (*Cochlicopa morseana*)	Snail	SC/N	S2
Cherrystone drop (*Hendersonia occulta*)	Snail	THR	S2S3
Boreal top (*Zoogenetes harpa*)	Snail	SC/N	S1

5.10.8 Federally Listed Endangered & Threatened Wildlife

The USACE generated an official list of federally threatened and endangered species using the USFWS Information for Planning and Consultation tool. The official species list identified seven listed species, including six wildlife species (Table 5.10-8), as potentially occurring along Enbridge's proposed Line 5 relocation route and route alternatives. The sections that follow describe the USACE's consultation with the USFWS and briefly describe the rare wildlife species and potential effects. Section 5.9.4 discusses endangered and threatened plants.

Table 5.10-8 Federally endangered and threatened birds and mammals identified by USACE as potentially occurring along Enbridge's proposed Line 5 relocation route and route alternatives.

Species	Status[1]	Habitat requirements
Birds		
Piping plover – Great Lakes population *(Charadrius melodus)*	END	Sandy beaches, bare alluvial and dredge spoil islands
Rufa red knot *(Caladris canutus rufa)*	THR	Along Lake Superior
Mammals		
Gray wolf (*Canis lupus*)	END	
Northern long-eared bat *(Myotis septentrionalis)*	THR	Hibernates in caves and mines – swarming in surrounding wooded areas in autumn. During summer, roosts and forages in cavities or crevices of both live and dead trees of upland forests.
Tri-colored bat (*Perimyotis subflavus*)	Proposed END	
Canada lynx *(Lynx canadensis)*	THR	Northern forests, although no resident populations are known from Wisconsin

[1] END = endangered; THR = threatened.

5.10.8.1 USFWS Consultation for Federally Listed Wildlife

Independent of this EIS, consultation under Section 7 of the Endangered Species Act (Section 1.4.1.8) is required for Enbridge's proposed Line 5 relocation project because of the need for an Individual Permit authorization from the USACE. In accordance with Section 7, the USACE as the federal action agency, in coordination with the USFWS, must ensure that any action authorized, funded, or carried out, in whole or in part, by the agency does not jeopardize the continued existence of a federally listed threatened or endangered species or result in the adverse modification of the designated critical habitat of a federally listed species. If the proposed action is likely to adversely affect a listed species or designated critical habitat, the USACE must submit a request for formal consultation to comply with Section 7. The USFWS would then issue a Biological Opinion as to whether the federal action (filling of wetlands) would likely jeopardize the continued existence of a listed or proposed species or result in the destruction or adverse modification of designated or proposed critical habitat.

The USACE initiated informal consultation with the UWFWS for the project in October 2020. In February 2021, the USFWS concurred with USACE's "May affect, not likely to adversely affect" determination for the Canada lynx and gray wolf and "may affect, incidental take not prohibited" under the 4(d) rule for the northern long-eared bat, which was at the time listed as threatened. In addition, the USACE made a "no effect" determination for the piping plover, and rufa red knot. "No effect" determinations do not require consultation with the USFWS.

In March 2023, the status of the northern long-eared bat changed from threatened to endangered. Due to this change, the USACE re-initiated informal consultation in January 2024 for the northern long-eared bat, and while not required, initiated consultation for the tricolored bat due to it being proposed for listing as endangered. In April 2024, the USFWS shared new draft guidance that replaces the Interim Consultation Framework for the northern long-eared bat, and recommended the USACE initiate formal Section 7 consultation. Using the approach provided in the USFWS guidance, the USACE evaluated the effects of Enbridge's proposed Line 5 relocation project on the northern long-eared and tricolored bats and arrived at a "may affect" determination. The USACE initiated formal consultation in May 2024 and provided a revised Biological Assessment that evaluates potential effects on these two species. As indicated in the Biological Assessment, Enbridge proposes implementing the Minimum Conservation Measures, as described in the 2024 USFWS Draft Consultation Guidance, during construction of the project. Formal Section 7 consultation is ongoing at the time of the publication of this EIS.

5.10.8.2 Piping Plover

Piping plover is listed as endangered under the Endangered Species Act, with designated critical habitat occurring in Ashland County. It is a small, sand-colored shorebird that nests and feeds along coastal sand and gravel beaches in North America. The Great Lakes population of piping plovers use open, sandy beaches, barrier islands, and sand spits formed along the perimeter of the Great Lakes (DNR, 2020l). Many coastal beaches traditionally used by piping plovers for nesting have been lost to commercial, residential, and recreational developments (USFWS, 2001). The habitat along the proposed project route consists of an herbaceous corridor with mainly forestland adjacent in most locations, and the project is located within the interior of Ashland and Iron counties ranging from approximately two to over 20 miles from the shoreline of Superior Bay. Piping plover use sandy beaches, bare alluvial islands and dredge spoil islands, such as the beaches along Lake Superior. Critical habitat designated for the species includes locations in Douglas and Ashland counties. However, neither Enbridge's proposed Line 5 relocation route nor any of the route alternatives are in close proximity to the designated critical habitat or habitat preferred by the species (DNR, 2020l). Impacts to the species are not anticipated from construction of Enbridge's proposed relocation route or routes alternatives. The USACE made a "no effect" determination for piping plover.

5.10.8.3 Rufa Red Knot

Rufa red knot is a large sandpiper about the size of a robin, measuring 9 to 10 inches in length with a wingspan of 20 inches. Populations of knots that winter near the southern tip of South America fly more than 9,300 miles from south to north to summer habitat in arctic Canada every spring and repeat the trip in reverse every autumn. Rufa red knots feed on invertebrates, especially small clams, mussels, and snails, but also crustaceans, marine worms, and horseshoe crab eggs. Key threats to the rufa red knot include coastal development, habitat destruction, habitat modification, sea level rise, climate change and other natural and anthropogenic factors (USFWS, 2019b; National Audubon Society, 2020). In Wisconsin, the red knot occurs uncommonly during migration along coastal sandy beaches in Wisconsin from mid-May to early June in spring and from mid-July to early-November in fall (DNR, 2020m).

The rufa red knot uses shallow wetlands habitat and open fields during migration through in the proposed route and alternative route corridors. Construction equipment noise or human presence could cause migrating red knots to avoid project corridors. However, these disturbances would be temporary and limited to construction and occasional inspections and maintenance. The abundance of wetlands in the vicinity of the proposed route corridor and alternative route corridors suggests that temporary impacts would not subtract from the overall availability of stopover habitat for rufa red knots and would not result in a detectable or measurable impact on an individual's survival or reproductive capacity. The USACE made a "no effect" determination for Rufa red knot.

5.10.8.4 Gray Wolf

In November 2020, the USFWS published a final rule that removed the gray wolf from the endangered species list effective January 2021. In February 2022, however, the final delisting was vacated. As a result, gray wolves in the lower 48 states outside of the Rocky Mountains are protected under the Endangered Species Act. The effects of Enbridge's proposed Line 5 relocation to the gray wolf are discussed in Section 5.10.3.5.

5.10.8.5 Northern Long-eared Bat

The endangered northern long-eared bat occurs across much of the eastern United States. During the summer (June 1 to August 15), adult females form breeding or maternity colonies that range in size from a few individuals to 30 individuals, whereas males typically roost alone (DNR, 2017). Roost sites could include both live and dead trees and can occur under bark and in crevices or cavities, suggesting that Northern long-eared bats are habitat generalists. Northern long-eared bats typically hibernate in caves and mines in mixed species groups. Hibernation begins between September and October. In April to May the species emerges from its hibernacula and migrates to summer roosting habitat (DNR, 2017). This species does not migrate great distances between its summer roosting habitat and winter hibernacula. Foraging habitat includes forested hillsides and ridges, and small ponds and streams within the forest interior and along corridors and edge habitat. The Northern long-eared bat is threatened by roost habitat destruction and by the fungal disease white-nose syndrome (DNR, 2017).

Northern long-eared bat could be impacted by clearing of forested areas in Enbridge's proposed Line 5 relocation route and alternative route corridors if clearing activities occurred outside of the winter months when the species is hibernating. Impacts to individuals could occur if tree clearing occurs while the bats are breeding, foraging, raising pups, or roosting. If time-of-year restrictions would be observed, the abundance of forest habitat in the vicinity of the proposed route corridor and alternative route corridors suggests that the project would not have a negative impact on the species. There were no NHI occurrences of the northern long-eared bat within one-mile of the proposed project area. As indicated in the USACE's Biological Assessment, Enbridge proposes implementing the Minimum Conservation Measures, as described in the 2024 USFWS Draft Consultation Guidance, during construction of the project. Formal Section 7 consultation is ongoing at the time of this EIS.

5.10.8.6 Tricolored Bat

In September 2022, the USFWS announced a proposal to list the tricolored bat as endangered under the Endangered Species Act. Once a common species, the tricolored bat ranges widely across the eastern and central United States and portions of southern Canada, Mexico, and Central America. During the winter, tricolored bats hibernate in caves and mines. During the spring, summer, and fall, they occur in forested habitats where they roost in trees, primarily among leaves. In addition, tricolored bats have been observed roosting during summer among pine needles, within artificial roosts like barns, beneath porch roofs, bridges, concrete bunkers, and rarely within caves. Female tricolored bats exhibit high site fidelity, returning year after year to the same summer roosting locations. Female tricolored bats form maternity colonies and switch roost trees regularly. Tricolored bats emerge early in the evening and forage at treetop level or above but may forage closer to ground later in the evening and are known to forage most commonly over waterways and forest edges. Males roost singly. White-nose syndrome, a fungal disease that impacts bats, has led to 90 to 100 percent declines in tricolored bat winter colony abundance at sites impacted by the disease.

Tricolored bats could be impacted by clearing of forested areas in Enbridge's proposed Line 5 relocation route and route alternative ROWs if clearing activities occurred outside of the winter months when the species is hibernating. Impacts to individuals could occur if tree clearing occurs while the bats are breeding, foraging, raising pups, or roosting. If time-of-year restrictions would be observed, the abundance of forest habitat in the vicinity of the proposed route corridor and alternative route corridors suggests that the project would not have a negative impact on the species. There were no NHI occurrences of the tricolored bat within one mile of the proposed project area. As indicated in the USACE's Biological Assessment, Enbridge proposes implementing the Minimum Conservation Measures, as described in the 2024 USFWS Draft Consultation Guidance, during construction of the project. Formal Section 7 consultation is ongoing at the time of this Final EIS.

5.10.8.7 Canada Lynx

Canada lynx is listed as threatened under the Endangered Species Act. It is a medium-size cat that generally inhabits moist boreal forests that have cold, snowy winters and a high-density snowshoe hare prey base. The predominant vegetation of boreal forests is conifer trees, primarily species of spruce and fir. In the contiguous United States, the boreal forest type transitions to deciduous temperate forest in the Northeast and Great Lakes, and to subalpine forest in the West. Lynx also require habitats with deep powdery snow, which limits competition with other hare predators. Lynx typically breed in March and April, and kittens are born from late-April to mid-June. Denning generally occurs from birth of kittens until the kittens are mobile (up until July if the kittens are born in June). Denning habitat includes log piles, windfall, or dense vegetation (USFWS, 2013). Individual lynxes maintain large home ranges generally between 12 to 83 square miles. Lynx are fairly common in interior Canada and Alaska and much rarer at the southern edge of their range in the United States. Most lynx habitat in the United States occurs on public (National Forest, National Park, and Bureau of Land Management) lands and private timber lands (USFWS, 2013).

Although rare, Canada lynx have been recorded within forested and non-forested habitats in northern Wisconsin. They are not known to reside or breed within the state. Forested habitats along the route alternatives account for 355 acres of the proposed route (59%), 279 acres of RA-01 (61%), 557acres of RA-02 (66%), and 1,043 acres of RA-03 (71%), based on a 120-foot-wide corridor. Enbridge's proposed route would have the lowest percent of impact to forest habitats. There areas would more closely reflect the totals of temporary and permanent impacts to forested habitat because the plans for the proposed alternative currently specify that the maintained permanent corridor would be 50 feet wide and narrow to only 30-feet at sections where the pipeline would be installed using trenchless methods. Regardless of the route alternative, Canada lynx could be disturbed by construction noise and activity in multiple areas and become temporarily displaced. However, it is likely that these animals would not be significantly affected by minor and temporary disturbance. In February 2021, the USFWS concurred with USACE's "May affect, not likely to adversely affect" determination for the Canada lynx.

5.10.9 State-listed Endangered, Threatened, & Special Concern Wildlife

In October 2019, Enbridge conducted an initial Endangered Resources Review for its proposed Line 5 relocation route. The DNR completed the latest Endangered Resources Review renewal in June 2024. Eighteen rare wildlife species, including eight insects, nine birds, and one reptile (Table 5.10-9), were identified as having known occurrences within one mile for terrestrial and wetland species and two miles for aquatic species of Enbridge's proposed Line 5 relocation route. These data were derived from the NHI Portal. The NHI Working List is made up of species known or suspected to be rare in the state along with natural communities and geological features native to Wisconsin. It includes species legally designated as threatened or endangered, as well as species in the advisory special concern category. The following sections describe the rare wildlife species within proximity of Enbridge's proposed Line 5 relocation route (Table 5.10-9). The NHI records along the alternative routes will not be discussed in detail. However, there were 14 state-listed species for RA-01, 36 state-listed species for RA-02, and 38 state-listed species for RA-03 (Enbridge, 2020e). Section 5.9.4 discusses effects on rare plants and Section 5.9.2.12 discusses effects on high-quality natural communities in the project vicinity.

Table 5.10-9 State listed wildlife species that may occur along Enbridge's proposed Line 5 pipeline relocation route and route alternatives.

Species	Group	State status	Federal status
Yellowbanded bumble bee (*Bombus terricola*)	Bee	SC/N	SOC
Confusing bumble bee (*Bombus perplexus*)	Bee	SC/N	
A predaceous diving beetle (*Agabetes acuductus*)	Beetle	SC/N	
Evening grosbeak (*Coccothraustes vespertinus*)	Bird	SC/M	
Loggerhead shrike (*Lanius ludovicianus*)	Bird	END	SOC
American goshawk (*Accipiter gentilis*)	Bird	SC/M	SOC
Long-eared owl (*Asio otus*)	Bird	SC/M	
Black-backed woodpecker (*Picoides arcticus*)	Bird	SC/M	
Least bittern (*Ixobrychus exilis*)	Bird	SC/M	
American bittern (*Botaurus lentiginosus*)	Bird	SC/M	
Canada jay (*Perisoreus canadensis*)	Bird	SC/M	
Upland sandpiper (*Bartramia longicauda)*	Bird	THR	
West Virginia white (*Pieris virginiensis*)	Butterfly	SC/N	
A caddisfly (*Psilotreta indecisa*)	Caddisfly	SC/N	
A humpless casemaker caddisfly (*Brachycentrus lateralis*)	Caddisfly	SC/N	
Swamp darner (*Epiaeschna heros*)	Dragonfly	SC/N	
A flat-headed mayfly (*Maccaffertium pulchellum*)	Mayfly	SC/N	
Wood turtle (*Glyptemys insculpta*)	Reptile	THR	SOC

NA = Not Applicable, SC = Special Concern, SC/M = Special Concern, Full Protected by federal and state laws under the Migratory Bird Treaty Act; SC/N = Special Concern/No lows regulating use, possession, or harvesting; SOC = Species of Concern; THR = Threatened.

5.10.9.1 Yellow Banded Bumble Bee

Suitable habitat for the yellow handed bumble bee may occur at or immediately adjacent the proposed project area. Although not protected under the state endangered species law, the DNR recommended that measures be followed to avoid effects to this species and its associated habitat. If the yellow banded bumble bee is present on or near Enbridge's proposed ROW, recommended measures include restoring the site with a native flowering seed mix.

5.10.9.2 Confusing Bumble Bee

Suitable habitat for the confusing bumble bee may occur at or immediately adjacent to the project area. Although not protected under the state endangered species law, the DNR recommended that measures be followed to avoid effects to this species and its associated habitat. If the confusing bumble bee is present on or near Enbridge's proposed ROW, recommended measures include restoring the site with a native flowering seed mix.

5.10.9.3 A Predaceous Diving Beetle

Suitable habitat (e.g., ephemeral and riverine ponds, and spring ponds/lakes) for a special concern predaceous diving beetle (*Agabetes acuductus*) may be present within or immediately adjacent the proposed project area. BMPs could be implemented for these community types to avoid effects on this species.

5.10.9.4 Evening Grosbeak

Suitable habitat for the evening grosbeak may be present within or immediately adjacent to the proposed project area. The DNR's modeling predicted the occurrence of evening grosbeak on nine acres of permanent ROW or temporary workspace on Enbridge's proposed relocation route, on 15 acres along RA-01, on 29 acres along RA-02, and 41 acres along RA-03 (Table 5.10-2), suggesting the potential for direct effects to this species if present during construction. Although not protected under the state endangered species law, the DNR recommended that measures be followed to avoid effects to this species and its associated habitat, including avoiding disturbances to the proposed project site from May 10 to July 31.

5.10.9.5 Loggerhead Shrike

Habitat cover within the project ROW consists of a combination of fallow and active agricultural/pastureland and forest edge. This cover type is suitable habitat for loggerhead shrike, and the potential exists for the species to use this area for hunting and nesting. Noise or presence of humans and equipment involved in Enbridge's proposed construction activities could cause loggerhead shrikes to startle and flush from the forest or fields or to avoid the area. Construction would temporarily affect some cultivated fields that could temporarily affect the foraging and sheltering behaviors of individual shrikes. Some forested areas would be permanently affected by operation of the pipeline (e.g., routine maintenance mowing and clearing of vegetation). In 2020, 2021, and 2023, presence/absence surveys were conducted for the loggerhead shrike in accordance with the guidance provided by the DNR and survey methods approved by the DNR. No observations were recorded during any of the field seasons. DNR bird species experts have agreed that given the negative results, presence/absence surveys can now occur every two years. Otherwise, it is required that disturbances to the project site be avoided from April 20 to August 1 to avoid impacting this species. According to Enbridge (Enbridge EIR), they will avoid activities March 15 to October 31 to the greatest extent practicable.

5.10.9.6 American Goshawk

Suitable habitat for the northern goshawk may be present within or immediately adjacent to Enbridge's proposed Line relocation route. The DNR's habitat modeling predicted the occurrence of American goshawk on three acres of the proposed ROW and temporary workspace and on six acres along RA-02 and RA-03 (Table 5.10-2), suggesting limited direct effects. However, the loss of 152 acres of forest cover along Enbridge's proposed route (Table 5.9-3), including 10.5 acres of boreal forest and 38.4 acres of northern mesic forest habitats (Table 5.9-1), could indirectly affect this species by reducing and fragmenting available habitat. Although not protected under the state endangered species law, the DNR recommended that measures be followed to avoid effects to this species and its associated habitat, including avoiding disturbances from March 20 to July 31.

5.10.9.7 Long-eared Owl

Suitable habitat for the long-eared owl may be present within or immediately adjacent Enbridge's proposed Line 5 relocation ROW. Although not protected under the state endangered species law, the DNR recommended that measures be followed to avoid effects to this species and its associated habitat, including avoiding disturbances from March 20 to June 20.

5.10.9.8 Black-backed Woodpecker

Suitable habitat for the black-backed woodpecker may be present within or immediately adjacent Enbridge's proposed Line 5 relocation ROW. Although not protected under the state endangered species law, the DNR recommended that measures be followed to avoid effects to this species and its associated habitat, including avoiding disturbances from May 1 to July 20.

5.10.9.9 American Bittern

Suitable wetland habitat for the American bittern may be present within or immediately adjacent Enbridge's proposed Line 5 relocation ROW. Although not protected under the state endangered species law, the DNR recommended that measures be followed to avoid effects to this species and its associated habitat, including avoiding disturbances from May 1 to July 15.

5.10.9.10 Least Bittern

Suitable open wetland habitat is not present within or adjacent Enbridge's proposed Line 5 relocation ROW within one mile of the known occurrence.

5.10.9.11 Canada Jay

Suitable habitat for the Canada jay may be present within or immediately adjacent Enbridge's proposed Line 5 relocation ROW. Although not protected under the state endangered species law, the DNR recommended that measures be followed to avoid effects to this species and its associated habitat, including avoiding disturbances from March 5 to May 20.

5.10.9.12 Upland Sandpiper

Suitable open upland habitat is not present within or adjacent Enbridge's proposed Line 5 relocation ROW within one mile of the known occurrence.

5.10.9.13 West Virginia White

Suitable habitat for the West Virginia white may occur along Enbridge's proposed Line 5 relocation ROW. The toothplant (*Cardamine diphylla*) is the host plant for this species. Suitable habitat may be present within or immediately adjacent to the proposed project area. Measures to reduce impacts on suitable habitat, including the host plant, could be implemented during the course of the project to minimize effects on the West Virginia white.

5.10.9.14 A Caddisfly

Erosion and sedimentation could affect the caddisfly (*Psilotreta indecisa*). Although not protected under the state endangered species law, because the proposed project has the potential to affect suitable rivers and a creek in the proposed project area, the DNR recommended that measures be followed to avoid effects to this species and its associated habitat, including erosion and runoff prevention measures.

5.10.9.15 A Humpless Casemaker Caddisfly

Erosion and sedimentation could affect the humpless casemaker caddisfly (*Brachycentrus lateralis).* Although not protected under the state endangered species law, because the proposed project has the potential to affect suitable rivers and a creek in the proposed project area, the DNR recommended that measures be followed to avoid effects to this caddisfly and its associated habitat, including erosion and runoff prevention measures.

5.10.9.16 Swamp Darner

Suitable wooded wetland/ditches habitat may be present within or immediately adjacent Enbridge's proposed Line 5 relocation ROW. Although not protected under the state endangered species law, certain measures can be taken to avoid affecting this species and associated habitat. If the swamp darner is present on or near the site, recommended measures include coordinating with the DNR's Endangered Resources Utility Liaison measures to minimize effects on this invertebrate.

5.10.9.17 A Flat-head Mayfly

Erosion and sedimentation could affect the flat-head mayfly (*Maccaffertium pulchellum*). Although not protected under the state endangered species law, because the proposed project has the potential to affect suitable rivers and a creek in the proposed project area, the DNR recommended that measures be followed to avoid effects to this mayfly and its associated habitat, including erosion and runoff prevention measures.

5.10.9.18 Wood Turtle

Seven known wood turtle occurrences occur within two miles of Enbridge's proposed pipeline relocation. The project would cross through areas of suitable wood turtle habitat and could impact the species. Anticipated effects on the wood turtle could occur if clearing of suitable habitat for construction workspace takes place during times of the year and at locations where individuals are overwintering, nesting, or foraging. Turtles could be injured or killed during construction if clearing occurs during the species' active window (March 15 to October 31).

Enbridge conducted preliminary habitat assessments concurrently with the wetland and waterbody field surveys in late August through October 2019 with specific habitat surveys taking place in 2020. The surveys were conducted in accordance with the guidance provided by the DNR to assess the presence of suitable wood turtle habitat within areas of waterbody crossings identified by the Endangered Resources Review within the proposed project area. Any incidental wood turtle observations encountered during habitat surveys were documented with spatial points in addition to digital photos of the individuals. Wood turtle habitat surveys resulted in the documentation of suitable waterbody and upland nesting habitats, and three incidental observations of wood turtles, along eight rivers in the project area.

Activities that would not be covered under the DNR's Broad Incidental Take Permit/Authorization for wood turtle and associated requirements within 300 meters of suitable waterbodies include the following:

- Ground disturbance, heavy equipment operation or supply/equipment storage within nesting habitat (exposed sand or gravel areas within 200 feet of a suitable stream/river) during the nesting season (May 20 to September 18) unless herp fencing has been installed or habitat has been made unsuitable outside of these dates;
- Instream work (e.g., streambank/rip rap installation, ford installation, open cut trenching, and dredging) and drawdowns during the maximum overwintering period (October 1 – April 30); and
- When construction crews are working within 300 meters of suitable waterbodies, crew members would need to move any turtles out of harm's way during construction operations.

Additional recommended actions to minimize or avoid take of the wood turtle include:

- For disturbance occurring within suitable upland habitat during the active period, impacts can be avoided by installing exclusion fencing during the preceding non-active period.
- Work within overwintering habitat should only occur from May 1 to September 30 to minimize impacts.
- Limit clearing to the winter months when the species is in hibernation and limiting the amount of habitat cleared.

5.10.10 Forest Interior Species

Forest interior species will be negatively affected temporarily and permanently due to habitat destruction and fragmentation. Habitat fragmentation results in an "edge effect" that changes the microecosystem by increasing light levels, rising daytime temperatures, increasing wind speed, and lowering humidity. These effects can result in habitat loss, greater fire risk, higher invasive species threats, decreased biodiversity and altered ecological processes (Primack and Morrison, 2013). Edge often favors and provides habitat to common species such as deer and coyotes while destroying important habitat for species of concern such as northern goshawks, American marten, amphibians and many forest interior birds and plants.

The loss of shrub and forest habitats would be long term, requiring from 5 to more than 100 years for establishment of shrubs and trees within reclaimed areas of the construction ROW. Within the new permanent ROW, mature forest stands containing relatively high wildlife habitat value would be converted into herbaceous cover dominated by grasses. The permanent removal of trees and large shrubs would fragment this mostly forested habitat and create a break in canopy cover that could increase exposure of some wildlife species to ground-based predators (such as fox and coyotes), aerial predators (such as hawks and eagles), and human hunting/trapping pressure. Some of the forest interior species that would lose habitat are uncommon, such as the American marten and northern goshawk, whereas edge species that will benefit from this proposed corridor are common such as white-tailed deer and turkey.

The permanent removal of trees would also result in loss of nesting and den sites, with greater losses resulting from the removal of older, more mature trees since these habitats take many decades to establish. Old-growth forests are ecologically important areas for wildlife. Today, only 0.3% of historic old-growth forests remain in Wisconsin (Bates, 2018).

Forested areas outside of the permanently maintained ROW would be allowed to revegetate naturally with tree and shrub species common to the area. Over time, natural growth and succession would restore the temporary portion of the construction ROW and additional temporary workspace areas to a forested community, and some wildlife species would return.

5.10.11 Climate Sensitive Communities & Species

Wisconsin Initiative on Climate Change Impacts (WICCI) is a collaboration of scientists and stakeholders in partnership with the Nelson Institute for Environmental Studies at the University of Wisconsin-Madison and the DNR. The general scope and impact of climate change in Wisconsin were evaluated based on predictions of future temperature patterns generated from appropriately scaled global circulation models.

Climate change affects Wisconsin's native species and natural communities in a variety of ways. The primary climate-related drivers of natural community change germane to this project include more frequent and intense rain events, warming temperatures, drought, and changes in winter weather – these may interact with each other as well as existing stressors and could lead to secondary effects such as longer growing season (WICCI, 2011).

Species with the following characteristics within the project area could be negatively affected by climate change (WICCI, 2011):

- Species with long generation times
- Species at the southern edge of their range or with narrow distributions
- Species having poor dispersal ability
- Habitat specialists
- Species that are sensitive to human activities

Decrease in the length of winters could result in spring weather onsetting six to 20 days earlier. In accordance, trees and flowers bud earlier and ice is off lakes sooner. Timing of life cycles of various organisms may no longer be in sync, such as the life cycles of pollinators and flowering plants that depend on them, and as a consequence, decreasing viability of both pollinator and plant. The changing timing of the seasons is also predicted to result in the modification of the migration behavior of wildlife. Increasing air temperatures are anticipated to result in increasing surface water temperatures. And predictably, increasing water temperatures are anticipated to result in changing habitability of streams for cold-water fish species (WICCI, 2011). Wisconsin is projected to have more frequent and more intense storms. Runoff from extreme storm events has greater velocity and carries greater amounts of sediment and nutrients to vulnerable streams and wetlands. The most vulnerable wetlands and waterways are those that lie downstream from areas such as construction sites where soils are disturbed, altered, and compacted.

Water is crucial to forested wetlands, and potential changes to hydrology are anticipated to have a large effect on northern lowland forests (Handler et al. 2020). Precipitation could become more variable in the future, with more rain instead of snow in winter, earlier snowmelt, and more rain falling in intense storms with longer dry spells in between. This could especially impact systems dependent on stable water levels like conifer swamps and could compound stress on sites where hydrology has already been altered.

In upland forests, warmer winters, a decline in snowpack and more freeze-thaw cycles are expected in the future, meaning tree roots normally protected by an insulating snowpack could be more vulnerable to frost damage (Handler et al. 2020). Snow-roosting species such as American marten and ruffed grouse will also be negatively affected if expectations become reality. Snow-roosting species depend on deep snow with a minimal to no-crust layer in order to thermal regulate. Decreased snowfall will result in fewer roosts for these species and could result in decreased fitness and/or death; for instance, American marten rely on subnivean habitat and were using subnivean sites over snag and live tree sites 100% of the time during periods of 100% snow cover (Spencer, 1987). Freeze-thaw cycles increase crust layers making it difficult for these species to burrow into the snow as well. Lastly, species who may do better in these conditions—such as fisher—will compete with threatened/endangered species—such as American marten—and heighten population decline (Krohn, Elowe, and Boone, 1995). Lastly, warmer temperatures, higher evapotranspiration rates and longer dry spells could lead to ephemeral ponds drying up earlier in the year, adversely affecting species that use these ponds for reproduction (e.g., frogs, salamanders, fairy shrimp; WICCI 2017).

Brook trout are common throughout the project area, and are a fish species highly focused on by WICCI's Fisheries Working Group. Due to their thermal and hydrologic sensitivities, brook trout are being negatively affected by climate change (both by warming and by increased precipitation in the winter and spring)(Maitland and Latzka, 2022), and their suitable habitat is expected to continue to decline across the state(Mitro et al., 2019). However, multiple sets of sub-watersheds in the project area have been identified as "Brook Trout Reserves" – places where brook trout may thrive even in a warmer future, provided other stressors are appropriately managed. These include the Brunsweiler and Bad River watersheds and the Potato River headwaters, both of which Enbridge has proposed crossing, and the Graveyard Creek watershed and nearby drainages into Lake Superior, and the headwaters of the Namekagon and White Rivers both of which are adjacent or connected to Enbridge's proposed crossings. All these reserves are considered priority areas to ensure the long-term health of brook trout habitat and populations.

Climate change also enhances opportunities for non-native invasives, forest pests and diseases to establish, spread and proliferate. Extreme droughts, floods, and blowdowns create novel disturbances and opportunities for invasion. Increased sediment and nutrient runoff associated with frequent and intense storms enhances conditions for germination and growth. Trees become stressed as they are exposed to drought and extreme heat. This stress increases their susceptibility to pests and diseases. Non-native invasive species also respond to a longer growing season and are known to increase growth in response to elevated CO_2 and warming. While cold winters and prolonged snowpack have been limiting factors for many of our invasives and forest pests, this may no longer be the case.

As discussed in Chapters 7 and 8, Enbridge's proposed pipeline relocation does not represent a new source of petroleum consumption or GHG emissions. The effects of GHG emissions from construction equipment and traffic would be a short-term, temporary incremental increase in GHG emissions, and not an ongoing new source. Nonetheless. Enbridge's proposed activities could be an added stressor to natural communities and species that are vulnerable to climate change impacts. Most if not all of the aforementioned effects of Enbridge's proposed Line 5 relocation and route alternatives may be amplified or exacerbated by climate change, and thus need to be carefully examined through a climate change lens. For example, Wisconsin's native plant communities are subject to multiple environmental challenges that diminish their ability to absorb the stresses of a rapidly changing climate. Habitat loss and fragmentation, invasive species, and storm water runoff are some of the most pressing concerns affecting natural communities (WICCI, 2020). Enbridge's proposed project would further fragment habitats as the pipeline and its 50-foot-wide ROW pass through them, non-native invasives may find increased opportunities to invade disturbed soils and wetlands via runoff, and construction-related soil disturbance could lead to increased storm water runoff. Climate change amplifies these non-climate stressors. (See Section 7.4.3 for more details.)

Wisconsin is projected to have more frequent and more intense storms. Runoff from extreme storm events has greater velocity and carries greater amounts of sediment and nutrients to vulnerable streams and wetlands. Forested wetlands and ephemeral ponds are at increased risk of rutting and hydrological disruption from construction equipment if shorter, warmer winters offer fewer days of frozen ground conditions (WICCI 2017). The most vulnerable wetlands and waterways are those that lie downstream from areas such as construction sites where soils are disturbed, altered, or compacted. Sites already prone to erosion could have increased risks of sediment losses during construction, particularly sites with sparse canopy, steep slopes, and impervious surfaces (Section 5.6). Excess sediment can negatively affect watershed hydrology and flow pathways, water quality, and potential survival and regeneration of plants and aquatic and terrestrial wildlife. Measures to limit and monitor for soil loss are essential and should meet or exceed standard BMPs.

5.11 Invasive Species & Noxious Weeds

In 2001, the Wisconsin Legislature directed the DNR to establish a statewide program to control invasive species and to promulgate rules to identify, classify, and control invasive species. Invasive species are “nonindigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health” (s. 23.22 (1) (c), Wis. Stat.). Invasive species can be aquatic or terrestrial plants or animals. These species can alter ecological relationships among native species and can affect ecosystem function, the economic value of natural resources, and human health.

Wisconsin’s invasive species rule, Chapter NR 40, Wis. Adm. Code, creates a comprehensive, science-based system with criteria to classify invasive species into two categories:

- **Prohibited invasive species** are invasive species that the DNR has determined are likely to survive, spread, and potentially cause harm if introduced into the state, but which are not found in the state, or in that region of the state where the species is listed as prohibited, with the exception of isolated individuals, small populations, or small pioneer stands of terrestrial species, or in the case of aquatic species, that are isolated to a specific watershed in the state or the Great Lakes, and for which statewide or regional eradication or containment may be feasible (s. NR 40.02(41), Wis. Adm. Code).

- **Restricted invasive species** are invasive species that the DNR has determined are already established in the state, or in that region of the state where the species is listed as restricted, and that causes or has the potential to cause harm, and for which statewide or regional eradication or containment may not be feasible (s. NR 40.02(46), Wis. Adm. Code).

With certain exceptions, the transport, possession, transfer, and introduction of prohibited species is prohibited. With certain exceptions, restricted species are also subject to a prohibition on transport, transfer, and introduction, but possession of restricted species is allowed, except for fish and crayfish. If prohibited species are discovered in the state, control may be required and the DNR may request, order, or conduct a control effort. Control of restricted species is encouraged but not required. In the context of a construction project, it is unlikely that invasive species will be moved or introduced intentionally; instead, the potential for invasive species to spread can arise from contaminated equipment and disturbance to the landscape. For both prohibited and restricted species, incidental or unknowing movement of invasive species is not prohibited if the DNR determines that reasonable precautions (intentional actions that prevent or minimize the spread) have been taken (ss. NR 40.02(44), 40.04(3)(b), 40.05(3)(b), Wis. Adm. Code).

Wisconsin statutes also define “noxious weeds.” These include Canada thistle (*Cirsium arvense*), leafy spurge (*Euphorbia esula*), field bindweed (*Convolvulus arvensis*), any weed designated as a noxious weed by the DNR by rule (as of the date of publication of this document, the DNR has not designated any noxious weeds by rule), and any other weed a county board or governing body of a municipality declares by ordinance or resolution to be noxious within its respective boundaries (s. 66.0407, Wis. Stat.). A person owning, occupying, or controlling land is required to destroy all noxious weeds on the land.

At the federal level, the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service's noxious weed program helps prevent the introduction of nonindigenous invasive plants into the United States. The federal Plant Protection Act defines a noxious weed as "any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment." The USDA maintains a list of noxious weeds.

5.11.1 Terrestrial Invasive Species & Noxious Weeds along Enbridge's Proposed Relocation Route

Terrestrial invasive species are present throughout Ashland, Bayfield, and Iron counties. Most are plants, insects, and diseases that affect the health of forested and grassland habitats. Common invasive terrestrial plants in the region include common and glossy buckthorn (*Rhamnus cathartica* and *R. frangula*), honeysuckle (*Lonicera japonica*), spotted knapweed (*Centaurea stoebe*), Canada thistle, crown vetch (*Coronilla varia*), leafy spurge, garlic mustard (*Alliaria petiolata*), tansy (*Tanacetum vulgare*), wild parsnip (*Pastinaca sativa*), and many others. Other terrestrial invasive species include insects like the spongy moth (*Lymantria dispar*) and emerald ash borer (*Agrilus planipennis*) and diseases like oak wilt and the white-nose syndrome fungus (*Pseudogymnoascus destructans*).

Enbridge documented existing invasive and noxious species occurrences throughout the construction workspace through pre-construction surveys and publicly available datasets. At the DNR's request, Enbridge also compiled and provided information on reed canary grass (*Phalaris arundinacea*) (Section 5.11.3). Invasive and noxious weed species occurrences have not been surveyed or documented for Enbridge's route alternatives.

In 2021, Enbridge conducted surveys for restricted invasive plant species and noxious weeds within the company's proposed workspaces including mainline workspaces, access roads, valve areas, and pipe yards. These surveys were limited to the construction workspace and may not fully capture invasive and noxious weed species that may be located adjacent, but outside the survey corridor. Nonetheless, Enbridge's surveys documented 23 different restricted invasive species at over 900 locations throughout the survey area (Table 5.11-1). Three USDA noxious weeds were observed: spotted knapweed, leafy spurge, and Canada thistle. The most observed invasive plants were upland species: tansy, Canada thistle, and common buckthorn. Enbridge also identified several restricted wetland plants including purple loosestrife, aquatic forget-me-not, hybrid cattail, garden heliotrope, and European marsh thistle (Table 5.11-1)

The documented invasive species and noxious weeds were generally located along roadsides, field edges, and other disturbed openings such as existing utility corridors, trails, and Enbridge's proposed pipe yards. Invasive species were also more frequently documented near population centers, including the cities of Ashland and Mellen.

Table 5.11-1 Number of terrestrial and wetland invasive plant species occurrences along Enbridge's proposed Line 5 relocation route.

Scientific name	Common name	Plant type	Occurrences
Aegopodium podagraria	Bishop's goutweed	Herbaceous	1
Alliaria petiolata	Garlic mustard	Herbaceous	4
Berberis thunbergii	Japanese barberry	Woody/Shrub	2
Campanula rapunculoides	Creeping bellflower	Herbaceous	2

Scientific name	Common name	Plant type	Occurrences
Caragana arborescens	Siberian peashrub	Woody/Shrub	1
Centaurea jacea	Brown knapweed	Herbaceous	19
Centaurea stoebe	Spotted knapweed	Herbaceous	102
Cirsium arvense	Canada thistle	Herbaceous	165
Cirsium palustre	European marsh thistle	Herbaceous	9
Coronilla varia	Crown vetch	Herbaceous	12
Epipactis helleborine	Helleborine orchid	Herbaceous	3
Euphorbia esula	Leafy spurge	Herbaceous	9
Frangula alnus	Glossy buckthorn	Woody/Shrub	36
Galeopsis tetrahit	Hemp nettle	Herbaceous	59
Lonicera sp. complex	Non-native honeysuckles	Woody/Shrub	72
Lythrum salicaria	Purple loosestrife	Herbaceous	2
Myosotis scorpioides	Aquatic forget-me-not	Herbaceous	42
Pastinaca sativa	Wild parsnip	Herbaceous	15
Rhamnus cathartica	Common buckthorn	Woody/Shrub	160
Robinia pseudoacacia	Black locust	Woody/Shrub	4
Tanacetum vulgare	Tansy	Herbaceous	201
Typha sp. complex	Hybrid cattail	Herbaceous	83
Valeriana officinalis	Garden heliotrope/ Valerian	Herbaceous	18

Nine of the mapped invasive species occurrences would be considered major infestations (greater than 0.5 acre with interrupted [50 percent to 75 percent] or continuous [75 percent to 100 percent] cover). Five of these infestations primarily contain spotted knapweed.

Enbridge provided the DNR with a table and maps documenting the locations of invasive species and noxious weeds documented by Enbridge. The DNR reviewed the information and mapped the density of invasive species and noxious weeds along Enbridge's proposed Line 5 relocation route. Observed densities increase along the project corridor from east-to-west (Figure 5.11-1), specifically between MP 0.0 and MP 3.8.

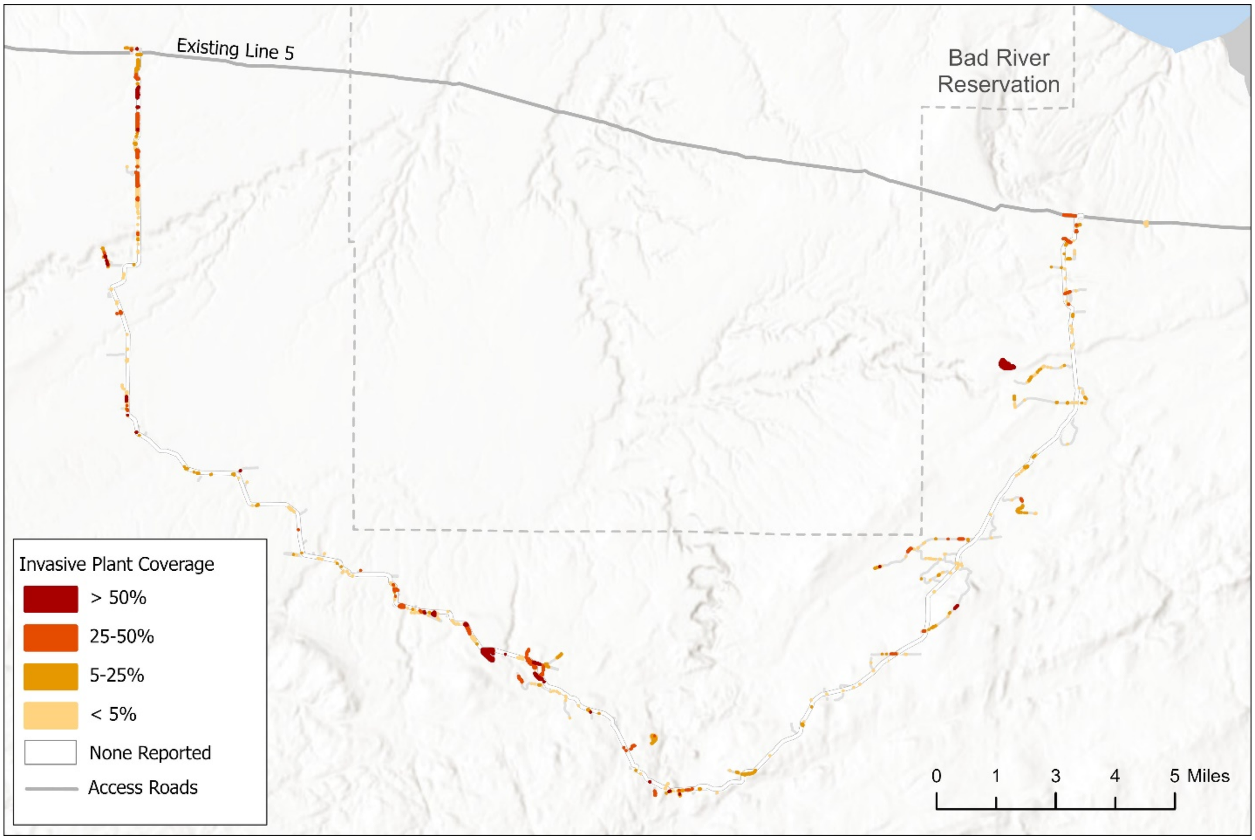


Figure 5.11-1 Percent coverage of invasive plants along Enbridge's proposed relocation workspace.

5.11.2 Aquatic Invasive Species along Enbridge's Proposed Relocation Route

Aquatic invasive species are also present in waterbodies in Ashland, Bayfield, and Iron counties. These include plants, invertebrates, and fish. Invasive aquatic plants include purple loosestrife (*Lythrum salicaria*), yellow iris (*Iris pseudacorus*), Queen of the meadow (*Filipendula ulmaria*), Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*). Invasive aquatic invertebrates include banded mystery snail (*Viviparus georgianus*), Chinese mystery snail (*Cipangopaludina chinensis*), rusty crayfish (*Orconectes rusticus*), and spiny water flea (*Bythotrephes cederstroemi*). Rainbow smelt (*Osmerus mordax*) is a restricted invasive species found in the area.

Enbridge reviewed public information for other aquatic invasive species that are known to be present in waterbodies crossed by Enbridge's proposed relocation route. Sources reviewed by Enbridge included a series of publicly available GIS mapping services and the DNR's:

- Lake, Stream, and Wetland Aquatic Invasive Species Mapping Tool
- Aquatic Invasive Species by Species Lists
- Aquatic Invasive Species by Waterbody Lists

Based on the publicly available data, Enbridge determined that its proposed Line 5 relocation route would cross one waterbody with a documented aquatic invasive species. The banded mystery snail has been reported in Tyler Forks.

The DNR also reviewed habitat suitability models developed by the UW-Madison Center for Limnology for zebra mussels, rainbow smelt, round goby (*Neogobius melanostomus*), rusty crayfish, spiny water flea, and Eurasian water milfoil. Although there are documented occurrences of these species at a small number of locations in the surrounding watersheds, apart from the rusty crayfish, the models showed limited suitable habitat for these species in the region.

5.11.3 Reed Canary Grass

Reed canary grass (*Phalaris arundinacea*) is a tall, aggressive, cool-season, perennial grass that invades and dominates a variety of wetland types, commonly forming extensive, single-species stands. Reed canary grass poses a threat to the ecological integrity of wetlands across Wisconsin. Hatch and Bernthal (2008) found approximately 500,000 acres of Wisconsin wetlands are infested with this species. The impacts of reed canary grass on the habitats it invades are many. Reed canary grass greatly reduces botanical and biological diversity by homogenizing habitat structure and environmental variability (both of which correlate with species richness), alters hydrology by trapping silt and constricting waterways, and limits tree regeneration in riparian forests by shading and crowding out seedlings. Reed canary grass also decreases retention time of nutrients and carbon stored in wetlands, accelerating turnover cycles and reducing the carbon sequestration capabilities characteristic of diverse plant communities. Reed canary grass is one of the first wetland plants to emerge in the spring, enabling it to shade out native species that emerge later in the growing season. Although its effects on wildlife are not yet entirely clear, preliminary data suggest that habitat specialist species, including several listed and protected species, are more adversely affected by reed canary grass dominance than habitat generalists. Reed canary grass invasions typically occur after disturbance from erosion, sedimentation, nutrient enrichment, road salt inflows, hydrological instability or modification, and restoration efforts that expose bare ground and increase light availability (Wisconsin Reed Canary Grass Management Working Group, 2009). Because of the prevalence and persistence of reed canary grass in Wisconsin wetlands and concerns regarding its effects, the DNR requested additional information from Enbridge regarding the distribution of reed canary grass along Enbridge's proposed relocation route.

During Enbridge's wetland delineation surveys, Enbridge documented reed canary grass occurrences throughout the proposed Line 5 relocation corridor. Since reed canary grass is not regulated in Chapter NR 40, Wis. Adm. Code, this species was not a target species during Enbridge's 2021 invasive species surveys. Enbridge reviewed the wetland delineation data sheets to determine which wetlands currently have reed canary grass; however, the delineation data sheets only document dominant vegetation species and may not provide a complete listing of reed canary grass locations. Similarly, the waterbody delineation data only documents dominant waterbody bank vegetation and may not provide a complete listing of reed canary grass locations associated with waterbodies.

Enbridge also reviewed the Wetland Rapid Assessment Method ("WRAM") data sheets completed as part of the 2019 and 2020 wetland delineation surveys as well as data from the high-quality wetland surveys completed in 2022 to further document the presence or absence of reed canary grass within wetlands that would be crossed by the proposed Line 5 relocation. Where the WRAM documented reed canary grass, the data typically only indicates if reed canary grass was present and the general distribution/density (e.g., rare, uncommon, common, abundant) and does not provide specific locations of the individual plants or overall population within the wetland. Enbridge also noted that the high-quality wetland surveys and the invasive species surveys were focused on surveying within the construction workspace and did not include the full 2019/2020 wetland delineation survey corridor; therefore, information from the high-quality wetland surveys and the invasive species surveys was limited to observations of species within the respective surveyed areas. Additional populations of reed canary grass and other invasive species may be present in adjacent areas, but outside of the surveyed areas.

Based on available information, Enbridge identified 247 wetlands as having reed canary grass present. Enbridge provided the DNR with a table and maps documenting all reed canary grass locations documented by Enbridge. The information was separated by upland, wetland, and waterbody.

As discussed above, reed canary grass is not a regulated species; however, Enbridge included management strategies in its Invasive and Noxious Species Management Plan (Appendix AB) to limit the potential introduction or spread of reed canary grass along its proposed Line 5 relocation route.

5.11.4 Effects of Terrestrial Invasive Species & Noxious Weeds

Humans have created conditions where plants and animals can aggressively invade and dominate natural areas and waterbodies in three ways:

- Introducing exotic species from other regions or countries that lack natural competitors and predators.
- Disrupting the delicate balance of native ecosystems by changing environmental conditions (e.g., stream sedimentation, ditching, building roads) or by restricting or eliminating natural processes (e.g., fire).
- Spreading invasive species through various means, including:
    - Moving watercraft from waterbody to waterbody without removing invasive plants and animals.
    - Carrying seeds of invasive plants on footwear or pet's fur.
    - Mowing along roadsides at certain times.
    - Transporting infested firewood or other wood products.
    - Driving or biking with seeds of invasive species in tire treads.

Land disturbance can also create conditions suitable to the establishment of invasive species, and improper cleaning of construction equipment can act as a vector for the spread of invasive species. One of the anticipated indirect effects to the environment during construction is the potential spread of invasive species. The plant species listed in Section 5.11.1 could be spread by the movement of construction equipment if proper measures are not taken to prevent their spread. Seeds of invasive species can stick to construction equipment and be carried along and released to areas where the invasive species are not currently present. Also, ground disturbing activities that either disturb the soil or fragment natural areas have the potential to promote the establishment of invasive species.

To address these effects, Enbridge developed an Invasive and Noxious Species Management Plan (Appendix AB) that outlines management strategies the company would use to prevent or limit the introduction and spread of invasive species and noxious weeds within the proposed project construction workspace (including pipe yards, access roads, valve sites, and the mainline construction corridor). The Invasive and Noxious Species Management Plan is complimentary to Enbridge's EPP (Appendix D) and Enbridge's Wetland and Waterbody Restoration and Post-construction Monitoring Pan (Appendix V). Enbridge's EPP (Appendix D) states, "It is Enbridge's intent to minimize the potential introduction and/or spread of undesirable species (i.e., invasive species, noxious weeds, or crop diseases) along the construction ROW due to pipeline construction activities. However, it is not practicable for Enbridge to eradicate undesirable species that are on or adjacent to the construction ROW."
Enbridge's Invasive and Noxious Species Management Plan (Appendix AB) establishes a performance goal "to have no introduction of any new invasive plant species (as listed in NR 40) that were not previously documented within the Project workspace; and no spread by the Project of existing invasive plant populations to previously uninfected areas along the Project workspace." As discussed above, reed canary

grass is not a regulated species; however, Enbridge has included management strategies to limit the potential introduction or spread of reed canary grass along its proposed relocation route. For reed canary grass, the performance goal is "to have no Project-related introduction of [reed canary grass] into wetlands where [reed canary grass] has not previously been documented and to prevent the spread of [reed canary grass] within wetlands where [reed canary grass] currently exists." According to the Invasive and Noxious Species Management Plan, Enbridge will work closely with the and USACE "to determine success or identify if additional restoration is required if performance standards are not reached after the planned monitoring is completed, or if an issue is identified during the monitoring period that may affect restoration success."

Enbridge's Invasive and Noxious Species Management Plan includes two primary strategies to prevent or minimize the introduction and spread of invasive species and noxious weeds within the project area:

- Application of prevention measures to limit introduction and spread of invasive species and nuisance weeds through use of BMPs.

- Active management of documented occurrences of invasive species, nuisance weeds, and reed canary grass.

Prevention measures and BMPs included in the Invasive and Noxious Species Management Plan that would be implemented during project pre-construction, active construction, and post-construction would address identification of invasive species and noxious weed populations, movement of personnel, movement of equipment, and movement of materials. Enbridge has also committed to several BMPs described in the EPP (Appendix D) that will limit the amount of disturbance associated with construction activities and assist with managing invasive species and noxious weed infestations. These BMPs include:

- Sequencing construction in a manner that prioritizes an east-to-west approach to minimize encountering and dispersing invasive species and noxious weeds as their densities increase along the project corridor from east-to-west (Figure 5.11-1), specifically along the existing powerline corridor between MP 0.0 and MP 3.8.
- Reducing the width of the construction workspace in wetlands and near waterbodies.
- Limiting grading and topsoil segregation to trench-line-only in wetlands.
- Installing construction mats for travel lanes in wetlands and other specific locations, using weed-free mulch.
- Removing accumulated sediment from silt fence when depth reaches one-third of height.
- Stabilization of all exposed areas, including spoil piles to limit soil erosion when construction activity has temporarily ceased in an area and will not resume for a period exceeding 14 calendar days.
- Initiating final seeding and restoration/stabilization within 48 hours of achieving final grading of the construction ROW, and upon the restoration of wetland and waterways if weather and soil conditions allow.
- Using project-specific seed mixes and adapted restoration procedures.
- De-compacting subsoil (Section 5.6.3.1).
- Conducting construction activities in agricultural lands as described in Enbridge's EPP (Appendix D) and Agricultural Protection Plan (Appendix AF).

According to Enbridge's Invasive and Noxious Species Management Plan (Appendix AB), active management practices would "be selected based on the site-specific conditions, timing, and invasive species and noxious weed ecology and applied as able throughout the project." Where existing invasive species and noxious weed occurrences have been documented, pre-treatment management would be implemented where possible. The pre-treatment objective would be to reduce the observable aboveground vegetative growth and seed production by invasive species and noxious weeds at known locations. The intended effects of pre-treatment would be to reduce the potential spread of existing documented invasive species and noxious weed plants, seeds (observable on above-ground seed heads), and propagules by reducing plant populations prior to clearing and ground-disturbing activities. Prior to conducting pre-treatment, a herbicide contractor or vegetation management specialist would verify identification to species level (where feasible) at the documented invasive species and noxious weed locations. Following pre-treatment, a visual assessment would be conducted to evaluate whether herbicide treatment had the intended effects. In areas where intended effects were not achieved, Enbridge would "consider implementing additional BMPs."

According to Enbridge's Invasive and Noxious Species Management Plan, Enbridge would implement active management strategies and BMPs during one or more of the following phases as appropriate:

- Prior to clearing.
- During clearing or other construction activities.
- During restoration.
- During wetland and waterbody post-construction monitoring.

Enbridge's Invasive and Noxious Species Management Plan includes provisions for personnel training, pre-treatment of known locations of invasive species and noxious weeds, pesticide use and application, alternative BMPs including topsoil segregation, installation of construction mats, and cleaning stations. The plan addresses the order of active management protocols and includes provisions for unanticipated invasive species and noxious weed populations.

5.11.5 Effects of Aquatic Invasive Species

Based on publicly available data, Enbridge determined that its proposed Line 5 relocation route would cross one waterbody with a documented aquatic invasive species. The banded mystery snail has been found in Tyler Forks. Enbridge has proposed installing a clear span bridge at the proposed Tyler Forks crossing location and to cross this waterbody using the HDD method. Therefore, no equipment would be expected to come into contact with the water as part of pipeline installation. If vehicles or equipment would contact the water, substrate, or other aquatic material during construction at Tyler Forks, the affected vehicles/equipment would be inspected and cleaned or allowed to dry for a minimum of five days. Enbridge proposes to ford across Tyler Forks at access road AR-085, which is at a public ford associated with Casey Sag Road and a forestry road, with a crane to allow installation of a clear span bridge. This crane would be staged on site for the duration of the construction and would be used to remove the bridge once construction was completed.

To minimize the potential for introduction or spread of invasive species due to hydrostatic testing activities, Enbridge would discharge the hydrotest water to the same source location. If water is used to test multiple test sections, it would be relayed back to the source water through the pipeline for final discharge (unless specified otherwise in applicable permits). Enbridge has proposed Tyler Forks as a source for hydrostatic test water. Water withdrawn from Tyler Forks would be discharged into an upland discharge structure near Tyler Forks and would not be discharged into other streams. BMPs to minimize potential effects on aquatic species associated with water withdrawal are described in Section 26 of Enbridge's EPP (Appendix D).

Wisconsin's invasive species rule (Chapter NR 40, Wis. Adm. Code) includes general preventive measures that address common pathways that may allow aquatic invasives to spread. These measures complement existing statutes and rules (s. 30.07(2), Wis. Stats, s. NR 19.055(1), Wis. Adm. Code) and include requirements to remove aquatic plants and animals and drain water from vehicles, boats, trailers, and equipment upon removal from the water and to remove aquatic plants and animals from any vehicle, boat, trailer, or equipment before placing it in any water or transporting it on a highway. Enbridge would be required to comply with these laws.

Enbridge proposes crossing 186 waterbodies using a variety of techniques including open-cut, dry crossing, and trenchless methods (Section 2.5). Vehicles and equipment that would contact the water during construction would be inspected and cleaned to ensure they are free of vegetation or debris following the completion of each crossing. To prevent and minimize the spread of invasive aquatic species, Enbridge would implement procedures that comply with Chapter NR 40, Wis. Adm. Code, and the DNR's "Boat, Gear, and Equipment Decontamination and Disinfection Protocol" (Manual Code 9183.1). Equipment would not be allowed to operate within waterbodies until an Enbridge Environmental Inspector (Section 2.8.2) verified that the appropriate inspection and decontamination procedures described had been implemented.

5.12 Public Lands & Trails

Public lands include lands owned by federal, state, or local units of government. Public lands within the corridors of Enbridge's proposed Line 5 relocation route and route alternatives include forestland, grassland, agricultural land, wetlands, urban/developed land, barren land, and open water areas. The total land requirements for pipeline construction, in general, include a 120-foot-wide construction ROW, with additional temporary workspace at feature crossings (e.g., roads and waterbodies) (Section 2.1). The DNR's consultants used GIS to overlay construction corridors on public lands to identify crossings and calculate affected acreages. Table 5.12-1 summarizes public land crossings and their direct effects.

Table 5.12-1 Public lands crossed by Enbridge's proposed Line 5 relocation route and route alternatives.

Owner	Name of Public Land	Acres in Corridor	Agricultural	Barren	Forested	Grassland	Open Water	Urban / Development	Wetland
Proposed Route									
Iron County	Iron County Forest	107.7	0.0	0.0	95.3	0.0	0.0	0.0	12.4
	Total	**107.7**	**0.0**	**0.0**	**95.3**	**0.0**	**0.0**	**0.0**	**12.4**
RA-01									
State of Wisconsin	White River Wildlife Area	3.5	0.0	0.0	1.8	0.7	0.0	0.1	1.0
Ashland County	Memorial Forest	4.0	0.0	0.0	3.8	0.0	0.0		0.2
Ashland County Fair Association Inc.		3.6	0.0	0.0	0.6	2.6	0.0	0.1	0.0
State of Wisconsin	Copper Falls State Natural Area	6.8	0.0	0.0	6.8	0.0	0.0	0.0	0.0
State of Wisconsin – DNR	Copper Falls State Park	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
State of Wisconsin – DNR		8.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0
Iron County	Iron County Forest	14.1	0.0	0.0	13.3	0.0	0.0	0.0	0.8
	Total	**42.0**	**0.0**	**0.0**	**36.2**	**3.2**	**0.0**	**0.2**	**2.3**
RA-02									
Ashland County Highway Dept.	--	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Iron County	Iron County Forest	13.1	0.0	0.0	12.6	0.0	0.0	0.2	0.0
Iron County		8.4	0.0	0.0	7.7	0.0	0.0	0.0	0.7
Town of Knight		4.2	0.0	0.0	4.2	0.0	0.0	0.0	0.0
Town of Pence		2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
City of Montreal		12.7	0.0	0.0	9.3	0.0	0.0	0.0	3.4
City of Hurley		9.9	0.0	0.0	8.0	1.7	0.0	0.0	0.3
Hurley School District		0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.1
State of Wisconsin		0.6	0.0	0.0	0.5	0.0	0.0	0.1	0.0
	Total	**51.5**	**0.0**	**0.0**	**44.5**	**2.2**	**0.0**	**0.3**	**4.5**
RA-03									
Ashland County	Ashland County Forest	59.3	0.0	0.0	38.0	0.0	0.0	0.0	21.3
Bayfield County	Bayfield County Forest	195.5	0.0	0.0	188.0	0.0	0.0	0.0	7.4
Bayfield County		14.4	0.0	0.0	4.2	0.0	0.0	0.0	10.3
City of Montreal		5.8	0.0	0.0	3.3	0.0	0.0	0.4	2.2
Dept. of the Interior (US)		1.6	0.0	0.0	0.5	0.0	0.0	0.0	1.1
US Forest Service		2.6	0.0	0.0	1.9	0.0	0.0	0.0	0.6

Owner	Name of Public Land	Acres in Corridor	Agricultural	Barren	Forested	Grassland	Open Water	Urban / Development	Wetland
US Forest Service	Fairyland	14.4	0.0	0.0	14.4	0.0	0.0	0.0	0.0
Iron County	Iron County Forest	167.2	0.0	0.2	100.6	0.0	0.0	0.0	66.4
National Park Service		<0.01	0.0	0.0	0.0	0.0	0.0	0.0	<0.01
Sanitary District #1, Town of Cable		6.8	0.0	0.0	3.2	3.6	0.0	0.0	<0.01
State of Wisconsin		7.7	0.0	0.0	0.0	0.0	0.0	0.0	7.7
State of Wisconsin	Island Lake Hemlocks State Natural Area	1.8	0.0	0.0	0.6	0.0	0.0	0.0	1.2
Town of Cable		<0.01	0.0	0.0	0.0	0.0	0.0	0.0	<0.01
Town of Gordon		3.9	0.0	0.0	3.6	0.0	0.0	0.0	0.3
Town of Namakagon	Fairyland	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Town of Namakagon		<0.01	0.0	0.0	<0.01	0.0	0.0	0.0	0.0
Town of Pence		1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5
U.S.A.	Chequamegon-Nicolet National Forest	397.2	0.0	0.0	285.4	<0.01	0.0	0.0	111.8
U.S.A.	Bearsdale Creek & Hyatt Spring State Natural Area	4.5	0.0	0.0	0.4	0.0	<0.01	0.0	4.1
U.S.A.	Saint Croix National Scenic Riverway	4.9	0.0	0.0	0.7	0.0	0.0	0.0	4.1
U.S.A.	Rock Lake	5.8	0.0	0.0	5.8	0.0	0.0	0.0	0.0
WIDOT		0.2	0.0	0.0	<0.01	0.0	0.0	0.1	0.0
	Total	**895.3**	**0.0**	**0.2**	**651.1**	**3.6**	**0.0**	**0.4**	**240.0**

Source: Enbridge June 2021

5.12.1 Chequamegon-Nicolet National Forest

Initially established as separate forests in the 1930s, the Chequamegon and Nicolet National Forests were combined administratively into the Chequamegon-Nicolet National Forest in February 1998. The Chequamegon-Nicolet National Forest covers more than 1.5 million acres of Wisconsin's Northwoods. The U.S. Forest Service manages the land for multiple uses, including forestry, wildlife habitat, outdoor recreation, special forest products gathering, fisheries, and wilderness and natural areas. The Chequamegon side of the forest is in Ashland, Bayfield, Sawyer, Price, Taylor, and Vilas counties, while the Nicolet side of the forest is in Florence, Forest, Langlade, Oconto, Oneida, and Vilas counties. The Chequamegon side of the National Forest would not be crossed by Enbridge's proposed Line 5 relocation route, RA-01, or RA-02. RA-02, however, would pass close to the National Forest. RA-03 would cross 28 miles of the Chequamegon side of the National Forest. The Nicolet side of the National Forest is outside Enbridge's proposed and alternative routes.

The U.S. Forest service conducted a Rapid Assessment to estimate the potential effects on extraordinary circumstances from Enbridge's RA-03 using GIS data to intersect with resource layers and existing information from previous projects to estimate the potential effects. Federally listed endangered and threatened species known to occur on the Great Divide Ranger District include gray wolf (*Canis lupis*), Canada lynx (*Lynx canadensis*), and northern long-eared bat (*Myotis septentrionalis*). No federally listed plant species are known to occur near the RA-03 alignment. RA-03 would intersect several perennial and intermittent streams and lakes within the National Forest (Table 5.12-2). There are no Congressionally designated wilderness areas, national recreational areas, or wild, scenic, or recreational rivers. The Rapid Assessment also found that there are no inventoried roadless areas, potential wilderness areas, or research natural areas along the RA-03 alignment. RA-03 would intersect 15 different trails including the North Country National Scenic Trail and the Rock Lake National Recreation Trail. The alignment would be within 600 feet of the Day Road/Dead Horse Trailhead. See Table 5.12-3 and Figure 5.12-1. RA-03 would also intersect eight management areas within the National Forest (Table 5.12-4).

Table 5.12-2 Waterways intersected by Enbridge's RA-03 alignment across the Chequamegon-Nicolet National Forest.

Perennial and intermittent stream intersects (200-foot buffer)	Lake intersects (200-foot buffer)
Augustine Creek	Rose Lake
Cap Creek	Chippewa Lake
Dingdong Creek	Hidden Lake
Dryden Creek	21 unnamed lakes/ponds
East River	
Kaari Creek	
Magee Creek	
Meyers Creek	
Muskeg Creek	

Table 5.12-3 Trails intersected by Enbridge's RA-03 alignment across the Chequamegon-Nicolet National Forest.

Trails	
Ahmeek Lake Walking	Dead Horse Run
Bayfield County ATV	Clam Lake Connector/ Deadhorse Run
Bayfield County Snowmobile	North County National Scenic Trail
Bear Paw ATV	Pigeon Lake Hunter Walking Trail
Buckskin ATV	Rock Lake National Recreation Trail
CAMBA – Namekagon (mountain bike)	Snowmobile Trail 21
CAMBA - Patsy Lake (mountain bike)	Snowmobile Trail 8
CAMBA - Rock Lake Bike (mountain bike)	

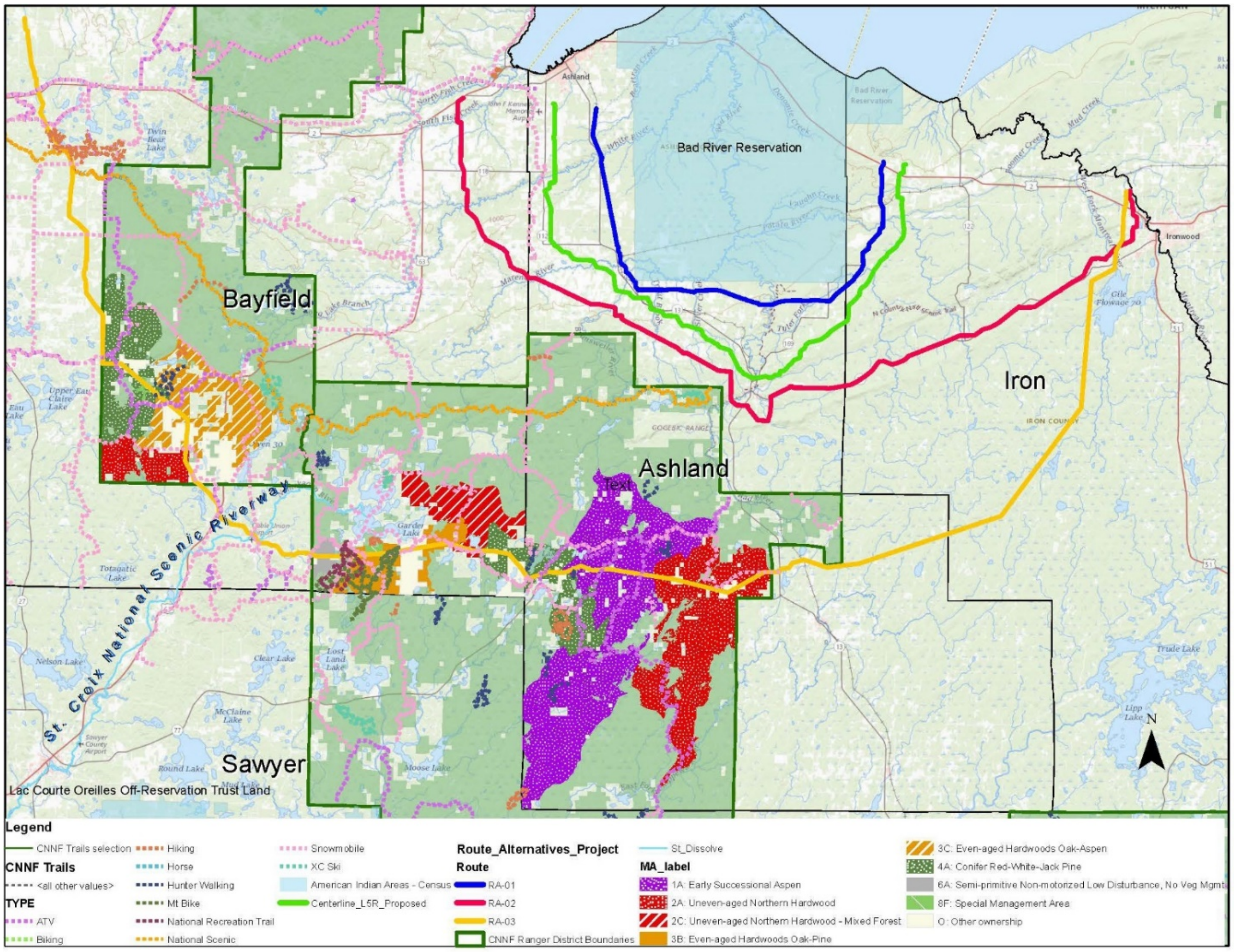


Figure 5.12-1 U.S. Forest Service's RA-03 alignment alternative Rapid Assessment

Table 5.12-4 U.S. Forest Service management areas intersected by Enbridge's RA-03 alignment across the Chequamegon-Nicolet National Forest.

	Length of MA Intersect (Feet/Miles)
1A - Early Successional Aspen	535/0.10
2A - Uneven-aged Northern Hardwood	62,420/11.82
2C - Uneven-aged Northern Hardwood - Mixed Forest	9,036/1.71
3B - Even-aged Hardwoods Oak-Pine	5,445/1.03
3C - Even-aged Hardwoods Oak-Aspen	5,091/0.96
4A - Conifer Red-White-Jack Pine	38,461/7.28

The Burke Tract SNA is on the Great Divide Ranger District. The Bearsdale Creek and Hyatt Spring SNA (Section 5.9.3.7) is on the Washburn Ranger District. The Bearsdale Creek and Hyatt Spring SNA does include a Research Natural Area, but it is not intersected by the RA-03 alignment.

5.12.2 County Forests & Recreational Areas

Iron County Forest lands would be crossed by Enbridge's proposed Line 5 relocation route and route alternatives. Ashland County Forest and Bayfield County Forest lands would only be crossed by RA-03. There would be approximately 107 acres of Iron County Forest lands in Enbridge's proposed route corridor, approximately 14 acres in the RA-01 corridor, approximately 14 acres in the RA-02 corridor, and 168 acres in the RA-03 corridor. There would be approximately 53 acres of Ashland County Forest lands in the RA-03 corridor and 289 acres of Bayfield County Forest lands.

Enbridge's proposed relocation route would cross 107.7 acres of Iron County Forest, of which 95.3 acres is forested and 12.4 acres is wetland. RA-01 would cross 42 acres of public lands, including 36.2 acres of forested area, 3.2 acres of grassland, 0.2 acres of urban/developed area, and 2.3 acres of wetlands. RA-02 would cross 51.5 acres of public lands including 44.5 acres of forested area, 2.2 acres of grasslands, 0.3 acres of urban/developed land, and 4.5 acres of wetland. RA-03 would cross 895.3 acres of public lands, including 651.1 acres of forested land, 240 acres of wetland, 3.6 acres of grassland, 0.4 acres of urban/developed area, and 0.2 acres of barren land.

Enbridge's proposed Line 5 relocation route also crosses the Tyler Forks and Potato rivers, which have significant stretches of rapids and waterfalls. Enbridge's proposed crossings are a considerable distance from the waterfalls and other public access points. The proposed route crossing is through a very remote area of Iron County Forest. Accessibility is limited to foot travel or ATV/snowmobile. Summer access is available from the west through private property and is not open to public use. As Iron County Forest is a public property and the lands are enrolled in County Forest Law, the public would have access and use to the proposed new ROW for the crossing. For future timber management activities and wildlife management activities, access along the new ROW would have to be coordinated with Enbridge to ensure safe pipeline crossing.

Iron County entered into an option agreement with Enbridge in late 2019. The option was for a utility easement for the proposed pipeline relocation project. Enbridge exercised the option in August 2020 and was granted a permanent easement for 6.74 acres for pipeline construction. This easement has been recorded with the Iron County Register of Deeds. As part of the discussions, Enbridge has agreed to improve forest roads that would be used by their contractors for pipeline construction. These roads would be left open for improved access to these areas of the County Forest, including logging, hunting, and other recreation. Iron County requested, and Enbridge agreed, to stump and clear all upland areas of the construction workspace and pipeline ROW. These areas would be reseeded after construction with wildlife seed mixes selected by Iron County in cooperation with the local DNR wildlife biologist. These areas would be managed as wildlife openings by the Iron County Forestry Department after construction is completed. Enbridge has also agreed to additional payments to Iron County towards the maintenance of these areas after the pipeline is operational. Any disturbed wetland and other riparian areas outside of the ROW would be left to naturally regenerate.

The GLIFWC's permit and registration data indicate that tribal members exercise usufructuary rights on Iron County Forest lands. To assess the effect of a potential barrier created by the proposed pipeline ROW through Iron County Forest, crossable only by way of public roads, GLIFWC modeled the change in travel time to county forest lands transected by the proposed route's ROW and summarized their findings in a March 5, 2021, letter to the USACE (Appendix AC). The GLIFWC modeling results demonstrated that access times to over 1,700 acres would be significantly increased, by 30 minutes or more, due to the construction and maintenance of Enbridge's proposed pipeline relocation. The GLIFWC's findings indicated that because of the proposed relocation route, tribal access to sections of Iron County Forest for the purpose of exercising treaty protected harvest would be eliminated in some areas and reduced in others. Additionally, one location was specifically identified by an Enbridge consultant and tribal staff as a Traditional Cultural Property that is actively used by tribal members to hunt, fish, and gather. The GLIFWC's findings indicate that the proposed route would restrict lawful access (s. 943.143, Wis. Stat.) from a public access road to the Traditional Cultural Property. The GLIFWC findings also indicated that all the public lands near the Bad River Reservation are important cultural properties as documented by the harvests that occur there.

5.12.3 Copper Falls State Park

The 3,068-acre Copper Falls State Park is located approximately two miles north of the City of Mellen and continues north to the southern boundary of the Bad River Reservation and encloses the Copper Falls State Natural Area. The Park spans the boundary between the North Central Forest and Superior Coastal Plain ecological landscapes. Copper Falls State Park draws between 200,000 and 250,000 visitors a year. Figure 5.12-2 shows the falls at Copper Falls.

Figure 5.12-2 Photograph of Copper Falls Gorge, at the confluence of the Bad River and Tyler Forks.
Photo Credit: Chris Bender, Wisconsin DNR

The Friends of Copper Falls State Park, Inc., a nonprofit corporation under Chapter 181, Wis. Stat., provides volunteer services for park projects, trail maintenance, events, and activities and financial and in-kind support for venues and trails, construction projects, and activities at Copper Falls. The nonprofit also supports, provides, and encourages visitor participation in interpretive, educational, and nature-based activities throughout the park. The Friends of Copper Falls State Park is supporting the Town of Morse's efforts to build a new 1.67-mile, multi-purpose trail between Copper Falls State Park and the nearby City of Mellen. In 2020, Enbridge awarded a pair of $50,000 grants—one to the Town of Morse and one to the Friends of Copper Falls State Park—to provide matching funds for this trail project.

Enbridge's proposed Line 5 relocation route would be located approximately one-half mile south of the State Park. RA-01 would cross approximately 0.5 mile of the Copper Falls State Park within 140 feet of the southernmost boundary of the Copper Falls ASNRI. Additionally, RA-01 would potentially cross through a portion of Copper Falls State Park that is listed on the National Register of Historic Places and Wisconsin State Register (NRHP # 05001425). RA-02 and RA-03 would avoid crossing Copper Falls State Park and would not be in proximity to the park.

5.12.4 St. Croix National Scenic Riverway

The St. Croix National Scenic Riverway, which includes the Namekagon River, is a unit of the National Park System located in northwest Wisconsin that is administered by the NPS. These rivers flow through some of the least developed country in the Upper Midwest. Congress established the St. Croix National Scenic Riverway, including the Namekagon River, as one of the original eight rivers protected under the national Wild and Scenic Rivers Act. The Namekagon is diverse in character with calm stretches flowing along marshes and scrub, and rocky segments up stream that offer views framed by hairpin turns and towering pines (NPS, 2021). Enbridge's RA-03 would cross the Namekagon River. None of the other three routes would cross the St. Croix National Riverway.

RA-03 would cross the St. Croix National Scenic Riverway on property owned by the NPS. Based on the NPS Reference Manual 53B: Rights of Way, Section I.A.2 (page 9):

> *There is no general NPS authority to permit petroleum product pipelines (or "pipelines") in NPS units. The Mineral Leasing Act, 30 USC§ 185, is the primary authority for such pipelines on other federal lands. But per 30 USC § 185(b), "lands in the National Park System" are specifically excluded from that authorization. Therefore, the Mineral Leasing Act does not authorize ROW permits for petroleum product pipelines on NPS lands. Nor does any other general authority allow such pipelines on NPS lands.*

Therefore, for Enbridge to secure an easement for the RA-03 crossing, Congressional action would be required.

According to the NPS, the free-flowing character, water quality, and outstandingly remarkable values are the characteristics on which the Riverway was designated as Wild and Scenic. The NPS did an analysis and confirmed that designated segments of both the St. Croix River and Namekagon River contain aquatic, cultural, recreational, riparian, scenic–aesthetic, and geologic values. Of these values, the NPS would be most concerned about the scenic-aesthetic value being affected by the RA-03 crossing of the river. Required mitigation actions would include erosion control measures and minimum effects to vegetation along the riverway, etc. The parcels that would be crossed by RA-03 would also need to be reviewed for incumbrances or financial obligations under the LAWCON program.

5.12.5 North Country National Scenic Trail

The North Country National Scenic Trail is one of 11 National Scenic Trails in the United States as designated by Congress in 1980. In October 2000, the North Country National Scenic Trail received the dual designation of State Trail by the Wisconsin Natural Resources Board. The North Country National Scenic Trail is administered by National Park Service in cooperation with other federal, state, and local agencies, private organizations such as the North Country Trail Association, and landowners. The North Country National Scenic Trail exists in many places with the permission of the landowners such as the DNR and Iron County Forestry Department. The DNR lands that are owned or leased primarily for the North County National Scenic Trail are administratively known as State North Country Trail Areas. The DNR owns one fee title State North Country Trail Area between Copper Falls State Park and the proposed route through Mellen and holds one State North Country Trail Area easement near the proposed route within 0.5 miles of the Bad River Reservation between Highway 169 and the Ashland-Iron county line.

The Iron County Forestry Department has granted the North Country Trail Association permission to construct and maintain the trail on Iron County Forest lands. There is not an easement or specific written agreement for the trail. Management authority on these lands remains exclusively Iron County's. Use of the Iron County Forest by the North Country Trail is documented and allowed in the county's 15-year Comprehensive Land Use Plan. Oversight of the lands and location of the trail is ultimately a decision of Iron County in cooperation and consultation with the North Country Trail Association. Enbridge's proposed Line 5 relocation route and all three route alternatives would cross the North Country National Scenic Trail at least once.

Enbridge's proposed relocation route would cross the current and planned future route of the North Country National Scenic Trail at three locations. The first crossing would be near MP 24.3, the second near MP 32.3, and the third near MP 37.3. Figure 5.12-4 depicts the current and future route of the North Country National Scenic Trail, where the second and third crossings would occur between Copper Falls State Park and the Michigan border.

Enbridge's first crossing of the North Country National Scenic Trail would occur within a forested wetland adjacent to the Bad River. The parcel is bounded on the west side by the Bad River, and on the east side by Highway 169. Enbridge is the fee owner of the land. No other transportation or utility corridors cross the parcel. The trail would be crossed as part of Enbridge's prosed HDD crossing of the Bad River.

Enbridge would clear trees within the 30-foot-wide operational maintenance corridor along the HDD path. Enbridge does not anticipate needing to close this section of the trail during HDD activities. However, a temporary closure of the existing boardwalk (Figure 5.12-3) may be necessary during clearing activities to allow construction crews to safely remove trees within the operational maintenance corridor and to protect the public during clearing activities. Enbridge has entered into an agreement with the City of Mellen in which Enbridge has agreed to keep the property open for public use so long as the use does not interfere with the construction, maintenance, operation, or inspection of the pipeline or ROW or risk the safety of members of the public or any of Enbridge's employees or contractors. If a temporary closure of the boardwalk path was necessary, Enbridge would establish an alternative walking route along Highway 169, then rejoin the existing trail north of the HDD. Enbridge would install signs directing potential trail users to the appropriate alternate pathway. Enbridge would also provide trail users with an escort along the road shoulder until the individuals are safely beyond the construction area and can rejoin the trail. Figure 5.12-5 illustrates potential reroute options during this period.

Enbridge's second crossing of the North Country National Scenic Trail would occur in the Town of Anderson, Iron County, where the trail uses the shoulder of Vogues Road, a gravel surface road. The adjoining parcels are owned by Iron County and are forested. A forested wetland is also present on the south side of Vogues Road. Vogues Road is the only transportation corridor at this location. No other utility corridors are present at this location. Tree clearing for construction and maintenance of an operational ROW would be conducted as described in Section 2.6.2.

Because this is an area of multiple current or planned North Country National Scenic Trail building projects, one of which is currently under archeological review, considerable coordination between Enbridge, NCTA, the DNR, and the NPS would be required. Enbridge's 2021 "North Country National Scenic Trail Coordination Plan, Line 5 Wisconsin Segment Relocation Project" document (Appendix AE) includes significant discussion of this area under the "NCT Access During Construction" section. Enbridge's Coordination Plan offers three options for successfully maintaining public use of the North Country National Scenic Trail through construction of the pipeline.

Enbridge's third crossing of the North Country National Scenic Trail would occur in the Town of Gurney, Iron County, within one mile of the Potato River. The crossing would initially be on a county forest road. In the future, after this off-road segment of the North Country National Scenic Trail is constructed, the crossing would be closer to the Potato River.

Figure 5.12-3 Boardwalk at North Country National Scenic Trail.
Photo: Dreux J. Watermolen, DNR

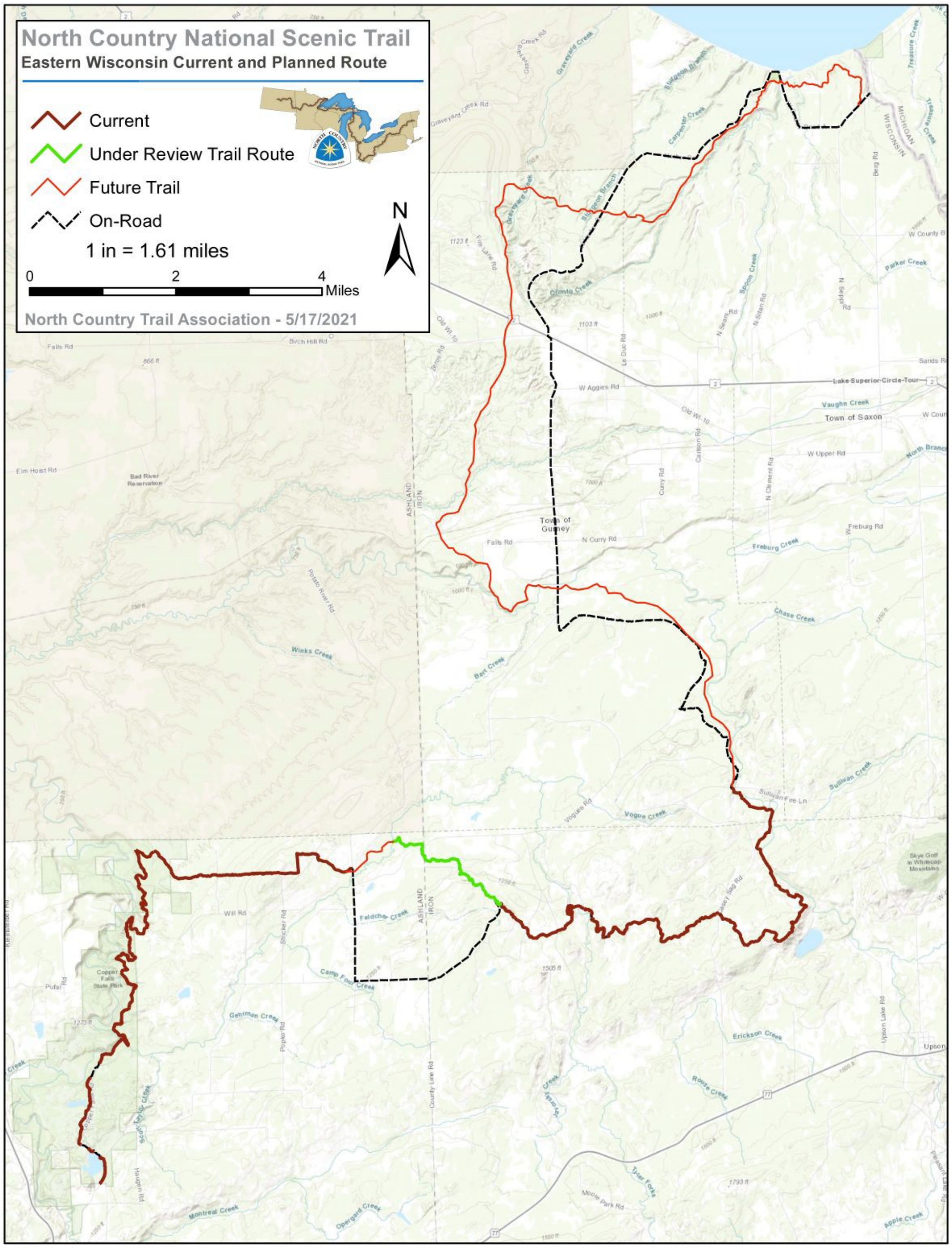


Figure 5.12-4 North Country National Scenic Trail, current and potential future routes.
Source: North Country Trial Association

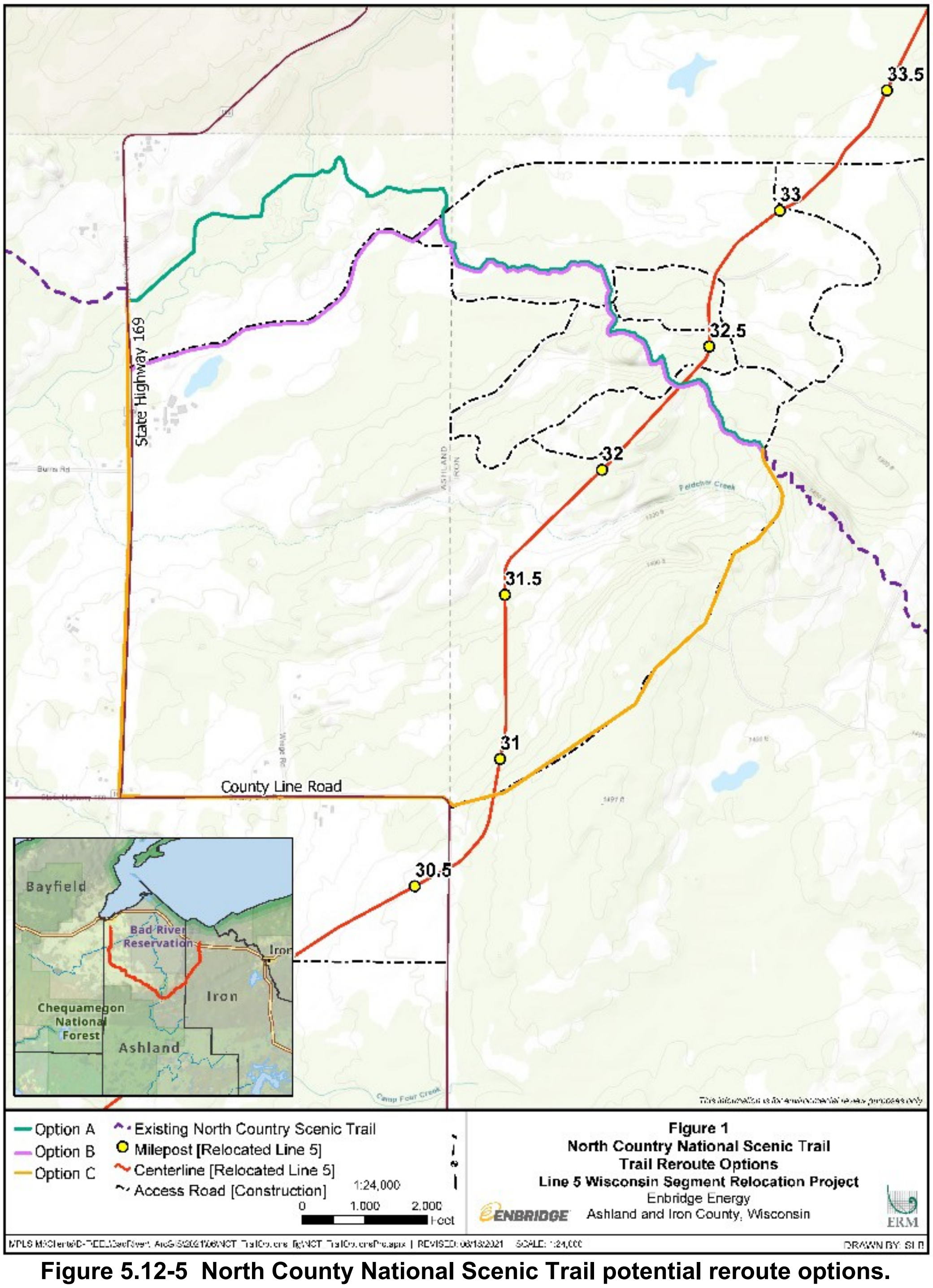


Figure 5.12-5 North County National Scenic Trail potential reroute options.
Source: Enbridge

There would be visual effects to the public during the time of active construction. However, these effects would be temporary, lasting only until the trail would be restored to pre-construction conditions. Limited long-term visual effects would result from maintenance of the permanent ROW.

Concerns raised by the three North Country National Scenic Trail partners regarding Enbridge's proposed crossings of the trail include:

- Unauthorized vehicular traffic using the pipeline ROW to access off-road segments of the North Country National Scenic Trail. This has happened on other ROWs causing concern over safety, erosion, and damage to constructed segments of native surface trail tread. Mitigation measure such as signs are not very helpful since people usually ignore these. Physical barriers, such as fences, gates, boulders, or timbers, are often needed.

- Character of the trail (aesthetics) is a major concern for the North Country Trail Association.

- Invasive plant species can be tracked into the trail due to hikers and tires from vehicles.

- If trail users are present at the time of crossing construction, Enbridge would assign staff to assist individuals to help them safely navigate through the construction zone to continue using the trail.

Successful management of the proposed trail crossings would require effective communications between Enbridge and the three North Country Trail partners: the North Country Trail Association, the National Park Service's North Country National Scenic Trail office in Lowell, MI, and the DNR's Bureau of Parks and Recreation Management.

The parcels that would be crossed by Enbridge's proposed reroute were reviewed for financial obligations under the Land and Water Conservation Fund (LAWCON) based on information from the various counties and landowner questionnaire responses. None of the parcels evaluated were documented to be involved in the LAWCON program. The parcels along the three alternative routes were not evaluated for incumbrances under the LAWCON program.

5.12.6 State & County Trails

Enbridge's proposed Line 5 relocation route and route alternatives would cross county ATV and snowmobile trails, many of which are state-funded trails under s. 23.09(26) and s. 23.33, Wis. Stat. Enbridge proposes to put in place controls and plans to safely manage the construction and provide for the safety of the public as it pertains to trails used for motorized vehicles, generally ATVs, UTVs, motorcycles, and snowmobiles (Enbridge Motorized Recreational Trails Management Plan, Appendix AD).

According to Enbridge's plan, interactions with motorized recreational vehicles can be separated into three categories:

1. Off Road Crossings – locations where a recognized motorized recreational vehicle intersects the pipeline ROW, workspace, or access road in a perpendicular fashion.
2. Off Road Parallels – locations where a recognized motorized recreational vehicle shares any part of the pipeline ROW or access road in a parallel fashion.
3. On Road Crossing or Parallels – areas where motorized recreational vehicle can legally use a recognized vehicular roadway.

Section 5.2 discusses snowmobile trials that Enbridge identified as falling into these categories.

For Off Road Crossings, Enbridge proposes placing warning and stop signage at an appropriate distance up each trail in both directions from the intersection with Enbridge's ROW. Permission to place signage would be secured by Enbridge or by working with snowmobile/ATV clubs as necessary. At each crossing location, stop signs would be installed. If construction work is occurring in the area and a hazard exists to recreators, flaggers would be placed at the crossing to ensure safe passage across the ROW. During times when work is not occurring, recreators would be guided by signs across the ROW. There would be a period where the pipe would be welded and installed of approximately 14 days where passage across the

ROW would not be allowed. See Appendix AD Table 1 for summary of Off Road Crossings and Parallels.

For Off Road Parallels, Enbridge would consider potential solutions independently. At times, motorized recreational vehicle traffic may co-route along the ROW, and at other times the interaction may be enough where the motorized recreational vehicles may need to be rerouted. Trails would need to be shut down while work is progressing through the area. See Appendix AD Table 1 for Locations and Proposed Actions for each motorized recreational vehicle interaction site.

For On Road Crossings or Parallels, Enbridge would consider any motorized recreational vehicle traffic the same as vehicular traffic as motorized recreational vehicle traffic is subject to the same traffic laws as vehicles. In these instances, Enbridge's traffic management plans would be followed.

Construction could occur in nearly any month. Depending on when construction would start, construction progression may or may not conflict with recreational trail use. Safety controls, reroutes, proposed actions discussed in this section would only be applicable during the season in which the trails are open for use, which in most Off Road cases would be the winter season. Enbridge has or would contact each of the snowmobile clubs in the area to ensure they are aware of the Line 5 relocation project, project routing, and points of intersection or overlap.

5.12.7 White River State Fishery Area

The White River Fishery Area was established in 1961 to manage and protect this unique and scenic trout stream and watershed. This multiple use area is dedicated to trout fishing, hunting, canoeing, and other compatible outdoor recreational and educational opportunities. Numerous feeder streams, spring ponds, and outlet flows of several glacial lakes provide the high-quality water for this outstanding trout stream. Habitat types include a riverine habitat transitioning from wooded headwaters, through the grassy swamp and steep clay banks, to a small impoundment. Three State Natural Areas are embedded within the fishery area boundary: White River Breaks (Section 5.9.3.3), Lake Two Pines (Section 5.9.3.4), and Sajdak Springs (Section 5.9.3.5).

Direct effects on the White River State Fisheries Area would not be anticipated from Enbridge's proposed Line 5 relocation route or route alternatives. However, there could be indirect, long-term, or cumulative effects should erosion occur during construction or if an HDD inadvertent release or a petroleum spill occurs upstream.

5.12.8 White River State Wildlife Area

The State Wildlife Areas were established to protect and provide habitat for animals but are also available for traditional outdoor recreational uses including hunting, fishing, trapping, hiking, nature study and berry picking. White River Wildlife Area is a 1,120-acre property located in northwest Ashland County. It was established in 1946 to protect winter deer habitat. The White River Wildlife Area is entirely wooded and features numerous habitats important to a range of wildlife species due to the varying topography and forest successional stages. From furbearers and waterfowl to grouse, deer, bear and raptors, the property offers opportunities for wildlife enthusiasts to see and enjoy their favorite species. The White River Boreal Forest SNA is located within the White River Wildlife Area.

Direct effects on the White River State Wildlife Area would not be anticipated from Enbridge's proposed Line 5 relocation route or route alternatives. However, there could be indirect, long-term, or cumulative effects should erosion occur during construction or if an HDD inadvertent release or a petroleum spill occurs upstream.

5.12.9 Wisconsin State Natural Areas

Six SNAs are in proximity to Enbridge's proposed Line 5 relocation route and route alternatives. These SNAs are described in Section 5.9.3 and anticipated effects to each are discussed in Section 5.9.3.8.

5.13 Population & Housing

Table 5.13-1 shows the ten-year population trends for Ashland, Bayfield, and Iron counties, and the Bad River and Red Cliff reservations, in comparison with Wisconsin as a whole. The three-county region had a total population of just over 38,300 people at the time of the 2020 Census, an increase of 3.5 percent from 2010, which is roughly equivalent to the change in statewide population over the same period. The population of Ashland County, however, decreased by a little under one percent (-130 residents). The population of the Bad River Reservation, which is a subset of the population of Ashland County, grew by 4.5 percent (+66 residents). The populations of Bayfield and Iron counties increased by eight percent and 3.7 percent, respectively. The population of the Red Cliff Reservation, a subset of the population of Bayfield County, increased by 25 percent (+280 residents).

Table 5.13-1 Population characteristics in the three-county area.

Population	Ashland County	Bad River[1] Reservation	Bayfield County	Red Cliff[2] Reservation	Iron County	Wisconsin
2010 Population	16,157	1,479	15,014	1,123	5,916	5,686,986
2020 Population	16,027	1,545	16,220	1,403	6,137	5,893,718
Change in population	-130	+66	+1,206	+280	+221	+206,732
Change in population (%)	-0.8%	+4.5%	+8.0%	+24.9%	+3.7%	+3.6%

Source: U.S. Census Bureau. 2020 Census

1. Population figures for the Bad River Reservation are subset of those for Ashland County.
2. Population figures for the Red Cliff Reservation are subset of those for Bayfield County.

According to Enbridge, approximately 700 construction workers would be employed during the estimated 12 to 14 months it would take to construct its proposed Line 5 pipeline relocation. In response to a request for information on how many of these workers would be local, Enbridge stated that half of the workers would come from local union halls subject to availability (Enbridge, 2020g). From this, it is assumed that there would be a temporary increase in the population of the three-county area of 350 people or just under 1 percent. It is anticipated that most of these workers would reside in the region's larger communities, particularly the City of Ashland and surroundings. It is further anticipated that most of these new residents would be temporary renters or lodgers and would cease residing in the area after the construction phase concluded.

Table 5.13-2 shows housing characteristics for these areas as of 2020. Bayfield County had the largest housing stock with 13,238 housing units. Vacancy was lowest in the Bad River Reservation, with 46 units (7.5%) reported as vacant during the 2020 Census, and highest for Iron Country, with 2,582 unit (47%) reported vacant. According to the American Community Survey, however, most vacant units across the region, and the entire state, are only seasonally vacant (i.e., units that are only used seasonally, recreationally, or occasionally). At the county level, the percentage of vacant housing units that are used in this manner range from 73 percent in Ashland County to 92 percent in Bayfield County. The high incidence of seasonally vacant housing reflects the area's popularity as a recreation destination. It is possible that some non-local workers would rent seasonal or other otherwise vacation housing units during construction.

Table 5.13-2 Housing characteristics in the three-county area.

Housing	Ashland County	Bayfield County	Iron County	Bad River Reservation	Red Cliff Reservation	Wisconsin
Total housing units[1]	9,407	13,238	5,523	625	610	2,727,726
Occupied housing units[1]	6,846	7,557	2,941	579	464	2,425,488
Owner-occupied (%)[2]	71.8%	82.8%	84.9%	63.0%	59.3%	67.7%
Renter-occupied (%)[2]	28.2%	17.2%	15.1%	37.0%	40.7%	32.3%
Vacant housing units[1]	2,561	5,681	2,582	46	146	302,238
Percent of vacant units with seasonal, recreational, or occasional use[3]	72.4%	91.8%	80.6%	60.0%	65.9%	59.3%
Median Housing Value [4]	$143,500	$214,700	$144,100	$113,100	$87,900	$231,400
Median Contract Rent [5]	$535	$611	$493	$180	$343	$849

[1] Source: U.S. Census Bureau. 2020. "HOUSING UNITS." Table H1, 2020

[2] Source: U.S. Census Bureau. 2022. "Occupancy Characteristics." American Community Survey, ACS 5-Year Estimates Subject Tables, Table S2501.

[3] Source: U.S. Census Bureau. 2022. "Vacancy Status." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B25004. Percentage calculated as share of the vacant housing units.

[4] Source: U.S. Census Bureau. 2022. "Median Value (Dollars)." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B25077. Includes all housing units.

[5] Source: U.S. Census Bureau. "Median Contract Rent (Dollars)." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B25058. Includes rented housing units.

Table 5.13-3 presents housing statistics, including housing values and rents, for Census block groups that are fully or partially within five miles of Enbridge's proposed Line 5 relocation route and route alternatives. Enbridge's proposed relocation route and RA-01 are close enough together that they share the same block-groups within this distance. As such, they have the same housing characteristics.

Enbridge would pay owners of properties that would be crossed by its proposed relocation route for the use of their land, through easement agreements or by purchasing the property outright. Few studies have evaluated the impact of proximity to a pipeline on property values. Wilde, Loos, and Williamson (2012) reported that proximity to natural gas pipelines had no discernable effect on residential property values. Another study similarly reported no measurable impact on the sales price or insurability of properties located along or in proximity to a natural gas pipeline (Integra Realty Resources, 2016).

Table 5.13-3 Housing characteristics by route alternative

Housing	Proposed/ RA-01	RA-02	RA-03	Iron, Ashland, and Bayfield counties	Wisconsin
Total housing unit[1]	10,116	12,416	21,172	28,234	2,734,511
Occupied housing units[1]	7,786	7,911	10,558	17,344	2,425,488
Owner-occupied[2]	78.9%	83.0%	85.3%	79.8	67.7%
Renter-occupied[2]	21.1%	17.0%	14.7%	20.2%	32.3%
Vacant housing units[1]	21.4%	31.3%	43.0%	39.2%	11.3%
Vacant for seasonal, recreational, or occasional use[3]	2,330	4,505	10,614	10,890	309,023
Percent of vacant units with seasonal, recreational, or occasional use[3]	55.6%	64.9%	76.2%	81.6%	57.8%
Housing value[4]					
Below $50,000	8.2%	12.3%	9.5%	9.0%	4.0%
From $50,000 to $99,9999	17.3%	20.6%	19.3%	18.2%	7.2%

From $100,000 to $299,999	60.3%	50.9%	49.5%	52.5%	56.4%
From $300,000 to 499,999	10.5%	12.3%	16.1%	15.0%	23.4%
Above $500,000	3.7%	3.8%	5.6%	5.1%	9.0%
Contract rent[5]					
Less than $250	12.5%	12.0%	6.0%	11.5%	2.7%
From $250 to $499	16.0%	24.3%	23.0%	27.1%	8.4%
From $500 to $999	44.7%	36.6%	44.6%	41.2%	53.7%
Equal or greater than $1000	6.4%	6.3%	6.1%	6.4%	31.1%

[1] U.S. Census Bureau. "Occupancy Status." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B25002, 2022. All housing units are considered.[2] U.S. Census Bureau. "Tenure by Occupants per Room." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B25014, 2022. Percentage calculated as share of the occupied housing units.

[3] U.S. Census Bureau. "Vacancy Status." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B25004, 2022. Percentage calculated as share of the vacant housing units.

[4] U.S. Census Bureau. "Vacancy Status." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B25004, 2022. Percentage calculated as share of owner-occupied housing units.

[5] U.S. Census Bureau. "Contract Rent." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B25056, 2022. Percentage calculated as share of renter-occupied housing units.

During the operation of the rerouted Line 5, Enbridge would employ workers periodically to perform maintenance activities along the pipeline route. While local workers would commute to the work sites, nonlocal workers would be expected to obtain short-term housing in the area. The long-term effect on population, demographics, and housing is anticipated to be small.

5.14 Economic Effects

Enbridge's proposed Line 5 relocation project would have a positive effect on the local and statewide economies. Most of this impact would be associated with the construction of the proposed 41 miles of relocated pipeline and associated facilities. The effect of this large-scale construction project would have on employment, income, and overall economic activity would be significant, but temporary. The following sections describe the sectors of the regional and statewide economy that would be most affected by Enbridge's proposed relocation project, and the results of separate economic impact analyses conducted by Enbridge's consultants and the DNR.

5.14.1 Economic Sectors Likely to be Affected

Table 5.14-1 lists current employment in Ashland, Bayfield, and Iron counties, by industry, in relation to Wisconsin as a whole. Nearly 25 percent of workers in each of the three counties, and statewide, are employed in educational, healthcare, and social assistance related services. Manufacturing employs the second largest workforces in Ashland County (14%) and Iron County (15%) which is consistent with the entire state. The percentage of the workforce employed in retail and trade in Ashland County (11.7%), the Bad River Reservation (11%), and Iron County (10.5%) is comparable with the state as whole. It is somewhat lower in Bayfield County and the Red Cliff Reservation.

Table 5.14-1 Employment by Industry, Region

	Ashland County	Bad River[1] Reservation	Bayfield County	Red Cliff[2] Reservation	Iron County	Wisconsin
Employed People, Age 16+	7,717	664	7,434	498	2,690	3,020,890
Percent in different industries						
Educational services, health care and social assistance	24.5%	14.0%	22.6%	5.2%	22.1%	23.2%
Manufacturing	14.0%	5.1%	10.2%	8.8%	14.6%	18.1%
Arts, entertainment, recreation, accommodation and food services	10.9%	23.5%	14.9%	41.4%	10.9%	7.8%
Retail trade	11.7%	11.0%	8.3%	4.8%	10.5%	11.0%
Construction	10.7%	11.6%	9.3%	7.2%	9.3%	6.1%
Professional, scientific, management, administrative, and waste management services	7.3%	2.3%	6.4%	2.8%	5.6%	8.9%
Public administration	6.5%	25.5%	6.4%	13.9%	5.8%	3.5%
Transportation and warehousing, and utilities	3.1%	1.7%	6.2%	4.8%	6.1%	4.9%
Finance and insurance, real estate, rental and leasing	3.1%	2.3%	4.2%	4.6%	2.9%	6.1%
Agriculture, forestry, fishing and hunting, and mining	3.0%	0.8%	3.7%	0.8%	4.0%	2.1%
Other services, except public administration	3.1%	1.4%	4.8%	0.0%	3.5%	4.2%
Wholesale trade	1.1%	1.1%	1.6%	5.2%	3.0%	2.6%
Information	1.0%	0.0%	1.4%	0.4%	1.7%	1.5%

Source: U.S. Census Bureau. 2022. "Industry by Sex for the Civilian Employed Population 16 Years and Over." American Community Survey, ACS 5 Year Estimates Subject Tables, Table S2403.

1. Population figures for the Bad River Reservation are subset of those for Ashland County.

2. Population figures for the Red Cliff Reservation are subset of those for Bayfield County.

5.14.1.1 Construction

Table 5.14-4 shows the average hourly and annual wages for different construction-related jobs in Wisconsin. Construction is influenced by the overall economic cycle, by changes in particular sectors of the economy like housing, and by public policy and public spending, particularly on infrastructure. Table Table 5.14-2 and Table 5.14-3 show average monthly employment and average annual wages for the construction sector in the three-county area and statewide. Ashland County has higher average monthly employment followed by Bayfield and Iron counties. Bayfield County has higher average annual wages followed by Ashland and Iron counties. The construction sector suffered during 2020 because of the COVID pandemic. However, the employment and annual wages surged in the post-pandemic period with Wisconsin achieving the highest record of employment in construction sector in March 2024.

Table 5.14-2 Average employment (workers) in the construction sector

Year	Ashland County	Bayfield County	Iron County	Wisconsin
2019	382	298	166	126,767
2020	395	310	162	126,146
2021	402	328	166	128,793
2022	418	314	173	133,116
2023	453	315	200	138,661
2024 (January)	-	-	-	140,400
2024 (February)	-	-	-	140,800
2024 (March)	-	-	-	142,300
2024 (April)	-	-	-	140,900
2024 (May)	-	-	-	139,400

Source: State of Wisconsin, Department of Workforce Development

Table 5.14-3 Average annual wages in the construction sector.

Year (Month)	Ashland County	Bayfield County	Iron County	Wisconsin
2019	$55,495	$85,765	$40,593	$63,710
2020	$55,024	$59,691	$43,972	$66,292
2021	$55,604	$107,070	$46,568	$69,044
2022	$58,720	$78,189	$47,928	$72,472
2023	$63,221	$74,277	$51,289	$76,139

Source: State of Wisconsin, Department of Workforce Development

Table 5.14-4 Average hourly and annual wages for construction-related occupations in Wisconsin.

Occupation	Mean hourly wage	Annual mean wage
Construction managers	$50.47	$104,980
First-line supervisors of construction trades and extraction workers	$36.46	$75,840
Surveyors	$34.51	$71,790
Operating engineers and other construction equipment operators	$33.08	$68,810
Miscellaneous construction and related workers	$19.56	$40,690
Welders, Cutters, Solders, and Brazers	$25.39	$52,800
Heavy and Tractor-Trailor Truck Drivers	$25.61	$53,270
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	$22.04	$45,850
Logging Equipment Operators	$20.73	$43,120

Source: U.S. Bureau of Labor Statistics, 2022

The construction industry in Wisconsin has surged in recent years, reaching its highest level of employment ever in 2024.

5.14.1.2 Tourism

The tourism industry generates jobs, income, and state and local tax revenues in Ashland, Bayfield, and Iron counties. The three counties have considerably larger workforces employed in the combined arts and entertainment, recreation, accommodation and food services industry, as a percent of their overall workforces, than Wisconsin as whole (Table 5.14-1). This industry is the single largest employer in both the Bad River Reservation (23.5%) and the Red Cliff Reservation (41.4%), and the second largest employer in Bayfield County as a whole (15%). According to the Wisconsin Department of Tourism, direct visitor spending across the three counties, including the two reservations, totaled $122.6 million in 2022, employing an estimated 1,464 people with a combined annual income of $34.8 million. State and local taxes generated by tourism in the three counties totaled $14.1 million (Table 5.14-5).

Table 5.14-5 The economic impact of tourism in 2022.

	Direct visitor spending	Tourism employment	Tourism income	State & local taxes from tourism	Total business sales impact
Wisconsin	$14.9 billion	174,623	$6.5 billion	$1.5 billion	$23.7 billion
Ashland County	$42.7 million	566	$16.8 million	$5.0 million	$65 million
Bayfield County	$54.0 million	644	$12.6 million	$6.5 million	$89 million
Iron County	$25.9 million	254	$5.4 million	$2.6 million	$36 million

[1]Rank of direct visitor spending out of Wisconsin's 72 counties. Source: Wisconsin Department of Tourism, 2022.

During construction, certain recreation trails, fishing sites, and hunting areas could experience impeded access and or temporary degradation. Disruptions are expected to be limited to the 12 to 14-month construction period, with access limited at specific sites for varying lengths of time. The proposed route would cross 15 designated trout streams and 107.5 acres of federal, county, and state-owned lands. The potential for effects on the tourism industry, however, is limited by the large variety of outdoor recreation resources in the three-county area. For example, Ashland County has over 100 fishing streams, Iron County has more than 70 fishing streams, and Bayfield County has more than 90 fishing streams.

Outdoor recreation is a major economic driver for Wisconsin and is a crucial job-supporting industry. Much of the tourism in Ashland, Bayfield, and Iron counties is based on outdoor recreation. A 2022 report prepared for the Wisconsin Office of Outdoor Recreation found that outdoor recreation contributed $9.8 billion to the state's economy. This is about 6.8% increase from 2021. The outdoor recreation economy generated 94,042 direct jobs and $4.6 billion in wages and salaries (Wisconsin Office of Outdoor Recreation, 2022). The outdoor recreation economy generated 94,042 direct jobs and $4.6 billion in wages and salaries (Wisconsin Office of Outdoor Recreation, 2022).

Significant recreation opportunities in Ashland, Bayfield, and Iron counties include: a) snowmobiling: 220 miles of groomed trails in Ashland county (Ashland Area Chamber of Commerce, 2021), over 600 miles of groomed trails in Bayfield county (Bayfield County, 2021), and over 500 miles of groomed trails in Iron County (Iron County Economic Development, 2021); b) all-terrain vehicles (ATV)/utility terrain vehicle (UTV) riding: hundreds of miles of trails in Ashland County, 168 miles of trails in Bayfield County (Bayfield County, 2021), and 200 miles of trails in Iron County (Iron County Economic Development, 2021); c) snowshoeing; d) cross-country and downhill skiing; e) fishing/ice fishing; f) dog sledding/mushing; g) road and mountain biking; h) canoeing; i) hiking; j) hunting and trapping; and h) horseback riding.

Snowmobiling and ATV riding, both of which are popular in the three counties, were estimated to generate $250 million and $295 million in gross domestic product (GDP) statewide, respectively. Non-motorized events, including cross-country skiing, mountain biking, and running races generated $14.7 million per year collectively in Ashland County, Bayfield County, and neighboring Sawyer county (Wisconsin Office of Outdoor Recreation, 2020).

The project's construction would potentially cause short-term disruptions to outdoor recreational resources during the pipeline's anticipated 12- to 14-month construction period or during periods of maintenance during operation. The duration of disruption to access at a given point along the pipeline route would vary by site but is anticipated to be no longer than 12 to 14 months. The longer routes, such as RA-02 and RA-03, would cross more recreation trails and fishing streams than the more direct routes, including the existing Line 5 pipeline route, the proposed relocation route, and RA-01.

5.14.1.3 Forestry & Agriculture

The combined sector of agriculture, forestry, fishing, hunting and mining employs 2.1% of the state workforce. In the three-county region through which Enbridge's proposed relocation route and route alternatives would pass, the percentage employed in this combined sector ranges from less than 1 percent in the Bad River Reservation and the Red Cliff Reservation, to three percent in Ashland County as a whole, 3.7 percent of Bayfield County as a whole, and four percent in Iron County (Table 5.14-1).

The DNR has estimated the county-wide economic effect of the forest products industry in Ashland County (DNR, 2020n), Bayfield County (DNR, 2020o), and Iron County (DNR, 2020p), including direct, indirect, and induced effects, and tax contributions. Direct effects are jobs, revenue, and taxes emanating directly from normal business operations of forest industry. Indirect and induced effects refer to the money that industry and households spend in other businesses and the local jobs supported by forest industry. Table 5.14-6 presents these effects for the three counties.

Table 5.14-6 Economic contribution of the forest products industry, 2020.

	Ashland County	Bayfield County	Iron County
Direct Effects			
Jobs (Number)	419	71	176
Labor Income	$24.7 million	$3.5 million	$7.5 million
Industry Output	$96.4 million	$12.4 million	$36.5 million
Value Added	$32.5 million	$3.6 million	$11.2 million
Indirect and Induced Effects			
Jobs	165	25	50
Labor Income	$8.1 million	$0.6 million	$1.5 million
Industry Output	$25.3 million	$2.8 million	$5.9 million
Value Added	$13.0 million	$1.2 million	$2.5 million
Total Effects			
Jobs	584	96	226
Labor Income	$32.9 million	$4.2 million	$9.0 million
Industry Output	$121.7 million	$15.2 million	$42.4 million
Value Added	$45.6 million	$4.8 million	$13.7 million
Tax Contributions			
State/Local	$0.4 million	-$50 thousand	-$0.1 million
Federal	$6.8 million	$1.0 million	$2.2 million

Sources: DNR (2020n; 2020o; 2020p)

The principal effect that a relocated Line 5 would have on forestry and agriculture in Ashland, Bayfield, and Iron counties would be the permanent loss of forest and temporary loss of agricultural land along the construction ROW. The construction of Enbridge's proposed relocation route would result in the permanent clearing of 152 acres of forest land to make way for the permanent ROW. Another 258 acres of forest land would be cleared from the adjacent temporary workspace. Following construction, Enbridge would reseed the temporary workspace (along with the permanent ROW) with standard seed mixes (Appendix D) but would not actively reforest areas of the temporary workspace that had been forested. The property owners of those lands could choose to actively reforest them, allow them to reforest naturally, or to maintain them as open land. Table 5.14-7 shows the acreage of forested land (deciduous, coniferous, and mixed) that would be cleared along Enbridge's proposed relocation route and route alternatives. Note that these acreages include, but do not distinguish between upland forest and forested wetlands. Section 5.9.2.12 describes the comparative effects that relocating Line 5 along Enbridge's proposed route and route alternatives would have on forested wetland natural community types and upland forest natural community types.

Table 5.14-7 Acres of forest land within the permanent ROW and temporary workspace of Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed	RA-01	RA-02	RA-03
Length of pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Permanent ROW				
Deciduous forest	127	102	221	324
Coniferous forest	21	27	32	232
Mixed forest	4	3	6	24
Total	**152**	**132**	**259**	**580**
Temporary workspace				
Deciduous forest cover	220	142	307	452
Coniferous forest cover	32	38	45	325
Mixed forest cover	6	4	9	34
Total	**258**	**184**	**361**	**811**
Combined Construction ROW				
Deciduous forest cover	347	244	528	776
Coniferous forest cover	53	65	77	557
Mixed forest cover	10	7	15	58
Grand Total	**410**	**316**	**620**	**1391**

Source: Wiscland 2.0 land cover data. Note: Acreages include forested wetland.

Table 5.14-8 shows the acreage of agricultural land (crop rotation, hay, and pasture) that would be cleared from the permanent ROW and temporary workspace along Enbridge's proposed relocation route and route alternatives. A total of 138 acres of cropland, 96 acres of hay, and 34 acres of pasture would be disturbed during construction of Enbridge's proposed relocation. Production of crops and grazing activities would be prevented during construction, resulting in losses to agricultural production and associated economic activity. Enbridge would compensate landowners for agriculture-related losses according to negotiated agreements. After the pipeline is installed and the construction ROW has been restored, landowners would be able to use the land again for crops or pasture.

Table 5.14-8 Acres of agricultural land within the permanent ROW and temporary workspace of Enbridge's proposed Line 5 relocation route and route alternatives.

	Proposed	RA-01	RA-02	RA-03
Length of pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Forest land				
Crop rotation	36	13	23	1
Hay	26	21	30	2
Pasture	10	8	27	5
Total	**72**	**42**	**80**	**8**
Temporary workspace				
Crop rotation	102	17	32	1
Hay	70	29	41	3
Pasture	24	10	39	7
Total	**196**	**56**	**112**	**11**
Combined Construction ROW				
Crop rotation	138	30	55	2
Hay	96	50	71	5
Pasture	34	18	66	12
Grand Total	**268**	**98**	**192**	**19**

Source: Wiscland 2.0 land cover data. Note: Acreages include forested wetland.

Anticipated effects on agricultural soils include temporary soil erosion, soil compaction, increases in the proportion of large rocks in the topsoil, loss of soil productivity and fertility by mixing of topsoil and subsurface soil horizons, and damage to existing tile drainage systems. Clearing of the construction ROW would remove protective vegetative cover and could increase soil erosion and sediment transport to waterways. Strategies contained in Enbridge's EPP (Appendix D) and Agricultural Protection Plan (Appendix AF) would be implemented to control erosion including installing sediment barriers, temporary slope breaks, and trench breakers. Enbridge's Environmental Inspector (EI) would ensure the repair of any ineffective erosion control measures within 24 hours of detection and/or authorize a stop work order or order corrective action in the event that construction activities violate the provisions of the EPP or APP, landowner requirements, or any applicable permit.

Construction and maintenance activities could lead to localized soil compaction, which could lead to slower or less successful vegetation reestablishment following construction. To reduce soil compaction, Enbridge would use deep tillage operations during restoration activities to minimize this effect. Construction could further result in concentration of large pieces of rock near the surface in areas where rocky soil or near-surface bedrock is found. To prevent this, Enbridge proposes to remove rocks from the surface of the entire construction area so that the size, density, and distribution of rock on the ROW is similar to that on adjacent off-ROW areas.

Construction could result in the loss of soil productivity and fertility by mixing of topsoil and subsurface soil horizons. Section 2.8.12.1 describes Enbridge's methods for restoring topsoil and preparing the seedbed in areas that were in cultivation prior to construction. To prevent mixing, Enbridge would remove up to 12 inches of topsoil, segregate and stockpile topsoil, and replace it in the proper order during backfilling in cropland, hay fields, and pasture. Enbridge does not intend to use three-lift (i.e., triple lift) soil handling to segregate subsoils of different quality. The three-lift soil handling method is most useful when the proposed trench will intersect both the B (part of the rooting zone) and C horizons of a soil profile and the C horizon is of poorer quality (gravel, rock, and/or sand) than the B horizon (silt, clay, and/or loam).

Construction of the proposed route could also result in the disruption of existing agricultural drainage tiles (drainage systems and pipes). Enbridge would repair or replace drainage tiles that are damaged by pipeline construction to prevent long-term effects on drain tile function. However, unavoidable temporary effects would be experienced during construction. Enbridge indicates in its draft Agricultural Protection Plan (Appendix AF) that the company would compensate landowners or tenants for demonstrated losses associated with flooding that could occur because of disruption of drain tile systems. For agricultural areas that are used for livestock grazing, there is a potential for livestock to fall into open trenches. To prevent this, plugs of subsoil would be left in the excavated trench ditch or temporary access bridges would be constructed across the trench for landowners to move livestock. If additional measures are necessary, Enbridge would coordinate with landowners to install temporary exclusion fencing along the construction ROW.

Eleven acres of prime farmland would be disturbed during construction of Enbridge's proposed relocation. Eleven acres would be disturbed by construction along route alternative RA-01, 20 acres along RA-02, and 165 acres along RA-03. The U.S. Department of Agriculture defines prime farmland as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses (7 CFR § 657.5(a)(1)).

One hundred sixty-five acres of farmland of statewide importance would be disturbed during construction of Enbridge's proposed relocation. 190 acres would be disturbed by construction along RA-01, 206 acres along RA-02, and 97 acres along RA-03. Farmland of statewide importance is land, other than prime or unique farmland, that is of statewide or local importance as determined by the state or local government with concurrence from the State Conservationist. No certified organic farms would be crossed by Enbridge's proposed relocation. One organic farm was identified approximately 0.5 mile west of the proposed route at MP 3.0.

Approximately 14 miles of Enbridge's proposed relocation route would cross the 'Fields, Waters and Woods' Agricultural Enterprise Area in Ashland County, designated under s. 91.84, Wis. Stat., and administered by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP). Agricultural Enterprise Areas receive designation from the state at the request of landowners and local governments to facilitate land preservation, conservation, and economic development. Landowners who own agricultural land within designated Agricultural Enterprise Area boundaries are eligible to enter into voluntary farmland preservation agreements under s. ATCP 50.04, Wis. Adm. Code. When a landowner signs a farmland preservation agreement, they agree to keep the land in agricultural uses, agricultural accessory uses, and natural resource and open space uses as defined in the terms of the agreement. A new oil pipeline falls outside the scope of allowable uses in existing farmland preservation agreements. Where landowners with effective farmland preservation agreements enter into an agreement with a utility for the pipeline to cross the farm, the applicable lands need to be released from the agreement under s. 91.66, Wis. Stat.

Enbridge's proposed relocation route crosses five tracts with Farmland Preservation Program agreements and five tracts with DATCP Soil and Water Resource Management Grant Program Agreements. The pipeline could also affect existing or planned county cost-share grants with agricultural landowners. County land conservation committees are authorized to use funds awarded to the county from DATCP to finance cost-share grants to landowners to install conservation practices (s. ATCP 50.34, Wis. Adm. Code). Cost share contracts include a minimum maintenance period for a landowner to maintain the practice. Enbridge would contact affected landowners and would plan construction activities accordingly.

There is also the potential for Enbridge's proposed pipeline relocation to affect current or planned county cost-shared conservation within Ashland, Bayfield, Douglas, and Iron counties. Where pipeline installation requires the removal of a county cost-shared conservation practice, the farm could be considered out of compliance and the county land conservation committee may pursue reimbursement of cost-share funds under s. ATCP 50.40(9)(k), Wis. Adm. Code.

5.14.2 Economic Impact Analysis

Enbridge contracted with Capital Policy Analytics to estimate the economic impact of Enbridge's proposed relocation project at a statewide level and national level, including direct, indirect, and induced impacts of construction (Brannon and Kashian, 2021). The researchers used IMPLAN for their analysis. IMPLAN is an industry-standard analysis and planning software that uses data on the interrelationship between different sectors of an economy to model the impacts of development projects, events, policies, and other scenarios. This approach is also known as input-out modeling. Capital Policy Analytics reported a direct statewide impact of 700 workers with a labor income of $27.5 million and a total output of $71.5 million. Estimated indirect effects – arising from business-to-business spending – included an additional 196 jobs, with $10.9 million in labor income, and a total output of $30.7 million statewide. Estimated induced impacts – generated by spending by workers whose jobs result from direct or indirect impacts of the proposed project – were reported as an additional 212 jobs, with $10.5 million in labor income, and $32.7 million in economic output statewide. Capital Policy Analytics reported a total estimated impact of 1,108 jobs, with $48.9 million in labor income, and $134.9 million in total output, statewide (Brannon and Kashian, 2021).

The DNR also used IMPLAN to estimate the economic impact of Enbridge's proposed relocation project, but did so at the local level (Ashland, Bayfield, and Iron counties) as well as Wisconsin as a whole. The dollar-year chosen was 2019 (the year Enbridge estimated the cost of constructing its proposed Line 5 relocation). The data year chosen was 2022 (the most recent data available in IMPLAN).

Two economic sectors were used to estimate the direct impacts of Enbridge's proposed relocation project: "Construction of other new nonresidential structures" (IMPLAN Sector 56) and "Wholesale - Petroleum and petroleum products. The latter was selected to account for direct sales of fuel for construction.

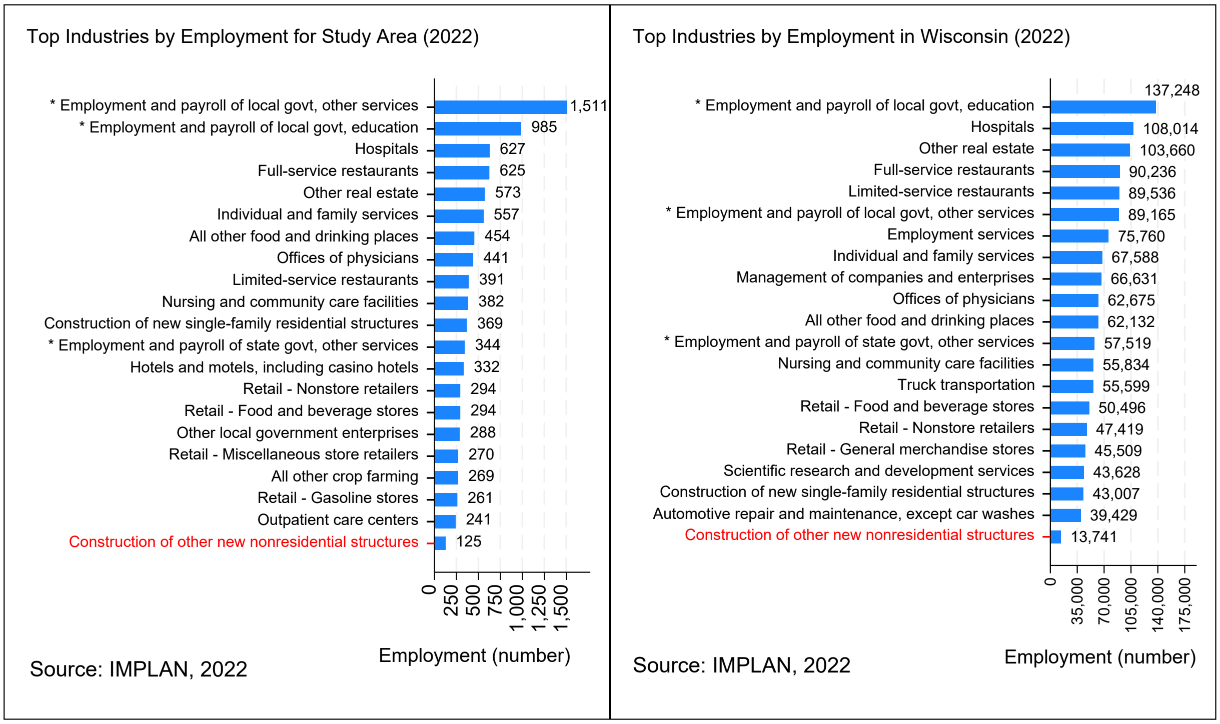
The impact of non-local spending was estimated based on the per diem using FY 2023 per diem standard rates for Wisconsin, provided by the U.S. General Service Administration. The total impact of the relocation project is estimated after summing the impact from construction project and the non-local spending. All the economic effects are reported in dollar year 2024.

Table 5.14-9 Top employment sectors impacted by Enbridge's proposed Line 5 relocation.

IMPLAN CODE	Sector	Direct	Indirect	Induced	Total
56	Construction of other new nonresidential structures	700	0	0	700
508	Other accommodations	79	0	0	79
511	All other food and drinking places	14	3	3	20
509	Full-service restaurants	11	1	5	18
510	Limited-service restaurants	9	0	3	13
490	Hospitals	7	0	5	12
405	Retail - Building material and garden equipment and supplies stores	0	12	0	12
519	Dry-cleaning and laundry services	11	0	0	11
483	Offices of physicians	5	0	4	9
447	Other real estate	0	6	2	8
417	Truck transportation	0	5	0	6
493	Individual and family services	0	0	5	5

Note: The total figures do not match the sum of direct, indirect, and induced effects because of rounding errors.
Note: Estimates are based on IMPLAN modelling

Figure 5.14-1 shows the top twenty sectors, as categorized by IMPLAN, in the three-county area and in Wisconsin as a whole. These sectors are more detailed than the combined industries listed in Table 5.14-1, which are based on Census data. The sector for “Construction of other new nonresidential structures” (IMPLAN sector 56) is not in the top twenty for either the region, or the state, but is included for reference. Of 546 sectors listed in IMPLAN, the “Construction of other new nonresidential structures” ranks 82nd and in Wisconsin and employs 13,741 residents. The sector ranks 45th in the three-county region and employs 125 residents.



Source: IMPLAN, 2022

Source: IMPLAN, 2022

Figure 5.14-1 Top industries by employment for study area (Bayfield, Ashland and Iron counties) and Wisconsin.
Source: DNR, IMPLAN (2022)

Enbridge estimates that its proposed relocation project will cost approximately $450 million. Brannon and Kashian (2021) estimated that $80 million would be spent in the three-county area. In response to a DNR information request, Enbridge estimated that approximately $30 million or 37.5% of the $80 million would be spent on fuel. Enbridge estimated that approximately half of the 700 workers needed for the construction project would be hired from local union halls; however, it acknowledged that it is not possible to predict how many workers will be hired who currently live in the three counties. For its analysis, the DNR assumed that one-third (233) of the total workers comes from the three-county area, another one-third come from elsewhere in Wisconsin, and the final one-third will come from out of state. The DNR assessed whether the total economic impact of the proposed project would be sensitive to different assumptions regarding the origin of the workers with respect to these three options. Enbridge further reported that about 150 non-construction workers would be hired, and, on an average, each would be paid a total salary of $75,000 over construction period. Similarly, 550 construction workers will be hired and will be paid $57,000 (Enbridge, 2020g). Based on the number of construction and non-construction workers, it is assumed that 78.6 percent of the total workers are construction workers and 21.4 percent are non-construction workers.

Based on the wage information provided by Enbridge, the total wages received by 233 local workers is estimated to be $14,181,000 (50 non-construction employees would be paid $3,750,000, while 183 construction employees would be paid $10,431,000 ($57,000 for nine months). Only the labor compensation received by the local workers is included in the IMPLAN model. The effect of non-local worker spending (estimated based on per diem) on the study area was modelled separately.

The DNR estimated the direct spending of non-local workers in various sectors of the economy based on Haynes et al. (2015). The total amount spent was estimated using the number of non-local workers, their length of stay, and per diem spending allowance. The rates provided by the U.S. General Service Administration for Wisconsin in 2023 are $107 for lodging expense and $59 for meals and incidentals. The amount spent per non-local worker was estimated to be $832 per week (assuming five working days in a week). With working duration of 9 months (39 weeks), the total per diem expected to be spent in the study area is estimated to be about $15 million (about $10 million in lodging and $5 million in meals and incidentals). Table 5.14-10 presents a complete list of the sectors and the direct effects modeled in each sector because of non-local construction worker spending.

Table 5.14-10 Sectors and direct effects used in modeling the impact of non-local worker spending.

Sector	Direct retail and hospitality spending	Percentage of spending	Direct spending ($)
507	Hotels and motels, including casino hotels	31.81%	$4,808,744
508	Other accommodations	31.81%	$4,808,744
490	Hospitals	9.06%	$1,369,517
509	Full-service restaurants	5.86%	$886,359
510	Limited-service restaurants	5.86%	$886,359
511	All other food and drinking places	5.86%	$886,359
483	Offices of physicians	3.73%	$564,045
519	Dry-cleaning and laundry services	2.15%	$324,505
406	Retail - Food and beverage stores	1.73%	$260,945
408	Retail - Gasoline stores	1.51%	$228,069
411	Retail - General merchandise stores	0.37%	$55,573
489	Other ambulatory health care services	0.25%	$37,570
	Total	**100%**	**$15,116,789**

Note: The percentage of spending is estimated following Haynes et al. (2015).

Table 5.14-11 summarizes the total economic effects of the project. These results use the direct expenditures provided by Enbridge, per diem spending by non-local construction workers and leakages to the neighboring Counties (Douglas, Price, Sawyer, Vilas, and Washburn) of the study area. The direct employment and expenditures were combined with the direct effects of non-local workers' spending to result to a total direct effect of about $65 million in spending and supported 839 jobs. The indirect effect shows the effects of increased spending between commercial, government and service industries because of the direct effects. The indirect effects lead to increase about $17 million from direct effects of industry spending and supported 82 jobs. Induced effects show the effects of increased spending by residential households because of the direct and indirect effects of labor compensation. The induced effects lead to increase in about $12 million in spending by residential households and support 79 jobs. The total effect is the sum of direct, indirect, and induced effects. The project is estimated to support about 1,000 jobs and lead to about $94 million in new spending during the project construction period. The total impact estimated is at the upper bound because some of the workers hired can be employed elsewhere (not a new job) and the economic loss resulting from the displacement of tourists is not accounted in the analysis. Given the limited accommodation available in the project area, the non-local workers are likely to displace tourists particularly during the peak season. The DNR is unable to estimate the cost of the tourist displacement and economic loss to the tourism industry.

Table 5.14-11 Total impact of Enbridge's proposed Line 5 relocation on the three-county area.

Impact	Employment	Labor income	Value added	Output
Direct	839	$20,061,207	$22,659,996	$64,770,984
Indirect	82	$3,812,296	$6,936,605	$17,539,353
Induced	79	$3,032,530	$6,428,960	$11,895,252
Total Effect	1,000	$26,906,033	$36,025,561	$94,205,589

Note: Estimates are based on IMPLAN modelling of the total spending of the project in the study area. The effects of non-local spending and the effects of the construction project are summed up.

The DNR estimated the impact of the reconstruction project at the regional (three county) level using the multi-regional input-output (MRIO) analysis that IMPLAN recently developed. The MRIO analysis approach allows for the selection of a smaller region where the event (direct impact) takes place and estimate the impact (leakages) on the neighboring regions. These neighboring counties might supply the inputs required for construction or some of its residents might be employed by the reconstruction project creating additional local effects. Table 5.14-12 shows the impact of Line 5 construction spending accounting the possible leakages to the neighboring counties.

Table 5.14-12 Effect of construction of Enbridge's proposed Line 5 relocation on the three-county area and its neighboring county area.

Impact	Employment	Labor income	Value added	Output
Direct	701	$15,128,826	$16,642,376	$54,825,712
Indirect	56	$2,520,555	$4,560,884	$11,002,536
Induced	58	$2,239,025	$4,737,306	$8,777,357
Total effect-without leakage	**815**	$**19,888,406**	$**25,940,566**	$**74,605,605**
Indirect leakage	12	$807,086	$1,551,294	$4,430,099
Induced leakage	3	$116,342	$257,548	$461,355
Total leakage	**14**	$**923,427**	$**1,808,842**	$**4,891,454**
Total effects with leakage	**829**	**$ 20,811,833**	$**27,749,408**	$**79,497,059**

Note: Estimates are based on using MRIO—new feature of IMPLAN model.

Results indicate that the project will lead to the direct spending of about $55 million in study area. The direct effect is lower than the project spending of $80 million because the major share of spending on fuel being transported through Line 5 will go out of the study area where oil extraction and refinery take place. The construction project is expected to support 829 jobs in the study area because of spending of labor income and local input purchases. There will be a leakage of about $5 million to the neighboring counties supporting 14 jobs. Table 5.14-13 shows the neighboring counties with the estimated leakage. Among neighboring counties, Douglas and Price Counties have the highest estimated leakages (both the indirect and induced effects).

Table 5.14-13 Estimated leakages to the neighboring counties from the three-county area.

Impact	Employment	Labor income	Value added	Output
Indirect				
Douglas	6	$484,180	$1,017,022	$3,198,030
Price	3	$223,930	$329,813	$722,015
Sawyer	0	$14,578	$58,762	$114,143
Vilas	1	$42,761	$77,617	$198,825
Washburn	1	$41,637	$68,081	$197,086
Total indirect	**12**	**$807,086**	**$1,551,294**	**$4,430,099**
Induced				
Douglas	1	$55,503	$128,172	$226,144
Price	1	$34,455	$73,486	$132,472
Sawyer	0	$11,686	$23,715	$43,406
Vilas	0	$8,550	$19,516	$36,359
Washburn	0	$6,147	$12,659	$22,974
Total induced	**3**	**$116,342**	**$257,548**	**$461,355**
Total leakage	**14**	**$923,427**	**$1,808,842**	**$4,891,454**

Note: Estimates are based on IMPLAN modelling

Table 5.14-14 illustrates the impacts of non-local worker spending. The direct effect (about $10 million) is less than the estimated total direct spending based on per diem (about $15 million). This is due to margining, which is applicable to all the retail spending done by non-local construction workers because a small portion of the money spent in a retail or wholesale sectors goes to the local retailer or wholesaler. The price of the commodity sold is passed on to producers. New spending from the non-local workers residing in the study area during project construction is expected to support about 169 jobs in the study area and lead to about $15 million in combined direct, indirect, and induced spending.

Table 5.14-14 Effects of non-local worker spending in the three-county area.

Impact	Employment	Labor income	Value added	Output
Direct	138	$4,932,381	$6,017,620	$9,945,272
Indirect	14	$484,655	$824,427	$2,106,718
Induced	18	$677,163	$1,434,106	$2,656,540
Total effects	**169**	**$6,094,199**	**$8,276,153**	**$14,708,529**

Note: Estimates are based on IMPLAN modelling

The DNR also estimated the effects of non-local spending on accommodation and restaurant sectors. The non-local spending on accommodation (hotels, motels, casino hotels) generated 95 jobs, $3.4 million in labor income, $4.6 million in value addition and $7.2 million in total output (Table 5.14-15). The non-local spending on restaurant sector generated 26 jobs, $0.7 million in labor income, $1.1 million in value addition, and about $3 million in total output (Table 5.14-16).

Table 5.14-15 Impact of non-local workers spending on accommodation sector.

Impact	Employment	Labor Income	Value added	Output
Direct	79	$2,852,064	$3,420,586	$4,847,896
Indirect	6	$205,712	$351,947	$861,013
Induced	10	$375,955	$795,710	$1,474,188
Total	**95**	**$3,433,731**	**$4,568,244**	**$7,183,097**

Note: Estimates are based on IMPLAN modelling

Table 5.14-16 Impact of non-local workers spending on restaurant sector.

Impact	Employment	Labor Income	Value added	Output
Direct	21	$483,547	$735,555	$1,763,955
Indirect	3	$118,746	$216,684	$574,627
Induced	2	$77,398	$164,108	$303,909
Total	**26**	**$679,691**	**$1,116,347**	**$2,642,491**

Note: Estimates are based on IMPLAN modelling

The construction of the project also affect local taxing jurisdictions. Payroll and income tax revenues would accrue to the State of Wisconsin as a result of labor expenditures, with ad valorem taxes generating additional funds. The total tax revenues anticipated to be generated by project is approximately $10.5 million, of which county tax will be $0.7 million, state tax will be $2.2 million, and federal tax will be $6.3 million (Table 5.14-17).

Table 5.14-17 Tax impact of Enbridge Line 5 relocation project in the three-county area.

Impact	Sub County General	Sub County Special Districts	County	State	Federal	Total
Direct	$312,024	$356,168	$377,587	$1,261,059	$4,638,737	$6,945,575
Indirect	$145,099	$177,829	$178,107	$527,821	$919,647	$1,948,503
Induced	$110,250	$128,003	$133,997	$408,354	$772,411	$1,553,014
Total	**$567,373**	**$661,999**	**$689,691**	**$2,197,234**	**$6,330,795**	**$10,447,092**

Note: Estimates are based on IMPLAN modelling

The DNR also estimated the impact of the relocation project at the state level. Enbridge calculated that $330 million (about 73%) out of the total $450 million of costs for the project will be directly spent in Wisconsin. Two-thirds of the 700 hired workers (466 workers) are assumed to be Wisconsin residents. The total labor compensation received by Wisconsin residents is $28,362,000 ($20,862,000 received by 366 construction workers; $7,500,000 received by 100 non-construction workers). The total per diem received by non-residence workers is $7,574,580, estimated using rates provided by the U.S. General Service Administration for Wisconsin in 2023. The project is estimated to generate approximately $535 million ($525 million from construction and $9 million from non-local spending) of new spending in Wisconsin, creating 1,726 jobs and about $96 million of labor income (Table 5.14-18). The project is estimated to generate value-addition of $144 million in Wisconsin economy. Further, the project is estimated to generate total tax revenues of about $38 million, of which county tax will be about $1 million, state tax will be about $9 million, and federal tax will be about $23 million (Table 5.14-19).

Table 5.14-18 Total impact of Line 5 Wisconsin segment relocation project in Wisconsin.

Impact	Employment	Labor Income	Value Added	Output
Construction				
Direct	701	$30,270,184	$32,975,483	$320,747,817
Indirect	602	$42,144,226	$69,839,176	$142,824,920
Induced	343	$19,587,136	$35,856,552	$61,774,288
Total	**1,646**	**$92,001,545**	**$138,671,211**	**$525,347,025**
Non-local spending				
Direct	56	$2,764,885	$3,306,082	$4,983,286
Indirect	8	$532,930	$835,209	$1,619,276
Induced	15	$880,483	$1,611,867	$2,776,886
Total	**80**	**$4,178,298**	**$5,753,159**	**$9,379,448**
Direct	757	$33,035,069	$36,281,566	$325,731,103
Indirect	610	$42,677,156	$70,674,385	$144,444,196
Induced	359	$20,467,619	$37,468,419	$64,551,175
Grand total	**1,726**	**$96,179,844**	**$144,424,370**	**$534,726,474**

Note: Estimates are based on IMPLAN modelling

Table 5.14-19 Tax impact of Enbridge Line 5 relocation project in Wisconsin

Impact	Sub county general	Sub county special districts	County	State	Federal	Total
Direct	$514,195	$685,150	$378,993	$2,232,749	$7,400,095	$11,211,183
Indirect	$1,039,813	$1,385,903	$765,808	$4,440,228	$10,144,889	$17,776,642
Induced	$500,756	$667,427	$368,799	$2,225,438	$5,027,025	$8,789,444
Total	**$2,054,764**	**$2,738,480**	**$1,513,600**	**$8,898,415**	**$22,572,009**	**$37,777,268**

Note: Estimates are based on IMPLAN modelling

As described in Section 1.1, Enbridge estimates construction of its proposed Line 5 relocation will cost approximately $450 million (privately financed) and take 12 to 14 months to complete. Of the total cost, Enbridge estimates that approximately $360 million (Enbridge's original estimate of $330 million was adjusted to 2024 dollars for inflation for analysis purposes) would be spent in Wisconsin. Of these expenditures, Enbridge estimates that $110 million would be spent in Ashland, Bayfield, and Iron counties. Of the total project budget, Enbridge estimates that 30 percent would be spent on construction labor, with an additional 40 percent spent on administrative labor, 20 percent on materials, and approximately 10 percent spent on design and engineering.

Enbridge's proposed relocation project would generate a significant increase in economic activity during the 12 to 14 months of active construction. During that time, the project would have positive direct economic effect on the three-county region (Ashland, Bayfield, and Iron counties) through the employment of local residents, the purchase of construction materials that are locally produced, and tax contribution.

The impact analysis conducted above is based on the employment scenario—one-third of the workers comes from the study area, one-third of the worker comes from out of the study area but within Wisconsin, and remaining one-third of the workers comes from out of Wisconsin. The DNR conducted a sensitivity analysis to assess the effects of different assumptions of source of labor origin on the estimated impact of the relocation project. The DNR used two additional employment scenarios in the sensitivity analysis. In second scenario, it is assumed that about fifty percent of the total workers will be from study area, twenty five percent will be from out of the study area but within Wisconsin, and twenty five percent will be from out of Wisconsin. In third scenario, it is assumed that about twenty percent of the workers comes from study area, forty percent comes from out of the study area but within Wisconsin and forty percent of the workers comes from out of state. Table 5.14-20 shows the impact of the project in the study areas and the Table 5.14-21 shows the impact of the project in the whole state. The Table also include a column on the change in economic outputs respect to the estimated outputs from the first scenario. Overall, the total economic output of the project changed by less than one percent although there is a slight change in direct, indirect, and induced effects. An assumption of increase in local labor share and decrease of non-local labor share results to increase in local labor compensation while decrease in per diem spending of non-local workers, and vice-a-versa. As a result, the total impact of the project remains similar suggesting that the total impact of the project is not sensitive to the different sources of labor origin.

As mentioned, impact of the relocation project is estimated based on the inputs provided by Enbridge. Any changes in the duration of the construction project, number of workers, and spending in study area will change the impact of the project. A study conducted by University Minnesota Duluth (2022) compared the actual and projected economic impacts of the replacement of Line 3 Enbridge project. Although the project was proposed to be constructed within two years, the project spanned about seven years. The labor income, value added, and outputs were larger than what was projected. Given the Enbridge Line 5 relocation project is anticipated to be completed in 12 to 14 months, the impact of the project will be no longer felt once the construction is completed. These temporary jobs would be lost, and the workers would have to find other jobs.

Table 5.14-20 The impact of Enbridge's Line 5 relocation project in the three-county area based on employment scenarios.

Employment scenarios	Impact	Employment	Labor income	Value added	Output	Percent change in economic output
Scenario 1 (Baseline)	Direct	839	$20,061,207	$22,659,996	$64,770,984	-
	Indirect	82	$3,812,296	$6,936,605	$17,539,353	-
	Induced	79	$3,032,530	$6,428,960	$11,895,252	-
	Total	**1,000**	**$26,906,033**	**$36,025,561**	**$94,205,589**	-
Scenario 2	Direct	804	$26,397,966	$28,724,865	$62,279,344	3.85%
	Indirect	78	$3,690,971	$6,730,189	$17,011,818	3.01%
	Induced	99	$3,825,259	$8,105,601	$15,001,769	26.12%
	Total	**981**	**$33,914,196**	**$43,560,655**	**$94,292,931**	**0.09%**
Scenario 3	Direct	867	$15,021,956	$17,836,864	$66,751,520	3.06%
	Indirect	84	$3,908,720	$7,100,641	$17,958,621	2.39%
	Induced	62	$2,402,123	$5,095,632	$9,424,834	20.77%
	Total	**1,013**	**$21,332,799**	**$30,033,138**	**$94,134,976**	**0.07%**

Note: Estimates are based on IMPLAN modelling. Scenario 1: Local (3-county) employees: 33%, rest of WI employees: 33%, out of State employees: 33%; Scenario 2: Local (3-county) employees: 50%, rest of WI employees: 25%, out of State employees: 25%; Scenario 3: Local (3-county) employees: 20%, rest of WI employees: 40%, out of State employees: 40%.

Table 5.14-21 The impact of Enbridge's Line 5 relocation project in Wisconsin based on employment scenarios.

Employment scenarios	Impact	Employment	Labor income	Value added	Output	Percent change in output
Scenario 1 (Baseline)	Direct	757	$33,035,069	$36,281,566	$325,731,103	-
	Indirect	610	$42,677,156	$70,674,385	$144,444,196	-
	Induced	359	$20,467,619	$37,468,419	$64,551,175	-
	Total	**1,726**	**$96,179,844**	**$144,424,370**	**$534,726,474**	-
Scenario 2	Direct	753	$35,935,164	$39,047,137	$324,474,631	0.39%
	Indirect	607	$42,325,842	$70,148,115	$143,614,375	0.57%
	Induced	368	$20,886,007	$38,307,099	$66,065,885	2.35%
	Total	**1728**	**$99,147,012**	**$147,502,352**	**$534,154,891**	**0.11%**
Scenario 3	Direct	784	$30,247,160	$33,603,139	$326,710,721	0.30%
	Indirect	610	$42,434,811	$70,333,479	$144,088,048	0.25%
	Induced	340	$19,177,036	$35,222,473	$60,793,222	5.82%
	Total	**1733**	**$91,859,007**	**$139,159,090**	**$531,591,992**	**0.59%**

Note: Estimates are based on IMPLAN modelling. Scenario 1: Local (3-county) employees: 33%, rest of WI employees: 33%, out of State employees: 33%; Scenario 2: Local (3-county) employees: 50%, rest of WI employees: 25%, out of State employees: 25%; Scenario 3: Local (3-county) employees: 20%, rest of WI employees: 40%, out of State employees: 40%.

5.15 Decommissioning of Existing Line 5 after Relocation

According to Enbridge, the company anticipates decommissioning the existing Line 5 pipeline segment that crosses the Bad River Reservation by abandoning it in place (Section 2.7.2). The effects of this would be the same as those outlined in Section 8.2.1, which would result from an outcome of the No Action alternative. Were Enbridge to remove pipe segments (Section 2.7.3), rather than abandon them in place, there would be additional effects along the existing route. These effects would be similar to the effects of pipeline construction, which are described in the preceding sections of this chapter. The exception would be the eventual return of portions of the permanent ROW and temporary workspaces to forested and woody land cover, and the positive effects that this could have on forest interior species (Section 5.10.10) and on the functional values of wetlands that had previously been converted from shrub or forested wetlands to emergent wetland communities(Section 5.8.5.14).

5.16 Summary of Positive & Negative Effects

Section NR 150.30(2)(g), Wis. Adm. Code, requires that an EIS prepared by the DNR include,

> "*An evaluation of the probable positive and negative direct, secondary and cumulative effects of the proposed project, and alternatives to the proposed project, on the human environment…*"

The following types of effects must be evaluated:

- Effects on scarce resources
- Unavoidable adverse effects
- Consistency with other governmental plans and policies

- The relationship between short-term uses of the environment and long-term productivity
- Potential to set precedent
- Risk and uncertainty
- Public controversy

Most of these effects are detailed elsewhere in the EIS, including the preceding sections of this chapter. The remainder of this section includes summaries of these effects and provides cross-references to where they are described in more detail.

5.16.1 Effects on Scarce Resources

Section NR 150.30(2)(g)1., Wis. Adm. Code, requires that the DNR evaluate:

> "*Effects on scarce resources such as: archeological, historic or cultural resources, scenic and recreational resources, prime farm lands, threatened or endangered species, and ecologically critical areas.*"

Enbridge's proposed relocation of Line 5 from the Bad River Reservation to the company's proposed relocation route and route alternatives would affect scarce resources to varying degrees, including minimal or no effect. While their magnitudes vary, none of the anticipated effects on these resources would increase or improve the resource's quantity or quality in either the short- or long-term. All the anticipated, non-zero effects would be negative. The specifics of these effects are described elsewhere in this EIS. Below is a list of the scarce resources evaluated for this EIS and references to the sections that discuss the anticipated effects the pipeline relocation would have on them:

- Archeological, historic, and cultural resources (Section 4.2)
- Scenic and recreational resources (Section 5.12)
- Prime farmlands (Section 5.14.1.3)
- Threatened or endangered resources (Section 5.9.4, Section 5.10.8, and Section 5.10.9)
- Ecologically critical areas (Section 5.9.2 and Section 5.9.3)

The No Action alternative could have no effect on these resources, if it resulted in a shutdown of the Line 5 pipeline (Section 3.5.2 and Section 8).

5.16.2 Unavoidable Adverse Environmental Effects

Section NR 150.30(2)(g)2., Wis. Adm. Code, requires that the DNR provide:

> "*A summary of the adverse environmental effects which cannot be avoided.*"

Chapter 2 describes Enbridge's proposed Line 5 relocation project, including Enbridge's proposed construction methods and means of avoiding or otherwise minimizing the risk and magnitude of various environmental effects that would result from the construction and long-term operation of the relocated pipeline. These and other project-specific plans, methods, and best practices are described or referenced in the preceding sections of this chapter and in Chapter 4 (Native American Nations, Treaty Rights, Cultural Resources, & Security). The environmental effects described in these two chapters take into account these plans, methods, and best practices. The remaining effects are unavoidable.

Chapter 6 (Likelihood and Anticipated Effects of Spills) describes and references Enbridge's plans, programs, and procedures for minimizing the risk and anticipated effects of accidental spills of oil and NGLs from Line 5. As characterized in Chapter 6 the frequency of occurrence of spills is small, but it is not zero. Over time, pipeline spills are unavoidable; however, it is virtually impossible to predict when and where they will occur, how much oil or NGLs they will release, or how successful the response and clean-up would be. Given the daily variability of weather and the wide range of environmental sensitivities across the different locations downstream of all potential spill locations along Enbridge's proposed relocation route and route alternatives, it is possible that two spills with similar (very low) probabilities of occurrence could have vastly different effects. While catastrophic spills–and smaller spills that could still cause significant environmental damage–are highly unlikely, they are not entirely avoidable.

Chapter 8 describes the anticipated and potential effects of the No Action alternative, which is that the DNR would not issue the state permits to Enbridge that would be required to proceed with its proposed relocation of the Line 5 pipeline. Because of other factors outside the control of the DNR, it is uncertain what the outcome of the No Action alternative would be. It could result in the decommissioning of Line 5, or it could result in the continued operation of Line 5, either through the existing pipeline or an alternative route. The chapter considers the anticipated effects of the potential outcome that Line 5 would be decommissioned, in terms of the risk of oil spills (including substitute modes of transport), implications for GHG emissions and climate change, and the socioeconomic effects in the region. At least some of these potential effects, whether environmentally detrimental or beneficial, are avoidable in the sense that different outcomes and energy pathways could result from, or otherwise follow, the No Action alternative. The uncertainties involved make it impossible to say with confidence that any particular effect resulting from the No Action alternative is unavoidable.

5.16.3 Consistency with Other Plans & Policies

Section NR 150.30(2)(g)3., Wis. Adm. Code, requires that the DNR evaluate the:

> "*Consistency [of the proposed action or project] with plans or policies of local, state, federal, or tribal governments.*"

Chapter 1 includes a description of the various federal, tribal, state, and local regulations and requirements that would apply to Enbridge's proposed Line 5 relocation project (Section 1.4), as well as the 1977 Agreement Concerning Transit Pipelines between the United States and Canada (Section 1.2.3). In addition, the federal government, State of Wisconsin, tribal governments, and local governments have various plans and policies that are potentially relevant to Enbridge's proposed relocation project, as well as the government actions Enbridge needs to carry it out (e.g., permit issuances) and the resulting environmental and socioeconomic effects. Plans include area-specific and general plans for resource management, environmental protection, and energy. Policies include policy statements, declarations, and resolutions made or passed by executive administrations, governing bodies, and commissions.

The degree to which a federal, tribal, state, and/or local government action (e.g., issuing a construction permit) can be deemed to be "consistent" with a plan or policy issued by the same (or different) branch or level of government, depends on the specificity of the plan or policy in question. Typically, plans and policies are broad, which makes it difficult to determine that an action is inconsistent with the plan or policy. Furthermore, plans and policies tend to be non-binding and non-enforceable, so the importance of consistency is itself a matter of policy, as opposed to law.

5.16.3.1 Federal

Congress declared the following environmental policy in Title I of the National Environmental Policy Act (NEPA) (Public Law 91–190):

> "*The Congress, recognizing the profound impact of man[kind]'s activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man[kind], declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man[kind] and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.*
>
> *(b) In order to carry out the policy set forth in this Act, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs and resources to the end that the Nation may—*
>
> *(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;*
>
> *(2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;*
>
> *(3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;*
>
> *(4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;*
>
> *(5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and*
>
> *(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.*
>
> *(c) The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.*"

The U.S. Supreme Court has ruled that this policy is unenforceable (not including authorities established by Congress in other federal statutes, like the CWA) and that NEPA's "mandate to [federal] agencies is essentially procedural" (Vermont Yankee Nuclear Power Corp. v. NRDC, 1978). NEPA's core procedural requirement, that an EIS be prepared for any "major Federal actions significantly affecting the quality of the human environment" ensures that federal agencies consider the environmental effects of their proposed actions, that they do so in coordinated manner, and that they disclose the anticipated effects to the public. Neither NEPA's procedural requirements, nor its stated environmental policy, provide specific guidance on whether or not to take a particular action, or set of actions–in this case, the granting of permits and approvals needed by Enbridge to carry out its proposed Line 5 relocation.

Federal policy on energy and climate change continues to evolve. Addressing climate change by building a clean energy economy has been a focus of the current administration. President Biden has set several goals for the nation:

- Reduce U.S. greenhouse gas emissions 50-52 percent below 2005 levels in 2030.
- Reach 100 percent carbon pollution-free electricity by 2035.

- Achieve a net-zero emissions economy by 2050.
- Deliver 40 percent of the benefits from federal investments in climate and clean energy to disadvantaged communities.

In 2021, Congress passed the Bipartisan Infrastructure Law and in 2022 the Inflation Reduction Act. These laws make substantial investments in renewable energy and transportation infrastructure and seek to reduce GHG emissions through various incentive, tax, and technical assistance provisions. Many of the provisions target low-income communities and tribal nations. Implementation of these laws is helping the nation meet the provisions of the Paris Agreement.

To the extent that Enbridge's proposed Line 5 relocation and the alternatives affect energy consumption and contribute to GHG emissions, the DNR has investigated and considered these factors. Continued operations of Line 5 would be essentially the same irrespective of the route alternative selected, with only minor incremental increases in GHG emissions resulting from the slightly longer pipeline routes compared to the existing segment. The effect that decommissioning Line 5 would have on GHG emissions and climate change would depend, in large part, on whether and to what extent companies that currently ship products via Line 5 would switch to alternative modes of transport. If the Line 5 products are moved using substitute transport modes, GHG emissions would be replaced or increased by those modes of transport. In the case of a Line 5 shutdown, climate change would continue to occur, and in practically the same way as in an approved permit alternative. However, the No Action alternative is the only alternative assessed by the DNR with a possible outcome that could result in a reduction in GHG emissions and could contribute to achieving the objectives of the Paris Agreement (Sections 1.4.3.5 and 7.1).

As set forth in the binational Great Lakes Water Quality Agreement, the governments of Canada and the United States are committed to restoring and maintaining the chemical, physical, and biological integrity of the Great Lakes, including Lake Superior. The Lake Superior Lakewide Action and Management Plan (LAMP; Section 5.7.2), an ecosystem-based strategy for protecting and restoring Lake Superior (Environment and Climate Change Canada, 2023), outlines the commitments made by the U.S. and Canadian governments under the binational Great Lakes Water Quality Agreement. The Lake Superior LAMP is updated and implemented to facilitate information sharing, set priorities, and coordinate binational environmental protection and restoration activities. The restoration and protection actions identified in the Lake Superior LAMP respond to, and are categorized by, the major threats that are affecting one or more of the Great Lakes Water Quality Agreement's General Objectives, specifically:

- chemical contaminant pollution;
- nutrient and bacterial pollution;
- invasive species;
- loss of habitat and species; and
- other threats.

Oil transport is identified among the "other threats" listed in the Lake Superior LAMP and the plan recommends stakeholders: "Engage the public to educate it on impacts and risks associated with transporting oils and other hazardous materials by road, rail, ship and pipeline; spill contingency plans in place; and where to report spills of oils and other hazardous materials." The plan does not provide specific guidance on whether or not to grant permits and approvals needed by Enbridge to carry out its proposed Line 5 relocation.

5.16.3.2 Tribal

As discussed in Section 4.1.6, the Bad River Band's Tribal Council resolved in 2017 and reaffirmed in 2019 to not renew the Line 5 easements and directed tribal staff to take all lawful action to remove Line 5 from the reservation as well as the Bad River watershed (Bad River Band of Lake Superior Chippewa, 2017; 2019b).

As discussed in Section 1.2.2, the Bad River Band filed a lawsuit in the U.S. District Court for the Western District of Wisconsin in 2019 (Case no. 19-cv-602-wmc) alleging trespass and unjust enrichment for Enbridge's continued pipeline operation across the Bad River Reservation without valid easements, public nuisance, ejectment, and a violation of Bad River Band's regulatory authority. In its opinions and orders from September 7, 2022, and June 16, 2023, the court held that the 20-year easements had expired, Enbridge's continued use of Line 5 on those parcels constituted trespass, a rupture on Line 5 would constitute a public nuisance, and that Enbridge was unjustly enriched by the continued operation of Line 5. The court ordered Enbridge to adopt a more protective monitoring and shutdown plan, pay a monetary award to the Bad River Band, and issued an injunction prohibiting Enbridge from operating Line 5 after three years of the order (June 16, 2026). Both Enbridge and the Bad River Band have appealed the District Court ruling to the 7th Circuit Court of Appeals (Case no. 23-2309). Oral arguments in the 7th Circuit were held on February 8, 2024.

As noted on Section 4.1.8.6, in open letters to members of the Bad River Band, Enbridge has indicated, "We don't intend to operate on the Bad River Reservation a day longer than it takes to finish the relocation." Relocation of Line 5 off the reservation would be consistent with the intentions expressed in the Tribal Council's resolutions. However, Enbridge's preferred Line 5 relocation route, RA-01, and RA-02 would traverse the Bad River watershed, which would be inconsistent with the Tribal Council's desires.

5.16.3.3 State

In Section 1 of WEPA (Chapter 274, Laws of 1971), the Wisconsin Legislature declared an environmental policy for the state that is nearly verbatim the policy that Congress declared for the nation in Title I of NEPA (Section 5.16.3.1). The exceptions are that the legislature did not include two of the six end goals that Congress had included in its policy declaration; specifically, the legislature did not list (4) "preserve important historic, cultural, and natural aspects of our national heritage…" or (5) "achieve a balance between population and resource use…" The absence of these end goals from WEPA does not mean they are absent from state plans and policies. The preservation of historic, cultural, and natural heritage preservation are part of many state plans and policies, as well as state laws and regulations.

As with NEPA, the environmental policy declared by the Wisconsin Legislature in Section 1 of WEPA is not enforceable outside of authorities established elsewhere in federal or state statute. Neither the WEPA policy, nor its procedural requirements, provide guidance on what actions the DNR or other state agencies should take with respect to Enbridge's proposed relocation project. Per s. NR 150.30(1)(b), Wis. Adm. Code:

> "*The purpose of an EIS is to inform decision-makers and the public of the anticipated effects on the quality of the human environment of a proposed action or project and alternatives to the proposed action or project. The EIS is an informational tool that does not compel a particular decision by the agency or prevent the agency from concluding that other values outweigh the environmental consequences of a proposed action or project.*"

The state energy policy outlined in s. 1.12, Wis. Stat. (Section 1.4.3.5), requires state agencies to "investigate and consider the maximum conservation of energy resources as an important factor when making any major decision that would significantly affect energy usage." To the extent that Enbridge's proposed Line 5 relocation impacts state energy consumption and conservation, the DNR has investigated and considered these factors. The products transported through Enbridge's Line 5 are not consumed in Wisconsin, and therefore the proposed Line 5 relocation does not directly impact Wisconsin's energy consumption or reliance on nonrenewable combustible energy resources. No state agency has general authority for identifying the need for or siting of petroleum pipelines in Wisconsin. The DNR's authority is limited to its authority under statutes and state administrative rules to review and make determinations related to the various environmental permits necessary for the construction of the pipeline.

As described in Section 1.4.3.5, Executive Order #38 directed the Office of Sustainability and Clean Energy to create a comprehensive Clean Energy Plan. Recognizing the existing conditions in Wisconsin and the role the state plays in both regional and national GHG emissions reductions initiatives, the plan lays out several objectives. The strategies included in the Clean Energy Plan provide a roadmap to accomplish Wisconsin's objective of achieving a carbon-neutral power sector, reduce a range of other energy-related emissions, and transition Wisconsin to a robust and affordable clean energy economy.

As described in Section 1.4.3.5, Executive Order #52 created a Task Force on Climate Change with goals of developing a strategy to "mitigate and adapt to the effects of climate change for the benefit of all Wisconsin Communities." The task force met and prepared a climate change report wherein 46 policy pathways were identified in the general categories of climate justice and equality, energy, transportation, agriculture, resilient systems, clean economy, education, food systems, and forestry.

To the extent that Enbridge's proposed Line 5 relocation impacts state energy consumption and contributes to GHG emissions, the DNR has investigated and considered these factors. The products transported through Enbridge's Line 5 are not consumed in Wisconsin, and therefore the proposed Line 5 relocation does not directly impact Wisconsin's energy consumption or reliance on nonrenewable fuels. One of the Task Force on Climate Change's policies is to avoid new pipelines and oppose new or expanded existing fossil fuel transportation infrastructure. Enbridge's proposed relocation of Line 5 would maintain existing energy infrastructure by replacing a section of an existing pipeline and would not represent a new or expanded source of GHG emissions (Chapter 8). Replacement of a section of existing pipeline infrastructure does not further the goals presented in the Task Force on Climate Change report yet is not directly inconsistent with them.

The effect that decommissioning Line 5 would have on GHG emissions and climate change would depend, in large part, on whether and to what extent companies that currently ship products via Line 5 would switch to alternative modes of transport. If the Line 5 products are moved using substitute transport modes, GHG emissions would be replaced or increased by those modes of transport. In the case of a Line 5 shutdown, climate change would continue to occur, and in practically the same way as in an approved permit alternative. However, the No Action alternative is the only alternative assessed by the DNR with a possible outcome that could result in a reduction in GHG emissions and could contribute to achieving the objectives of the Paris Agreement and Wisconsin's 2025 goal for a 26 to 28 percent reduction in GHG emissions from 2005 levels (Sections 1.4.3.5 and 7.1).

5.16.3.4 Local

Enbridge's proposed Line 5 relocation route would pass through Ashland and Iron counties and eight local jurisdictions: the towns of Ashland, Gingles, Marengo, Morse, White River, Anderson, Gurney, and Saxon. These local governments do not have pipeline permitting authority and are not regulating bodies for the proposed project. The governing bodies of several local governments have passed resolutions showing either support or opposition to Enbridge's prosed Line 5 relocation. These resolutions do not have legal requirements but express the policy positions of the local jurisdictions.

The governing bodies of Douglas and Iron counties, the towns of Morse and White River, and the nearby City of Mellen passed resolutions expressing support for Enbridge's proposed Line 5 relocation and urging the DNR to promptly process and approve the permits required for the project to move forward. The

Wisconsin Counties Association, a statewide voice for county officials, also supported permitting the project. The resolutions list reasons for supporting the project such as the products delivered to regional refineries provide jobs, construction of the new pipeline would bring an estimated 700 family-sustaining construction jobs hired largely from the region's union halls, and Enbridge has developed multiple plans and procedures that detail best management practices to be used during construction to minimize impacts.

The governing bodies of Ashland County and the City of Ashland passed resolutions in opposition to Enbridge's proposed Line 5 relocation and urged the DNR to deny the permits required for the project. Ashland County also opposed granting Enbridge eminent domain authority. The City of Ashland's resolution supports the efforts of the Bad River Band to remove the Line 5 pipeline from the Bad River watershed. The City's resolution lists reasons for their opposition to the proposed project such as the existing Line 5 has experienced 29 leaks and spills over the years totaling more than a million gallons of oil and natural gas released and that an oil spill could have irreparable damage to the natural and cultural resources of the Bad River.

Other local jurisdictions have recognized the public controversy associated with Enbridge's proposed Line 5 relocation but have not taken formal steps to support or oppose the project. For example, in commenting on the Draft EIS, the Board Chair from the Town of Gingles wrote,

> "*After deliberation within the Town Board we have no opposition to the project at this time and have had previous discussion with Enbridge as to concerns with the utilization of Town roads and right-of-way and expect further agreement as to having on-going maintenance and repairs to any Town roadways or properties as the project progresses and after it is completed. However, there are viable concerns within the private sector of our community which have been brought to our attention and we feel they deserve the utmost scrutiny prior to, during, and after the pipeline construction*."

Enbridge's proposed Line 5 relocation project or the alternatives, including the DNR's No Action alternative, could be consistent or inconsistent with the policy positions of local jurisdictions depending on the sentiments expressed in their individual resolutions.

5.16.4 Short-term Uses versus Long-term Productivity

Section NR 150.30(2)(g)4., Wis. Adm. Code, requires that the DNR evaluate:

> "*The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitments of resources*."

Enbridge estimates that its proposed Line 5 relocation project would cost approximately $450 million (privately funded) and take 12 to 14 months to complete (Section 1.1). The phases of active construction (Section 2.6) would have many temporary, direct effects. These constitute Enbridge's "short-term uses" of the human environment. As defined in defined in s. NR 150.03(12), Wis. Adm. Code, the human environment encompasses not only the "physical environment" but its "aesthetic, historic, cultural, economic, social, and human health-related components."

Some components of the human environment would only be subject be short-term effects (uses) during the active construction. These are described in the first four sections of this chapter, and include:

- Noise and vibration (Section 5.1)
- Transportation (Section 5.2)
- Air quality (Section 5.3)

- Public health & safety (Section 5.4)

After construction was completed, a relocated Line 5 would continue to have direct and indirect effects on other components of the human environment–for as long as the relocated Line 5 remains in operation, and longer for some components. In addition, ongoing changes in regional land use, land cover, soils, wetlands, and climate–including the continuation of the trend towards more frequent and intense storm events (Section 7.3.3)–could act to heighten long-term risks and effects like fluvial erosion (Section 5.6.7) creating additional cumulative effects. Finally, there is the risk and potential effects of accidental spills of oil or NGLs from the relocated pipeline (Chapter 6).

Other sections in the current chapter, as well as Chapters 4 and 6, cover components of the human environment that would not only be subject to short-term effects (use) but would continue to be affected (directly, indirectly, and in some cases cumulatively) for at least as long as Enbridge's relocated Line 5 would be in operation, and in some cases, longer. These include:

- Cultural resources (Section 4.2)
- Environmental Justice (Section 4.3.4)
- Geology & groundwater (Section 5.5)
- Soils (erosion & sediment) (Section 5.6)
- Surface water resources (Section 5.7)
- Wetlands (Section 5.8)
- Ecological Landscapes, natural communities, and plants (Section 5.9)
- Wildlife (Section 5.10)
- Invasive species (Section 5.11)
- Public lands & trails (Section 5.12)
- Population & housing (Section 5.13)
- Economy (Section 5.14)

One other component of the human environment covered in this EIS is the ongoing tragedy of murdered and missing indigenous people (Section 4.4). The concern, which Enbridge addresses in its Environmental Justice Commitment Plan (Section 4.5; Appendix J) is that the influx of temporary workers in the project area could result in an increase in sexual assault, abduction, and other violent crimes committed against tribal women and other vulnerable populations in the Bad River Reservation and surrounding area. These crimes would have long-term effects, regardless of when they occur.

Overall, the relationship between Enbridge's short-term use of Wisconsin's human environment and the long-term productivity of Wisconsin's human environment would be a net negative. The relationship would vary between different components of the human environment; for example, the loss of soil productivity, in the form of erosion, would decrease sharply following active construction, whereas the risk of an oil spill affecting aquatic habitat would increase. In neither case would long-term productivity increase on account of Enbridge's proposed Line 5 relocation. This is the case for all components of the human environment addressed in this EIS, except for the regional and state economy. As described in Section 5.14, this increased productivity could have some long-term residual effect, but most of the productivity would be temporary. Enbridge estimates the construction of its proposed project would take 12 to 14 months. Notwithstanding the residual effects of a short-term economic boost, most of the non-local workforce would likely leave when construction was completed, and some portion of the local workers would go elsewhere for work.

Almost none of products derived from the oil and NGLs transported via Line 5 from the Superior refinery through Wisconsin are consumed by Wisconsin households. In analyzing the anticipated effects of the No

Action alternative, the DNR assumed that the out-of-state consumers would substitute the petroleum and NGLs currently transported via Line 5 with a combination of the same products transported by other means, different products (e.g., alternative energy), improvements in energy efficiency, or some combination of these alternatives. Regardless of how they come about, these substitutions would have their own effects on the quality of the human environment, which in turn could offset or compound the direct, indirect, and cumulative effects of this outcome of the No Action alternative over time.

5.16.5 Potential to Establish Precedent

Section NR 150.30(2)(g)5., Wis. Adm. Code, requires that the DNR evaluate,

> "*The potential to establish a precedent for future actions or to foreclose future options.*"

The issuance of DNR permits and approvals are made on a case-by-case basis applying the relevant legal standards to the facts, and a specific permit decision do not set precedent for future permitting decisions.

All pipeline projects are unique, and in Wisconsin, DNR involvement typically relates to natural gas pipelines. The DNR has cooperated with the Public Service Commission of Wisconsin (PSC) on the preparation of EIS documents for a number of natural gas pipeline projects in the state. The PSC does not have authority over oil pipelines. A search of the DNR's WEPA archive indicates that the DNR has prepared one other EIS on a proposed oil pipeline project: Enbridge's 14-mile-long Alberta Sandpiper Pipeline and Line 3 Replacement Projects in Douglas County in 2016. The DNR issued the necessary permits and approvals.

Pipeline construction within a new or relocated route (new ROW) is an infrequent occurrence in Wisconsin. This EIS sets a benchmark for the level of detail and comprehensiveness of environmental impact analysis for such projects.

5.16.6 Risk & Uncertainty

Section NR 150.30(2)(g)6., Wis. Adm. Code, requires that the DNR evaluate:

> "*The degree of risk or uncertainty in predicting environmental effects or effectively controlling potential deleterious environmental impacts, including those relating to public health or safety.*"

The anticipated environmental effects of Enbridge's proposed Line 5 relocation vary in their degree of risk and uncertainty. Risk can be thought of as the likelihood that a particular type of event will occur multiplied by the amount of damage that such an event would cause. Several types of events associated with the construction or operation of a relocated Line 5 pipeline, as proposed by Enbridge, have a relatively high risk or high degree of uncertainty. These include:

- Aquifer breaches (Section 5.5.2.12)
- Inadvertent releases of HDD or direct bore drilling fluid (Section 5.6.5)
- Sediment deposition in streams (Sections 5.6.3 and 5.6.7).
- Elevated water temperatures (Section 5.7.7.1)
- Pipeline exposure caused by geohazards (Section 5.6.6)
- Accidental spills of oil or NGLs (Chapter 6)

Enbridge, or a third-party consultant hired by Enbridge conducted a risk analysis for each of these types of events. The DNR reviewed the results of these analyses and used them to inform its own evaluation of the risks and potential effects that these events would have on different components of the human environment. In some cases, the DNR conducted its own analyses, using the input data or outputs of the analyses conducted by Enbridge and its consultants (which Enbridge provided in response to DNR requests) as well as data and information from other sources. The methods and results of these various analyses are included in the Appendices cited below.

- Aquifer breaches (Appendix G)
- Inadvertent releases of HDD drilling fluid (Appendix N)
- Sediment transport and deposition in streams (Appendices Q, R, S, and AH)
- Elevated water temperatures (Appendix X)
- Pipeline exposure caused by geohazards (Appendix O)
- Accidental spills of oil of NGLs (Appendix AG)

5.16.7 Public Controversy

Section NR 150.30(2)(g)7., Wis. Adm. Code, requires that the DNR evaluate:

> *The degree of controversy over the effects on the quality of the human environment.*

Oil and gas pipeline projects have become increasingly controversial in recent years, with significant opposition and protest. Examples include the Dakota Access Pipeline (completed in 2017), the Keystone XL pipeline (permit revoked in January 2021), the Enbridge Line 3 replacement project in Minnesota (completed in September 2021), the ongoing controversy and lawsuits over the Enbridge Line 5 crossing of the Straights of Mackinac, and the federal lawsuit to remove Enbridge Line 5 from the Bad River Reservation (Section 1.2.2). The Bad River Band's ongoing efforts to remove Line 5 from its tribal land are the subject of the documentary film *Bad River: A Story of Defiance* (Mazzio, 2024).

Enbridge's proposal to relocate the segment of Line 5 crossing the Bad River reservation to its proposed route is itself a source of considerable public controversary. Both the DNR and USACE's reviews of Enbridge's proposed relocation receive regular coverage in the news media. Between December 16, 2021, and April 15, 2022, the DNR received over 32,000 written comments on its Draft EIS, plus verbal testimony from over 160 individuals during a ten-hour public hearing. The USACE has received over 150,000 comments on its combined Draft Environmental Assessment, Clean Water Act Section 404(b)(1) Guidelines Evaluation, and Public Interest Review. At least 135 people registered to testify at the public hearing on that draft document.

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6 LIKELIHOOD & ANTICIPATED EFFECTS OF SPILLS

This chapter describes the likelihood and anticipated effects of accidental spills of crude oil or NGLs from Enbridge's proposed Line 5 relocation, as well as each of the three route alternatives and that portion of the existing Line 5 pipeline that would be replaced by Enbridge's proposed relocation. The chapter begins with an overview of the various pipeline safety regulations, plans, and procedures under which Line 5 operates, followed by a discussion of historical trends and probability of spills of different sizes, and concludes with a description of the impacts of such spills occurring in different locations under different conditions.

Following the public comment period on the DNR's draft EIS, Enbridge independently hired the consulting firms RPS (a Tetra Tech Company) and Det Norske Veritas (DNV) to conduct analyses of the probability, trajectory (i.e., the pathway and extent), and fate of hypothetical oil spills occurring at points along Enbridge's proposed relocation route, route alternatives, and spans of the existing Line 5 pipeline that would be replaced by those alternatives. The DNR reviewed the methods and results of these analyses in collaboration with the USGS and used the digital outputs for its own evaluation of the comparative risks and impacts from spills occurring along the different routes under different conditions. The analyses conducted by RPS and DNV are referenced throughout this chapter. For a detailed description of those analyses see Appendix AH.

6.1 Pipeline Safety & Integrity Management

The USDOT's Pipeline & Hazardous Materials Safety Administration (PHMSA) regulates the transportation of all hazardous liquids in the United States, including crude oil and NGLs. All pipeline related incidents, including spills, are reported to PHMSA and the agency makes information about these incidents available to the public. Many of the graphs and tables in this chapter were obtained from PHMSA or derived from PHMSA data and reports. While PHMSA regulates and oversees pipeline operators' plans and procedures for spill response, it is not actively engaged in these activities. In the event of an inland (i.e., non-marine) spill requiring emergency response, EPA and USGS jointly oversee spill response and post-spill remediation activities. These are carried out by the pipeline operator in concert with state and local emergency response agencies.

PHMSA has authority over pipeline construction and design but its authority does not extend to routing or approving or denying the exact location of the pipeline (Gosman et al., 2012). PHMSA requires that pipeline operators develop and implement a comprehensive integrity management program (IMP) for their pipeline facilities. Enbridge has developed IMPs for major geographic zones across Canada and the United States. Line 5 is located within the Eastern zone. Integrity threats to a pipeline include anything that would impact on the ongoing viability of a pipeline to safely perform its designed functions. Such threats include pipe exposure; failure of the pipe, pipe welds, and pipeline equipment; external corrosion; a lack of public awareness of pipelines and related facilities; and appropriate responses to leaks and general damage.

6.1.1 Integrity Management

The integrity of a pipeline over its operational lifetime depends on how well protected it is against threats that can lead to defects. The Enbridge IMP was developed to comply with the requirements of 49 C.F.R. § 195.452, which establishes standards for pipeline integrity management in high consequence areas (HCAs).

According to Enbridge, pipeline material, component, and construction quality specifications consistent with its IMP are included in all construction and maintenance contracts, and project managers conduct construction site inspections to confirm they are implemented. Enbridge proposes to use inline tools to evaluate new pipeline for compliance with specified tolerances for diameter, roundness, and straightness, and x-ray all welds in the newly constructed pipeline. During construction, Enbridge proposes to conduct hydrostatic testing of all new pipeline segments to verify they are leak free at design pressures (Section 2.6.13).

Enbridge also proposes to use cathodic protection and pipe coatings to prevent external pipe corrosion. A cathodic protection system applies a small electric current to the pipeline, inducing corrosion in a remote, sacrificial anode and inhibiting corrosion of the steel comprising the pipeline itself (Section 2.1.4.1).

According to Enbridge, a pipe with wall thicknesses of 0.750 inches would be used for railroad crossings, 0.625 inches for horizontal directional drilling and direct bore applications, and 0.500 inches for the remainder of the project (Section 2.4). All pipe would be coated with a fusion bond epoxy, with an abrasion resistant overlay applied to sections used for boring applications (Section 2.6.10).

PHMSA's integrity management standards require pipeline operators to identify locations along pipeline routes where a pipeline leak or failure could affect HCAs. Operators are also required to develop a "process for continual integrity assessment and evaluation," which is also known as a Baseline Assessment Plan (PHMSA, 2020). This requires operators to keep a closer eye on pipeline integrity in the sections of pipeline that could affect an HCA. HCA locations also inform decisions in emergency response situations. Spill response is described in Section 6.3.

The five types of HCAs required to be analyzed under PHMSA include:

- Commercially navigable waterways (CNW)
- High population areas (HPA)
- Other populated areas (OPA)
- Drinking water resources (DW)
- Ecological resource unusually sensitive areas (ESA)

HCAs are identified as either direct effect HCAs or indirect effect HCAs. Direct effect HCAs are those that fall within a five-mile collection zone of the pipeline impact area. For Enbridge's proposed pipeline reroute, Enbridge identified 17 ESAs and 48 DWs within a five-mile collection zone of the pipeline impact area. Many of the ESAs and DWs were within the 5-mile collection zone but not predicted to intersect with modeled oil spill plumes. Only three ESAs and 23 DWs were considered direct or indirect effect HCAs. Indirect HCAs are those that are downslope or downstream of the pipeline that, depending on the timeliness of the spill response, could be affected by the spill. Direct effect HCAs are those that are in the path of a liquid plume and predicted to be impacted by a spill. Table 6.1-1 shows identified HCAs in a large (greater than 8,000 bbl) spill scenario.

Table 6.1-1 High-consequence areas that would be affected in a large spill scenario.

Directly Impacted	City of Ashland – (OPA)
	1 drinking water well - (DW)
Indirectly Impacted	City of Ashland – (OPA)
	Town of Marengo – (OPA)
	City of Mellen – (OPA)
	9 drinking water wells – (DW)
	1 Agency provided – (ESA)
	Great Lakes and connecting waters – (ESA)
	Lake Superior – (CNW)

Source: Appendix AH; *RPS Oil Spill Report Appendix C -Table 5-9*

6.1.2 Mainline Block Valves

Mainline block valves are pipeline control devices that can be closed to stop the flow of oil or NGLs in case of an emergency. Enbridge plans to construct 10 new mainline block valves; seven along its proposed relocation route and three more along the existing route (Section 2.1.4.2). In the event of a spill, the valve sites on either side of the spill would be turned off, limiting the amount of oil that would be released into the environment.

To optimize valve locations, Enbridge conducts intelligent valve placement studies for new pipelines. Valve locations are identified to reduce the risk of discharge and to comply with the requirements of 49 CFR Part 195. The intelligent valve placement study considers the placement of mainline valves to reduce the potential consequences in the event of a pipeline rupture and crude oil release, and addresses waterbody crossings greater than 100 feet wide, the presence of potential HCAs, as defined by PHMSA, proximity to densely populated areas, construction limitations, pump station locations, accessibility, operational considerations, and future pipeline expansion potential. As a result of the intelligent valve placement evaluation, Enbridge would implement ten remote-operated valves for the approximately 41-mile proposed route. Enbridge reviewed placement of additional valves and determined that there would be no significant reduction in risk based on the geography, topography, and distance from HCAs. The minimum number of mainline valves is set by PHMSA. The State of Wisconsin does not have authority to require additional valves.

6.1.3 Remote Monitoring

Continuous monitoring and control of Line 5 is carried out by Enbridge personnel and systems housed in an existing control center. The control center is staffed by pipeline operators 24 hours per day and includes a computerized Supervisory Control and Data Acquisition (SCADA) system that allows operators to monitor and remotely control the pipelines and related facilities.

The SCADA system collects and displays a comprehensive set of pipeline operating data, including flows and pressures. A Pipeline Controller monitors these data to identify unexpected operational changes, such as pressure drops, that may indicate a leak. Additional sensors monitored through SCADA, such as the detection of combustible gases, pump seal failures, equipment vibration levels, leak alarms, and sump levels, can also be used by the Pipeline Controller to identify potential leaks.

Telephone lines (landlines) and satellite communications are used to exchange computerized data for pipeline monitoring and control. Enbridge also maintains an ultra-high-frequency radio system, supplemented by cellular phones, to facilitate personnel communications during operation, maintenance, and emergency activities. SCADA operations include full-time monitoring and control of the assets, direct interaction with all maintenance activities that affect system control, and emergency response including a 1-800 emergency hotline.

During operation, the pipeline would be monitored 24 hours per day using four primary methods:

- **Controller Monitoring.** The SCADA system monitors pipeline conditions. It identifies unexpected operational changes (such as pressure drops) outside normal variations that may indicate a release. The system uses additional sensors at pumping stations monitored through SCADA to identify potential leaks.

- **Computational Pipeline Monitoring.** Computational Pipeline Monitoring (CPM) systems continuously monitor changes in the calculated volume of liquids and use measurements and pipeline data to detect abnormal operating conditions (such as pressure) that are above or below preestablished limits that could indicate possible releases. The primary

CPM system would be a Material Balance System, which is a real-time model that calculates material balance and displays alarms when imbalances exceed prespecified thresholds. A secondary, statistical-based CPM system would also be used that continuously calculates the statistical probability of a release based on fluid flow and pressure measured at remote valve locations and the inlets and outlets of a pipeline to detect the location of releases.

- **Scheduled Line Balance Calculations.** These are calculations of oil inventory in operational pipelines to identify unexpected losses of pipeline contents during pipeline flow conditions that may indicate a possible release. The calculations are conducted at fixed intervals, typically every two and 24 hours, with a rolling 24-hour calculation conducted based on the two-hour interval calculations.

- **Visual Surveillance and Reports.** These are reports of oil or oil odors from scheduled aerial and ground line patrols or from third parties. Third-party reports are received through an emergency telephone line: the Emergency Pipeline Control Center, 1-800-858-5253. PHMSA requires aerial line patrols every two weeks, and additional focused aerial and ground patrols may be carried out upon review of the status of a pipeline.

Enbridge also has a public awareness program that facilitates communication with residents along pipeline routes, public officials, excavators, and emergency responders. Enbridge provides information to these parties on how to recognize, react, and report abnormal conditions or observations that could be the result of an oil release. Enbridge uses the nationwide one-call system to promote utility location awareness and help prevent pipeline excavation damage. Enbridge maintains a public awareness program that facilitates communication with residents along pipeline routes, public officials, excavators, and emergency responders. Marker signs are installed throughout the route at roadway and waterway crossings and other noticeable locations. Signs include 24-hour emergency call information.

Enbridge’s Control Center would notify local emergency responders to respond to the site of a suspected spill, based on an established protocol for addressing abnormal operating conditions. Depending on the location of a potential incident along the pipeline route, emergency response timing would typically be 60 minutes or less, but Enbridge could supplement the initial response with personnel from other Enbridge locations and contract resources as necessary.

Enbridge routinely updates the existing control center and SCADA when it adds new assets such as the proposed replacement section of Line 5 and the accompanying facilities. This system is the primary means of detecting leaks. Pressures, volumes, and line balance calculations are monitored in real time and continuously feed information to operators and CPM computers that analyze the information to identify leaks in real time. It is important to note, however, that there is always a risk of human error. In both the 2010 Kalamazoo Spill (Section 6.4.2.1) and the 2016 Saskatchewan River Spill (Section 6.4.3.4) alarms were misinterpreted resulting in a delay in shutting down the line.

A 2020 PHMSA inspection of Enbridge’s Control Room management procedures and records found that Enbridge had failed to conduct a point-to-point verification between SCADA displays and related field equipment when equipment is added or moved and when other changes that affect pipeline safety are made to field equipment or SCADA displays. PHMSA also found that Enbridge had failed to test and verify an internal communication plan to provide adequate means for manual operations of the pipeline safety, at least once each calendar year, but at intervals not to exceed 15 months.

6.1.4 Physical Monitoring

Enbridge maintains the 50-foot permanent ROW of its existing pipelines to provide access and to accommodate pipeline integrity surveys. The new permanent ROW for Enbridge's proposed project would be added to the existing ROW maintenance program. Vegetation along the permanent ROW easement would be maintained on a regular basis by removing brush and trees to prohibit the growth of woody vegetation over the pipeline for safety and pipeline integrity issues. Forest land located within temporary work areas would be restored to allow preconstruction land uses (Section 2.6.14).

Physical monitoring is conducted through line patrols. Enbridge inspects the entire Line 5 corridor periodically from the air and portions of the corridor on foot, as conditions permit, but no less frequently than the federal government requires in 49 CFR Part 195. In the event of a leak, Enbridge has the capabilities to remotely activate isolation valves that would fully shutdown Line 5 within three minutes (Enbridge, 2020h).

The corridor is currently patrolled by air by an Enbridge-employed pilot who notes unusual activity in or near the ROW, or conditions that could indicate potential crude oil releases. If abnormal conditions are noted, ground crews are immediately dispatched for further investigation. If a release is suspected, the pilot notifies the control center by radio, and the affected pipeline may be shut down pending an onsite investigation. As a supplement to the aerial patrol, Enbridge employees visually inspect the ROW from the ground in selected locations on a periodic basis. These surveillance activities provide information on possible encroachments and nearby construction activities, erosion, exposed pipe, and other potential concerns that could affect the safety and operation of the pipelines.

As described in Section 2.1.4.1, Enbridge would install a cathodic protection system to protect the relocated pipeline against external corrosion. Each calendar year, the cathodic protection systems of the existing pipelines are inspected by electronic measurements of the pipe/structure-to-soil and line currents (where possible). In addition, all elements of the cathodic protection system are inspected to ensure proper operation. Repairs and adjustments to the cathodic protection system are made either during the annual survey or during later maintenance activities.

Mainline valves and other components of the pipeline, such as tanks and pump stations, are routinely inspected. All overpressure safety devices capable of limiting, regulating, controlling, or relieving operating pressures are inspected and tested to ensure that the devices are in good mechanical condition and functioning properly.

Enbridge periodically conducts in-line (internal) inspections of its pipelines. Periodic internal inspections are required under PHMSA's regulations at 49 CFR Part 195, which requires pipeline operators to assess a pipeline's integrity over five-year intervals. There are multiple in-line inspection technologies used to detect distinct types of pipeline features. One such technology is known as a "smart pig" (Figure 6.1-1). Smart pigs are inserted into pipelines at a valve or pump station and driven down the line, either by being pulled by a cable or pushed by the flow of product. A smart pig can identify features that could compromise pipeline integrity, such as internal corrosion, dents, gouges, and cracks. Inspections using different tools may run more frequently over a five-year period to assess varying feature types. In addition, Enbridge assesses certain features via a risk-based approach that may require multiple inspection tool runs over a five-year period. Under 49 CFR Part 195, Enbridge would be required to conduct a baseline assessment prior to operation of the relocated pipeline.

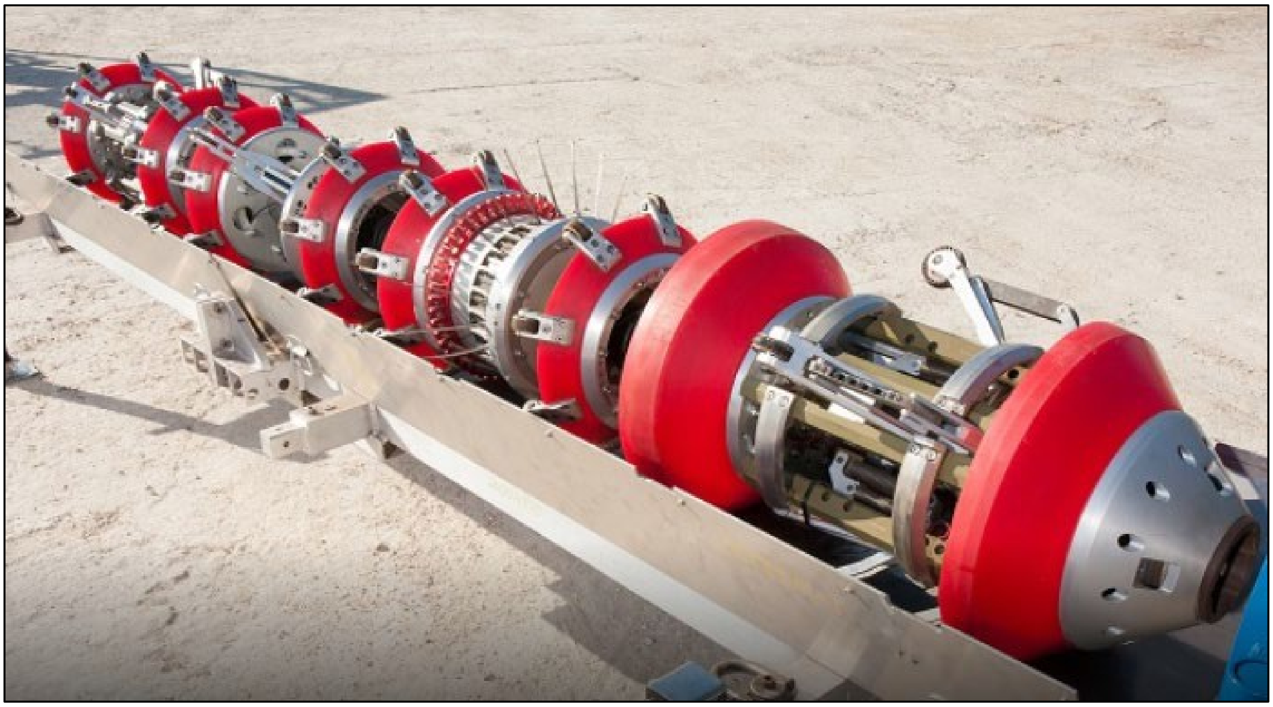


Figure 6.1-1 "Smart Pig" inline inspection device.

6.1.5 Integrity Inspections

49 CFR Part 195 requires hazardous liquid pipeline operators to conduct periodic pipeline integrity inspections, which include assessing pipeline depths of cover, current geotechnical conditions, status of corrosion control measures, and third-party activity near the ROW. PHMSA in turn requires operators to submit annual reports summarizing inspection results and any associated actions taken that could affect an HCA.

Enbridge periodically uses internal inspection tools to assess the condition of a pipeline as part of its "Digs Program." If an inspection locates a defect or feature that requires further investigation a dig may be required. This is called an Integrity Dig. The basic steps of an integrity dig are:

- Stake out dig location and strip topsoil and subsoil.
- Excavate to expose the pipe.
- Clean exposed pipe.
- Inspect the pipe.
- Perform maintenance or repair.
- Recoat the pipe.
- Backfill excavation and site cleanup and restoration.

6.2 Likelihood of Spills

While it is difficult to put a recurrence interval number to the risk of a pipeline spill at a certain location or segment of pipeline, data from PHMSA and other sources suggest that pipeline spills will continue to occur on an annual basis. Safety protocols and operational standards have greatly reduced the frequency of spills. The contingency response plans by operators and emergency response plans and teams at regional and state levels have improved the response to and outcomes of spills (Section 6.3).

Most crude oil spills occur at tank farms, but these spills are not as environmentally problematic because tank farms have berms around the tanks, called secondary contaminant areas, that are designed to contain spills. Spills that occur at tank farms, and do not impact property outside of the tank farm, are still required to be reported to PHMSA. While most spills that occur at a tank farm are easily contained without much damage to the surrounding area, occasionally, with large enough spills, these spills can breach the containment area and spill into the surrounding environment. In 2003, at the Superior tank farm in northern Wisconsin, a material failure led to a release of over 4,000 barrels of oil, some of which spilled into the nearby Nemadji River.

After a spill occurs, recovery of oil is attempted by qualified emergency response personnel. Operators are required to provide an incident report to PHMSA including the estimated quantity of spilled crude oil and the estimated quantity of oil that was recovered. From that PHMSA can calculate a third variable, which is net barrels lost. The net barrels lost is the spilled volume minus any recovered oil. According to PHMSA, recovered oil is oil that is no longer in the environment (PHMSA, 2023).

$$\text{Net Barrels Lost} = (\text{Spilled Volume} - \text{Recovered Volume})$$

The recovered volume is an estimated volume, and it includes oil that has been removed from the environment after a spill event by absorbent material, vacuum truck, bioremediation, or soil removal. For this reason, the barrels-spilled variable is more accurate in determining acute impacts on the environment and is the one that the DNR uses in this EIS. Once the oil is spilled, it immediately begins negatively impacting the environment including air quality, soils, and aquatic and terrestrial species. If the oil is then removed a few days or months later, it still has influenced the environment.

6.2.1 Likelihood by Size

For this EIS, the DNR considered the likelihood and potential effects of spills within three size categories, listed below. These were developed by RPS for its spills analysis (Appendix AH).

- Recent average release volume (RARV): 334 bbl to 1,911 bbl
- Historical accidental release volume (HARV): Any spill between 1,911 bbl to 8,517 bbl
- Full-bore rupture (FBR): greater than 8,517 bbl

RPS estimated the HARV to 334 bbl by calculating the average spill volume for all Enbridge crude oil pipelines since 1985 (Horn, 2023a). RPS estimated the RARV based on an analysis of the average release volume of all spills with any reportable size (recorded as greater than 5 gallons or greater than 0.12 bbl) from 2010 to 2019, for all of Enbridge’s liquids pipelines (Horn, 2023a). The full-bore rupture of 8,517 bbl is a site-specific estimate for Enbridge’s proposed crossing of the White River–one of two rivers for which RPS simulated the fate and transport of oil spill scenarios using the SIMAP model (Section 6.4.2.3).

Site-specific FBR volumes were estimated by Enbridge for hypothetical spill points all along its proposed Line 5 relocation route and route alternatives, as well the existing Line 5 pipeline. The volumes were based on the distance along the pipeline from each spill location to the nearest mainline valves and the terrain between them. It assumes that pipeline operators at the Enbridge control center would identify that a rupture had occurred within 13 minutes of the event and that they would then initiate pipeline shutdown and full valve closure in the affected section of pipeline. The volume of the spill would include the gravitational drain down from the section between the valves after they are closed. Hence, the exact volume varies from location to location. For example, the estimated FBR volume for Enbridge's proposed crossing of the Bad River was 9,874 bbl, which is higher than the White River. Figure 6.2-1 shows the estimated FBR spill volumes for points along Enbridge's proposed relocation route, route alternatives, and existing Line 5 pipeline.

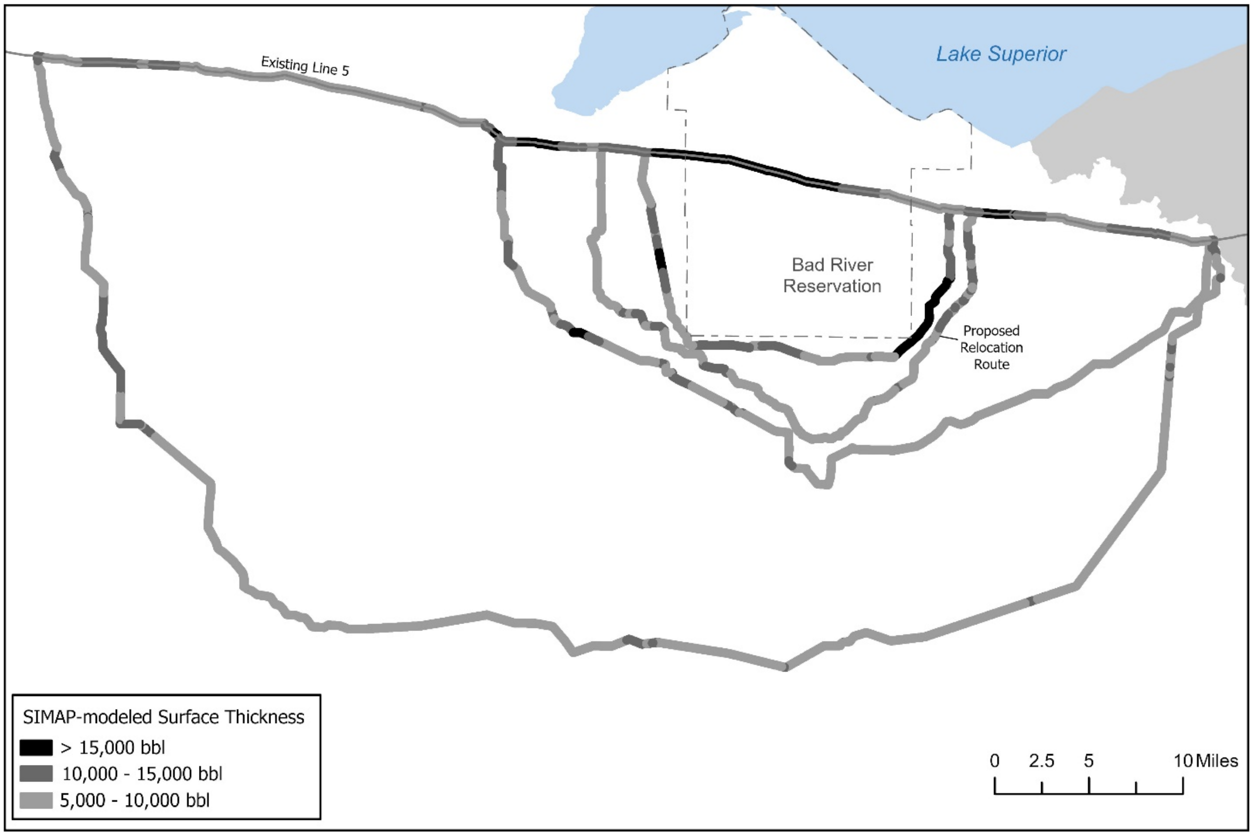


Figure 6.2-1 Estimated full-bore rupture spill volumes along Enbridge's proposed relocation route, route alternatives, and the existing Line 5 pipeline.
Data source: Enbridge

As indicated in Figure 6.2-1, FBR volumes for the existing Line 5 pipeline that currently crosses the Bad River Reservation are much larger than the projected release volumes that could occur on the proposed relocation route–reaching as high as 21,974 bbl. This is because Enbridge's proposed relocation would have mainline valves placed more frequently along the pipeline then the existing line. When looking at spill modeling done on the existing line, a greater amount of oil would be released into the rivers in those model scenarios. For the proposed route, there is expected to be less oil released from a farther distance away from Lake Superior which is why less oil is predicted to impact Lake Superior in the modeling conducted for the Enbridge's proposed Line 5 relocation route than the modeling conducted for the existing Line 5.

Enbridge's other consultant on the spill modeling project, DNV, estimated the probability of a spill occurring along Enbridge's proposed Line 5 relocation route and route alternatives. The probability of failure (POF) is expressed as the number of spills that are likely to occur per year per mile of pipeline. Because the POFs were calculated based on historic date, it was assumed that new safety standards have improved pipeline operation such that the use of historic data would provide a higher POF then the actual POF for this project. According to American Petroleum Institute, in 2022, liquid pipeline incidents were down 16 percent and incidents within HCAs, were down 39 percent (API, 2023). As a result of this lower rate of incidents in combination with British Standards Institution Code of Practice for Steel Pipelines guidelines, DNV developed a mitigation reduction factor based on pipeline enhancements such as better pipeline construction materials, thicker pipeline walls, and an increased depth of coverage over the buried pipeline. The mitigation reduction factor is a factor of 10, resulting in one order of magnitude of reduction in estimate POF (Appendix AH). DNV-estimated probabilities of failure are shown in Table 6.2-1. Removing DNV's mitigation reduction factor would move the decimal point one digit to the right. To make these estimates easier for the public and decision-makers to understand, the DNR extrapolated them to a 20-year period over 40 miles of pipeline—the approximate length of Enbridge's proposed relocation project. The resulting long-term probabilities remain low, just .00317 spills of any size over 20 years for the proposed Line 5 relocation route.

Table 6.2-1 Probability of spills as estimated by DNV.

	Proposed Route	RA-01	RA-02	RA-03
Spills per year per mile of pipeline				
Any spill size	0.0000040	0.0000102	0.0000089	0.0000040
RARV (334 - 1,911 bbl)	0.0000007	0.0000017	0.0000015	0.0000007
HARV (1,911 – 8,517 bbl)	0.0000003	0.0000007	0.0000006	0.0000003
FBR (>8,517 bbl)	0.0000001	0.0000002	0.0000001	0.0000001
Spills over a 20-year period per 40 miles of pipeline				
Any spill size	0.00317	0.00054	0.00021	0.00317
RARV (334 - 1,911 barrels)	0.00816	0.00139	0.00055	0.00013
HARV (1,911 - 8,517 barrels)	0.00714	0.00122	0.00048	0.00011
FBR (> 8,517 barrels)	0.00308	0.00053	0.00021	0.00005

Source: DNV (Appendix AH)

It should be noted that while DNV used a mitigation reduction factor of 10 it did not adjust its POF calculations for areas identified as geohazards (Section 5.6.6). DNV's assumption being that the sites listed in Table 5.6-14 and Table 5.6-15 would be fully mitigated. As discussed in Section 6.2.2.6, geohazards and the potential for pipeline exposure are a recognized risk to pipelines. Further, much of the area through which Enbridge's proposed relocation route would traverse is vulnerable to long-term fluvial erosion (Section 5.6.7).

The DNR conducted its own analysis of spill risk based on PHMSA data on oil pipeline spills for the 13-year period between 2010 and 2023 for Wisconsin and its four surrounding states: Minnesota, Michigan, Iowa, and Illinois. During that period there were 130 reported spills in the region, including three within the RARV category (334 to 1,911 bbl), two in the HARV category (1,911 to 8,517 bbl), and one in the FBR category (greater than 8,517 bbl). The one FBR spill during that period was the Marshall, Michigan, spill of 2010, which is described in Section 6.4.3.1. Figure 6.2-2 shows a map of all pipeline spills that occurred in Wisconsin and neighboring states between 2003 and 2022.

Table 6.2-2 shows the number and rate of spills in these states from 2010 to 2023. The rate of spills is the number of spills per year per mile, which enables comparison with the FOF estimates made by DNV and the number of spills extrapolated to a 20-year period over 40 miles. These rates are higher than the probabilities calculated by DNV, but they are still very small. For example, the historic rate of spills of any size in the region between 2010 and 2013 was such that less it translates to less than one spill of any size over a given 40-mile stretch of pipeline over 20 years.

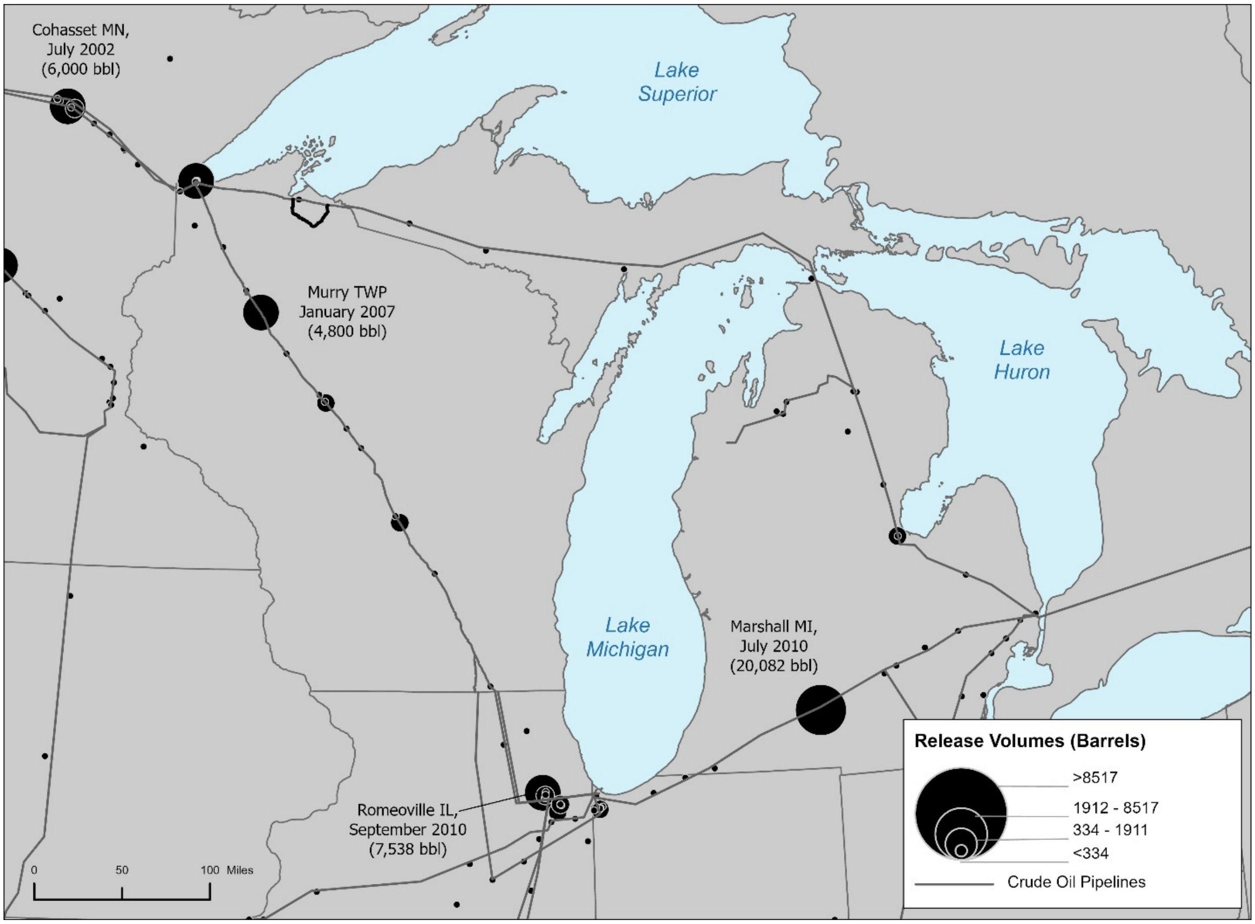


Figure 6.2-2 Historical spills by release volume, 2003-2022.
Source: PHMSA

Table 6.2-2 Rate of spills in Wisconsin, Minnesota, Michigan, Iowa, and Illinois, 2010-2023

	Total Number of Oil Spills	Number of Spills per year per mile	Number of spills extrapolated to 20 years over 40 miles
Any spill size	130	0.000088	0.071
RARV (334 to 1,911 barrels)	3	0.0000025	0.0020
HARV (1,911 to 8,517 barrels)	2	0.0000014	0.0011
FBR (greater than 8,517 barrels)	1	0.00000084	0.00068

Source: PHMSA

Table 6.2-3 shows the average number of crude incidents per year nationwide and in Wisconsin. These averages suggest that up to three incidents could occur per year in Wisconsin totaling 653 barrels spilled and costing an estimated $827,720 in remediation costs. This calculation is based on the historical data from which shows a total of 59 incidents in Wisconsin from 2003 to 2022. Thes 59 incidents include all reportable incidents related to crude oil including those that occurred from pipelines, tank farms and underground storage facilities. Due to the improvements of safety standards, materials, and technology spills are occurring less frequently therefore using historical data may not be accurate in predicting the future spills.

Table 6.2-3 Average annual crude oil pipeline incidents, 2003-2022.

	Annual number of incidents	Annual number of barrels spilled	Annual number of barrels lost (not recovered)	Annual total reported cost
Nationwide	181	37,015	9,397	$157,090,677
Wisconsin	3	653	141	$827,720

Source: PHMSA

6.2.2 Risk Factors

Pipelines can suffer different modes of failure resulting in spills. Risk factors that affect pipelines include, but are not limited to the following:

- External corrosion
- Internal corrosion
- Abrasion
- Pipe damage and deformation
- Cracking and fatigue of the pipe
- Exposure (loss of cover)
- Operational errors (hydraulic pressures)
- Intentional and unintentional damage by human
- Geological hazards (ground movement, washouts and flooding)

In Wisconsin over the past 18 years, equipment and material failure have been the leading cause of spills (Figure 6.2-3). External and internal corrosion of the pipeline were also common causes of pipeline spills.

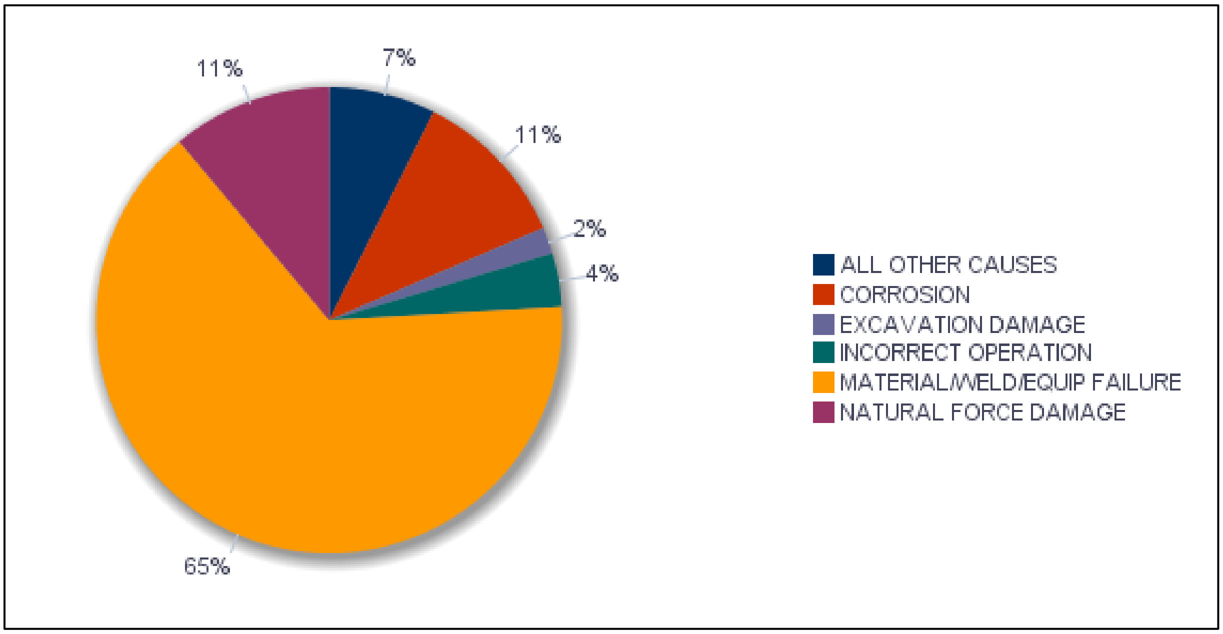


Figure 6.2-3 Causes of Wisconsin pipeline crude oil incidents, 20-year average (2004-2023).
Source: PHMSA

6.2.2.1 Material/Human Failure

Many pipeline failures occur due to material failure and/or human failure. Excavation damage is an example of a common human failure that occurs, while digging in a location near an active pipeline. Other human errors include the incorrect operation during a planned shut down or the incorrect installation of a new pipeline fitting.

6.2.2.2 Corrosion

Corrosion is “a chemical reaction between the environment and the pipeline steel that reduces the pipe wall thickness” (Enbridge, 2021d). The ongoing computational pipeline monitoring that occurs on the pipeline is designed to alert operators of stress points or areas of concern along the pipeline. Once areas of concern are identified, a preventative maintenance dig might be completed which includes exposing the pipeline to provide a visual inspection of the corrosion and determine if repairs or recoating are necessary (Enbridge, 2021d).

External corrosion can occur to the pipe if mitigations are not put in place and continually monitored. According to information available on PHMSA’s website, all new pipelines are now made of either plastic or specially coated steel. The coating on the steel pipelines combats pipeline corrosion by minimizing the interaction between soil and the steel pipeline (Section 2.6.10). The differences in soil type along the pipeline and the characteristics of the soil including moisture, aeration, and soil content influence the corrosivity of the environment (Baker, 2008) Clay soils are more likely to pull the coating away from the pipe while rocky soils are more likes to dent or puncture the coating reducing the cathodic protections of the pipe in those locations (Baker, 2008). Additionally, Enbridge would install a cathodic protection system along the length of the pipeline to prevent external corrosion (Section 2.1.4.1).

Internal corrosion is also problematic primarily due to water entering the inside of the pipeline and causing corrosion. There are many methods to clean the inside of a pipeline including adding inhibitors to the oil to reduce the rate of corrosion or using cleaning pigs to ensure the pipeline is completely clean and there is no buildup of solids or material within the pipeline that could cause corrosion.

6.2.2.3 Pinhole Leaks

A pinhole leak is a small leak that occurs in a pipeline either on the main line or at a connection point. Although leak detection systems would be in place, some leaks might not be detected by the system for an extended period. Pinhole leaks often do not result in a notable pressure drop and could be undetected for days or a few weeks if the release volume rate were small and below detectable levels. Although the total volume of a release from a pinhole leak could be relatively large (e.g., up to a substantive spill size), in most cases the oil would likely remain within or near the pipeline trench where it could be contained and cleaned up after discovery. Detection would likely occur through visual or olfactory identification, either by regular pipeline aerial inspections, ground patrols, or landowner or citizen observation, in most cases before the release of a substantive volume of oil to environmental features on the land surface. The discovery of unexplained contaminated soil near a pipeline also prompts a pipeline shutdown, followed by excavation of the pipe and visual inspection. A pinhole leak can be repaired by installing a sleeve around the leak area and welding the sleeve in place.

6.2.2.4 Pipeline Age

The effect that pipeline age has on the risk of spills is unclear. Using data obtained from PHSMA, the Pipeline Safety Trust reported that pipelines installed in the 2010s (the newest age-class analyzed) had the highest rate of failures per mile of pipeline, followed by pipelines installed in the 1920s (the oldest class). Some types of older pipe, such as cast iron, and pipes that were welded using low frequency electric resistance welding are known to be at greater risk of failure (PS Trust, Safe Pipelines – Spring 2015).

6.2.2.5 Pipe Fatigue

Pipe fatigue results from pressure cycling on the pipe. When internal pressures increase and decrease on the pipe due to operational requirements, this induces stress into the pipe material and may result in a fatigue crack. Inline inspection of a pipeline inspects for fatigue or stress cracking and is part of standard pipeline inspections.

6.2.2.6 Pipeline Exposure from Geohazards & Fluvial Erosion

Pipeline exposure (the loss of cover) is a common and dangerous scenario for pipeline operators. As discussed in Section 5.6.6, Enbridge identified 49 geohazards, including 22 hydrotechnical geohazards along its proposed Line 5 relocation route (Table 5.6-14). These are illustrated in Figure 2.1-9 and shown in greater detail in Figure 5.6-11. (Table 5.6-14 and Table 5.6-15) Migrating stream channels, downcutting, landslides, gullies, and various other forms of fluvial erosion can increase the risk of pipeline exposure.

6.2.2.7 Migrating Stream Channels

When a stream migrates (Section 5.6.7.4), a section of pipeline that is not buried as deep as the pipeline was during the original installation under the stream, may become exposed. This exposure places that section of pipeline at greater risk to damage and failure by external influences. An exposed pipe is more likely to be affected by natural events and human contact.

6.2.2.8 Downcutting

Multiple waterways within the project area have a history of downcutting, which can reduce or remove pipeline cover. In portions of the project area, downcutting has been exacerbated by extreme flood events. Materials provided by Enbridge state that the company conducted evaluations of the waterway channel boundaries and crossings associated with the proposed Line 5 relocation project to assess the potential for hydrotechnical geohazards (Table 5.6-14) and determine appropriate depths for pipeline cover. Downcutting can remove the cover over the pipe. This has been exacerbated by extreme flood events in portions of the project area (2016 and other events).

6.2.2.9 Ravines

Like migrating stream channels, pipelines can become exposed in ravines as the ravine is down cut during rain or other erosional events (Figure 5.6-27). The pipeline then becomes suspended off the bottom of the ravine and is at risk. Pipeline operators are required to monitor and repair these exposures, but doing so requires project planning, permitting, and coordination of shutting down the pipeline for the required maintenance.

6.2.2.10 Area Hydrology

The Lake Superior and Bad River watersheds, especially in the clay plain region, have flashy flow regimes. Flashy flows are defined by a rapid rise in water levels following a rain event. This is caused by the impermeable soils that dominate the watershed, i.e. clay soils. Streams in the project area are flashy in nature, similar to the Nemadji River in Douglas County, Wisconsin. A 2017 USGS study following the 2016 floods in the region confirmed the flood event that occurred on July 11, 2016 had an Annual Exceedance Probability (AEP) of < 0.002 (slightly less than a 500yr storm) (USGS, 2017). Flashy streams typically suffer from quicker downcutting and more meandering courses (DNR, 2010)(Wisconsin Watersheds). During large rain events a chute may develop between two meanders (Section 5.6.7.4). A chute is when a stream or river creates a shortcut between meanders, essentially straightening the flow path. If a chute were to develop during a large rain event the pipeline is at greater risk of exposure, unless the pipeline is buried at sufficient depth below the stream beyond the loops of a meander. By installing pipelines deeper beneath the streams and carrying that depth beyond the banks of the meanders the risk of exposure is reduced.

6.2.2.11 Knickpoints

Knickpoints are part of a river or channel where an abrupt change in slope occurs (Section 5.6.7.3). Waterfalls are an example of knickpoints. Knickpoints form from the influence of tectonics, climate, and lithology. Lithology is the physical description of the rock unit or area. Impact to a pipeline from a knickpoint would be unlikely unless the pipeline were located relatively near a knickpoint. Knickpoints slowly move over time. This is best exampled as Niagara Falls is slowly migrating upstream as the face of the knickpoint is being eroded away. Knickpoint migration is slow and typically measured in inches per year. The waterfalls at Copper Falls State Park are located over two miles away from Enbridge’s proposed pipeline relocation route, and the timeframe for the migration of those waterfalls to the pipeline would most likely be measured in centuries.

Other knickpoints, such as culvert crossings, have the potential to move more quickly. During flood events a roadway crossing can fail and a rapid change in stream bed elevation can occur locally resulting from the culvert failure. If a pipeline is located in relatively close proximity to a knickpoint, such as a culvert crossing, there is an increased risk of exposure and damage during large rain events. Knickpoints are a form of geohazard. Geohazards are discussed in more detail in Section 5.6.6.

6.2.2.12 Flooding & Storm Events

Flooding has been a part of the landscape in northern Wisconsin for decades. The landscape around the Bad River within Copper Falls State Park changed considerably from major floods that occurred in 1941, 1946, 1992, 2016, and 2018. The rock in the area is a conglomerate of different types of sandstone, granite, and lava. Due to this mix, some of the areas around Copper Falls have been unstable, allowing for sluffing and carving away of the rock. Figure 6.2-4 shows Copper Falls today compared to 1901.

Figure 6.2-4 Copper Falls over time: 1901 (top), 2021 (bottom).
Source: DNR

On the Bad River Reservation, the town of Odanah was relocated approximately 30 years ago from its original site along the Bad River to its current site north of U.S. Highway 2 due to almost yearly flood events (D. Wiggins, Jr., pers. Comm.). Within the last five years, the confluence between the Bad River and the White River moved upriver approximately one-half mile due to changes in the river channels over the years. Some of the recent floods have been more severe with storms in 2012, 2016, and 2018 bringing between 10 and 16 inches of rain over the course of the storm in Iron County and in Ashland County causing widespread flooding, damage to infrastructure, and damages to the landscape (Davies, 2016). Rainfall events of this extreme nature increase the chance of pipeline exposure and damage. Any spills that may occur could be complicated by rain events. The high flow rates seen in the region's flashy streams increase the risk of hazardous material being quickly swept downstream, making cleanup and containment more difficult and increasing the risk of downstream ecosystems to contamination. Because the area is prone to frequent flooding, it is important to considered how an oil spill during high flow and overbank conditions might be able to spread out and effect the landscape. Figure 6.2-5 shows the extent of flooding during the July 11, 2016, event.

Figure 6.2-5 Flood conditions along the Bad River in 2016. Site of Old Odanah.
Source: (Davies, 2016)

6.2.2.13 Flood Debris Damage to Exposed Pipes

Exposed pipelines within streams and rivers have a greater risk of damage. The clay plain region creates streams with flashy flow regimes (Section 5.6). A 2017 USGS study following the 2016 floods in the region confirmed the flood event that occurred that July had an annual exceedance probability of greater than 0.002 (slightly less than a 500-year storm) (USGS, 2017). Flashy streams, when combined with extreme rainfall events, quickly erode at the banks, which releases debris such as trees and boulders downstream. This debris flow is a hazard to exposed pipelines. Exposed pipelines are at risk of damage due to impact and abrasion.

6.2.2.14 Potential Project Construction Incidents

Construction-related spills could include releases of small quantities of refined products (e.g., gasoline, diesel, and lubricating and hydraulic fluids). These releases would be subject to federal and state reporting requirements and would typically result from vehicle and construction equipment fueling and maintenance. Refined product releases could also result from accidents (e.g., tank truck rollover); excess fuel or lubricants accidentally released during vehicle, equipment, or machinery maintenance; and incorrect operation of equipment or fueling procedures.

Hydrostatic testing of the pipelines prior to operation would not result in release of oil to the environment as the water used in the testing does not contain oil. Also, the discharged hydrostatic test water would be required to meet conditions of the DNR’s WPDES General Permit for Hydrostatic Test Water or Water Supply System Water under (Permit No. WI-0057681-4).

In the event of a spill of refined product or crude oil during construction, the contractor’s Spill Coordinator would be responsible for reporting the spill, mobilizing containment and cleanup measures, and coordinating with emergency response contractors to ensure that actions are consistent with Enbridge’s EPP

(Appendix D). The Spill Coordinator would mobilize onsite personnel, equipment, and materials for containment and/or cleanup commensurate with the extent of the spill, request additional assistance if needed, and assist the emergency response contractor and monitor containment procedures to ensure that the actions are consistent with the procedures defined in the EPP. Construction spills would likely be relatively small and contained with onsite equipment and personnel.

In the event of a larger spill, the onsite response equipment and personnel would be supplemented, as required, by equipment and response assistance from an emergency response contractor. Enbridge would report spills to appropriate federal, state, and local agencies as soon as possible and consistent with applicable regulatory requirements, and initiate cleanup measures according to all federal, state, and local regulations.

Potential treatment and disposal facilities for contaminated materials, petroleum products, and other construction-related wastes is provided for in Enbridge's EPP (Appendix D). In Wisconsin, facilities that treat, store, or dispose of hazardous waste must be licensed by the DNR. Recyclable wastes, such as motor oil, could be recycled where an established program is available. Grease or oily rags would be disposed of in accordance with state requirements. According to Enbridge, all contaminated soils, absorbent materials, and other wastes would be disposed of in accordance with all applicable state and federal regulations, and only licensed carriers would be used to transport contaminated material from the site to a disposal facility. If it is necessary to temporarily store excavated soils onsite, these materials would be placed on and covered by plastic sheeting (Appendix D).

6.2.3 Nationwide Trends

As of 2022, there were 84,518 miles of crude oil pipeline in the United States. Oil pipeline mileage in the United States increased significantly between 2007 and 2020 (Figure 6.2-6). Despite this, the number of pipeline related incidents has been relatively stable over the past 20 years, with the most incidents occurring between 2013 and 2018 (Figure 6.2-7). The incidents reported in that figure include all crude oil incidents from pipelines, as well as underground storage facilities and tank farms. They do not include incidents from refined petroleum (gasoline, diesel etc.), high volatile liquids (propane, ethane etc.), carbon dioxide, or biofuels.

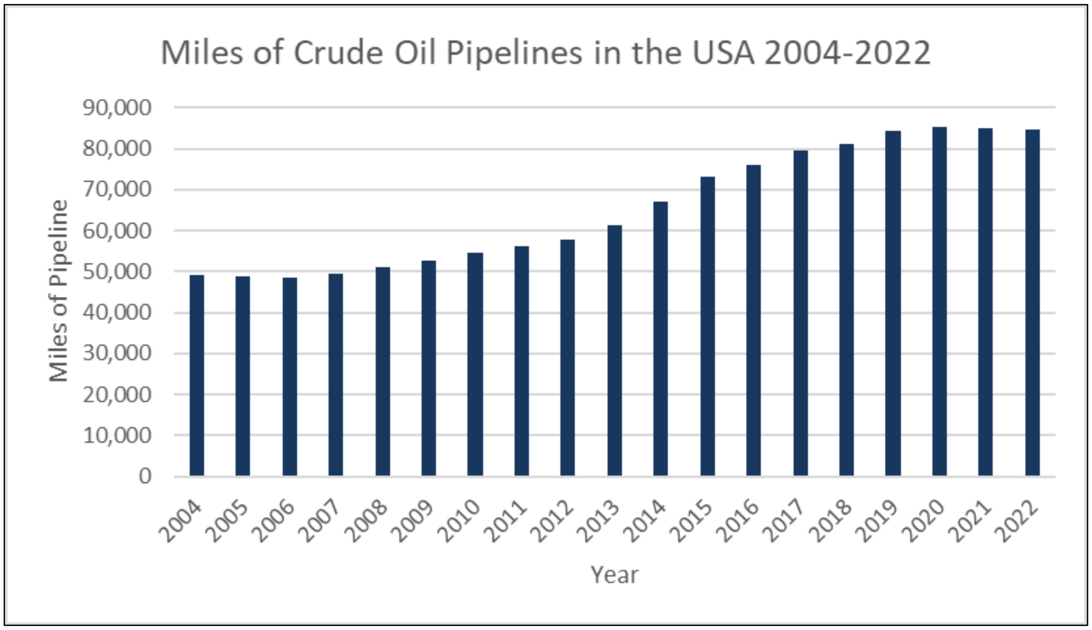


Figure 6.2-6 PHSMA Annual Report Mileage Summary Statistics.

Source: PHMSA

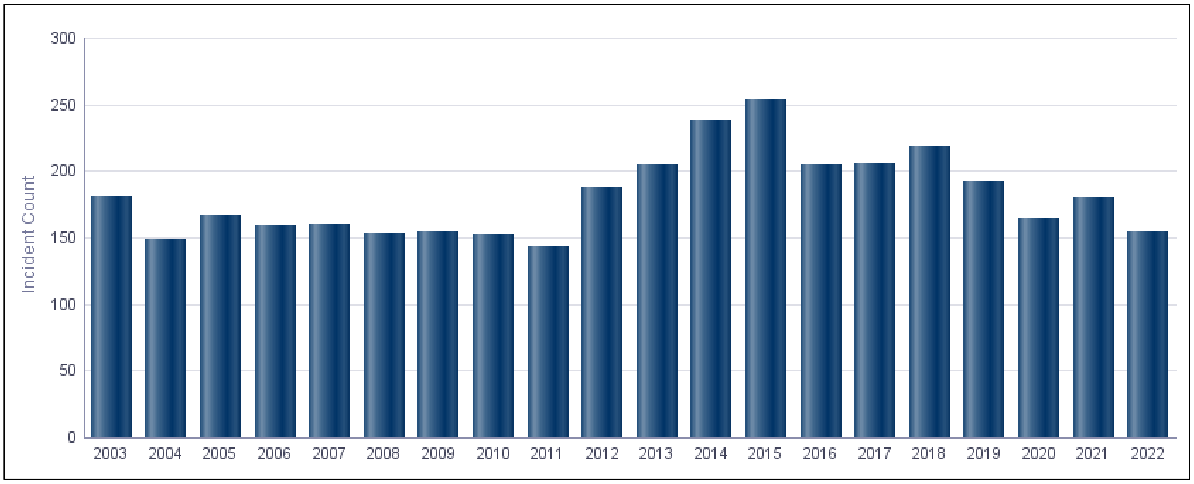


Figure 6.2-7 All reported pipeline incidents for crude oil nationwide, 2003- 2022.
Source: PHMSA

The decrease in pipeline spills is primarily due to an increase in safety measures and regulations related to pipeline operations. Some examples of increased safety measures include technology advances in leak detection systems, including computational pipeline monitoring, and more protective coatings to combat corrosion. While crude oil related incidents have stayed relatively constant, the number of barrels spilled has decreased over the past 20 years (Figure 6.2-8). Technology advancements have been able to detect spills sooner allowing operators to limit the quantity of released oil in most spills. However, catastrophic accidents and large-scale spills continue to be a concern. According to PHMSA's 20-year average data trends, there are an average of 181 pipeline related incidents involving crude oil nationwide every year resulting in an average of 37,015 barrels spilled each year nationwide. According to the most recent PHSMA data from 2022, there were 84,512 miles of crude oil pipelines nationwide in 2022 and there were 1194.3 miles of crude oil pipelines in Wisconsin.

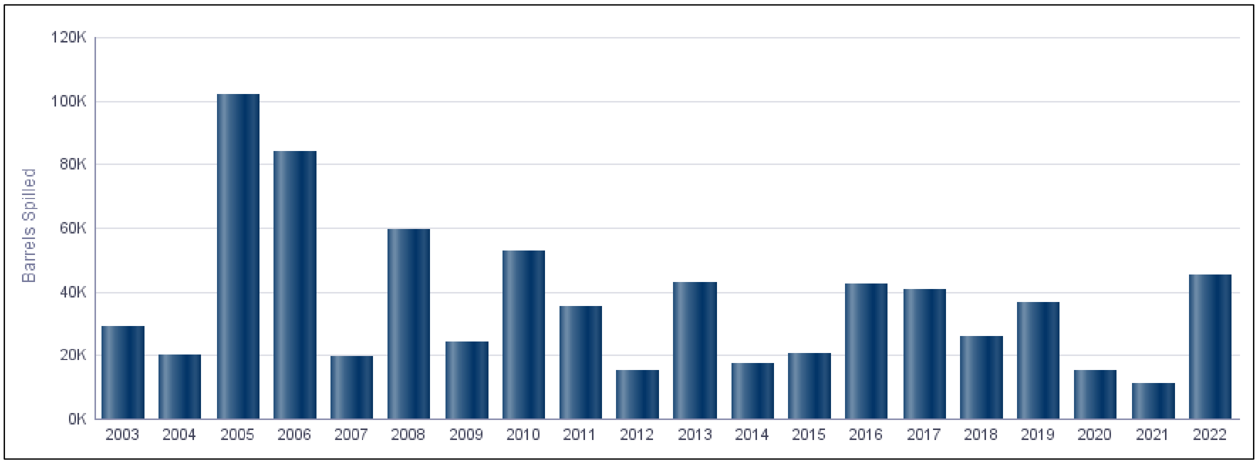


Figure 6.2-8 All reported pipeline incidents: barrels of crude oil spilled nationwide, 2003-2022.
Source: PHMSA

Most pipeline related incidents include some amount of spilled oil but not all of them, and the majority of spills occur in tank farms or areas where the oil can be more easily contained.

6.2.4 Regional Trends

Table 6.2-4 highlights the major high-volume spills that have occurred in the states surrounding Wisconsin (Minnesota, Illinois, and Michigan) over the past 20 years. Figure 6.2-2 shows the position and size of crude oil spills in the Great Lakes region since 2002.

Table 6.2-4 Spills over 1,000 barrels in the past 20 years in Minnesota, Illinois, and Michigan (not including spills that occurred in tank farms).

Date	Location	Spill volume (barrels)	Description
March 11, 2022	Edwardsville, Illinois	3,500	Rupture occurred downstream of Roxana station where pipeline runs adjacent to Cahokia creek. The National Transportation Safety Board determines that the probable cause of crude oil pipeline rupture was an overstress fracture of a girth weld from external loads caused by slope instability
March 3, 2012	New Lenox, Illinois	1,500	A drop in pressure occurred in line 64 and line 14. Leak occurred from a car collision that sheared off a 4” pipeline connection causing the release of crude oil and a fire.
December 14, 2010	Romeoville, Illinois	1,760	Leak occurred due to a high current arc discharging energy from the pipe wall to the ground after powerlines fell in the vicinity of line 257 one day prior to the leak detection. Local firefighters responding to the downed powerlines found actively arching powerlines. A day later, the fire crew identified crude oil on the ground and alerted the control center at which point the pipeline was shutdown. Oil spilled in suburban area.
September 9, 2010	Romeoville, Illinois	7,538	Edmonton control center received a call from the Romeoville Fire Department stating that crude oil was visible on the ground near 719 Parkwood Ave in Romeoville IL. The control center shut down lines 6A, 14, 13 and 61 to determine the source of the leak and Enbridge staff was immediately dispatched to the area. Oil from the spill migrated to the storm water and septic sewer systems and reached a storm water retention pond and a water treatment plant. Emergency personnel advised 470 people to vacate the area during initial phases of response. Probable cause of the release was erosion caused by a leaking water pipe 5” below our pipeline.
July 25, 2010	Marshall, Michigan	20,082	Mainline pipeline rupture of line 6B that resulted in heavy diluted bitumen oil releasing into the Kalamazoo River. The river was in a flood state at the time of the release causing oil to deposit high on the shorelines and reaching 38 miles downstream to Marrow Lake. Cleanup of this spill took over 4 years to complete.

Date	Location	Spill volume (barrels)	Description
December 4, 2009	Staples, Minnesota	5,000	A leak occurred in an open ditch near Staples MN while performing an in-service pipe replacement. A connection failure occurred on the pipe and investigation into the release identified that a gasket lacked adequate compression after replacement. 2414 barrels recovered.
August 10, 2008	Golden Gate, Illinois	5,790	A sudden drop in pressure indicated a release and initiated the shutdown of the pipeline. Cause of the failure was material failure due to a cracked stem.
March 23, 2007	Minnesota	1,600	Frost heaves suspected to have caused cracked connection of pipe to Tank 6. On-duty operator smelled petroleum during rounds and initiated emergency response.
June 27, 2006	Little Falls, Minnesota	3,200	Pipeline rupture due to prior mechanical damage to the underground pipeline. 1750 barrels recovered.
February 19, 2004	Grand Rapids, Minnesota	1,003	Oil contaminated soil was discovered by an excavation crew near the pipeline. The leak was determined to be a slow weeping crack in Line 2. Upon excavation a rock was determined to be the root cause of the leak.
July 4, 2002	Cohasset, Minnesota	6,000	Line 4 at MP 1002 experienced a pipeline rupture in a remote wetland area of Minnesota. To minimize the impact to the surrounding environment, a controlled burn of the released crude oil was executed in coordination with company, local and state officials. 2574 barrels were recovered.

Source: PHMSA

6.2.5 Historical Spills in Wisconsin

There are four pipelines that carry crude oil in Wisconsin. Three of the pipelines run diagonally across the state (Line 6, Line 14, and Line 61) and share the same ROW carrying crude oil from Superior, Wisconsin, to Chicago, Illinois. The fourth pipeline is Line 5. All crude pipelines in Wisconsin are operated by Enbridge. According to Enbridge’s website, Line 5 is the oldest crude oil pipeline in Wisconsin and was installed in 1953. Line 6 was installed in 1969 and carries crude oil from the Superior Terminal Tank Farm to Chicago along with Line 14 which was constructed in 1998 and Line 61 constructed in 2009.

A total of 59 incidents related to pipeline operation have occurred over the past 20 years (2003-2022) in Wisconsin (Figure 6.2-9). Forty-seven of these have resulted in the release of crude oil, totaling a spill amount of 13,066 barrels. The largest crude oil spill that occurred in Wisconsin over the past 20 years was in 2007 and resulted in the release of 6,302 barrels of oil (Figure 6.2-11, Figure 6.2-10). This incident was due to excavation damage while working within the ROW and resulted in a punctured pipeline.

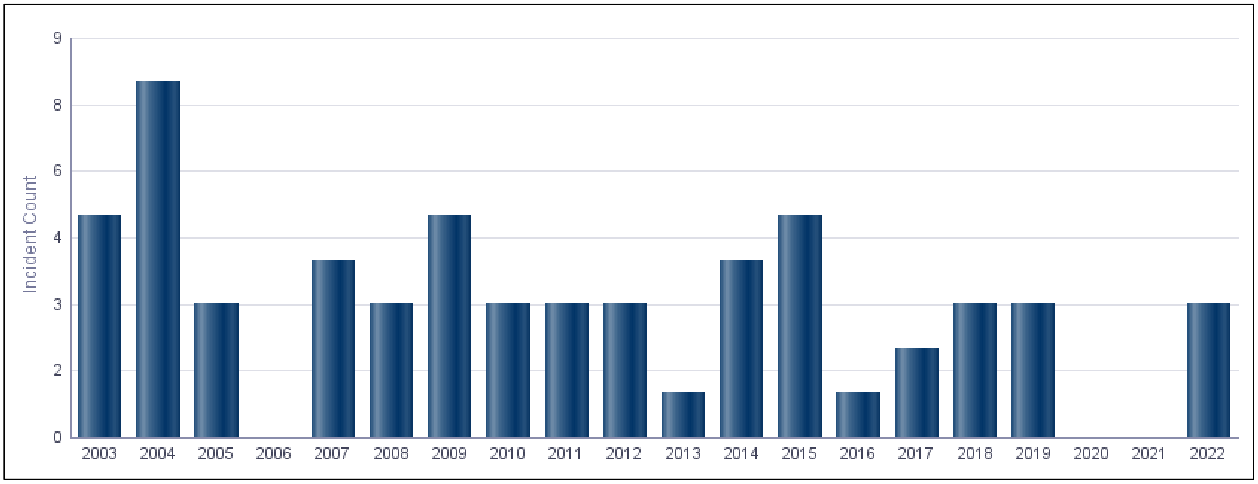
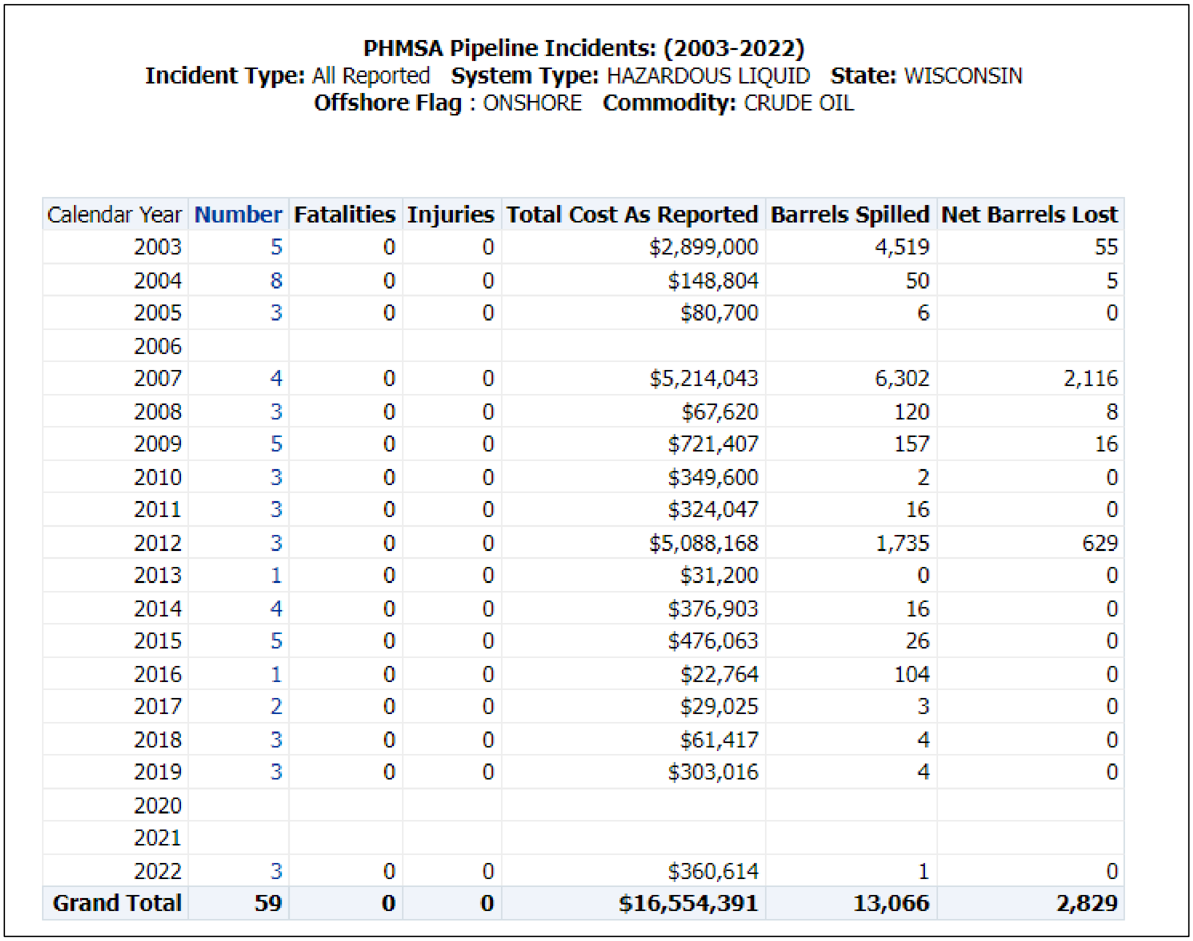


Figure 6.2-9 All reported crude oil pipeline incidents in Wisconsin, 2003-2022.
Source: PHMSA



PHMSA Pipeline Incidents: (2003-2022)
Incident Type: All Reported **System Type:** HAZARDOUS LIQUID **State:** WISCONSIN
Offshore Flag : ONSHORE **Commodity:** CRUDE OIL

Calendar Year	Number	Fatalities	Injuries	Total Cost As Reported	Barrels Spilled	Net Barrels Lost
2003	5	0	0	$2,899,000	4,519	55
2004	8	0	0	$148,804	50	5
2005	3	0	0	$80,700	6	0
2006						
2007	4	0	0	$5,214,043	6,302	2,116
2008	3	0	0	$67,620	120	8
2009	5	0	0	$721,407	157	16
2010	3	0	0	$349,600	2	0
2011	3	0	0	$324,047	16	0
2012	3	0	0	$5,088,168	1,735	629
2013	1	0	0	$31,200	0	0
2014	4	0	0	$376,903	16	0
2015	5	0	0	$476,063	26	0
2016	1	0	0	$22,764	104	0
2017	2	0	0	$29,025	3	0
2018	3	0	0	$61,417	4	0
2019	3	0	0	$303,016	4	0
2020						
2021						
2022	3	0	0	$360,614	1	0
Grand Total	**59**	**0**	**0**	**$16,554,391**	**13,066**	**2,829**

Figure 6.2-10 PHSMA data for all reported crude oil pipeline incidents in Wisconsin, 2003-2022.

Wisconsin had a 40 percent increase in the number of miles of crude oil pipeline over the past 15 years. Line 61 was constructed in 2009 which increased the number of miles of crude oil being transported in Wisconsin by approximately 380 miles, bringing the total millage for the state up to 1,194.3.

Over the past 20 years there have been seven crude oil spills in Wisconsin that resulted in a release of more than 50 barrels of oil, four of which were over 1,000 barrels and are highlighted in Table 6.2-5). The additional 56 spills that have occurred over the past 20 year were small spills ranging from one to 50 barrels, with most being not more than one or two barrels.

Table 6.2-5 Notable Wisconsin crude oil spills in the past 20 years.

Date	Location	Spill volume (barrels)	Description
July 1, 2012	Grand Marsh WI	1,729	Line 14 spilled into a field. Enbridge detected a drop in pressure to the line and shut off the line (rupture). According to PHSMA data, 1,004 barrels were recovered.
February 1, 2007	Rusk County WI	4,800	Crude oil spill occurred during construction operations to line 14 (excavation damage). According to PHSMA, 4,372 barrels were recovered.
January 1, 2007	Clark County WI	1,500	Crude oil spill into a farmer’s field due to equipment failure of line 14. Low pressure noticed and the pipeline was immediately shut down (rupture). According to PHMSA data,1,450 barrels were recovered.
January 1, 2003	Superior WI	4,500	Crude oil spill at Superior terminal during end cap failure during tank switch. Much of the oil was contained in Enbridge’s containment areas and retention ponds but some oil spilled into the Nemadji River. According to PHMSA 4,450 barrels were recovered.

Source: PHMSA

The number of barrels spilled over the past 20 years is highlighted in Figure 6.2-11, with 2003, 2007, and 2012 being years that resulted in the highest volumes of spilled crude oil in Wisconsin. The peak in 2007 is the highest because two spills occurred in that year. According to PHMSA data, the 20-year average for crude oil spills in Wisconsin is three spills every 20 years of a volume of 653 bbl.

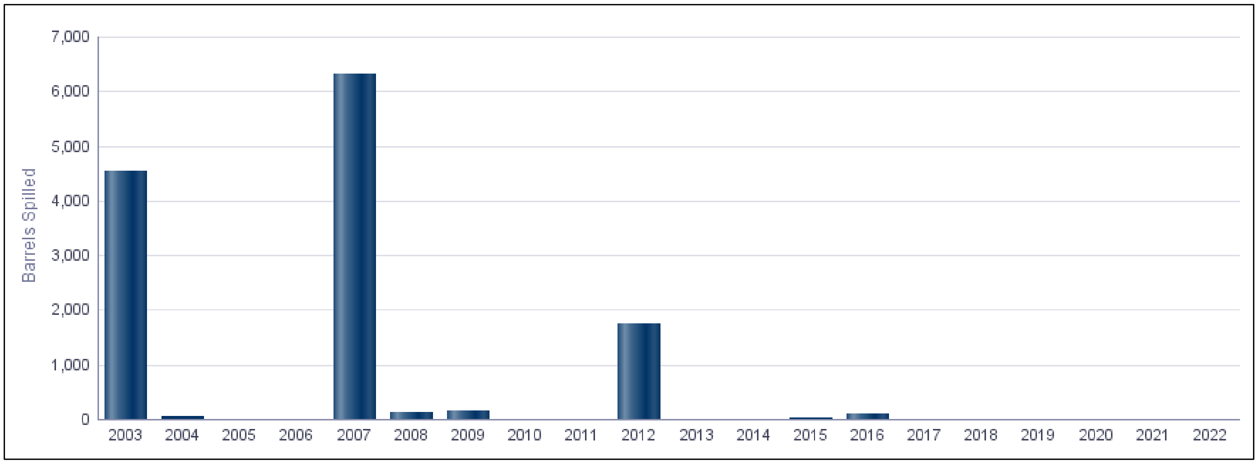


Figure 6.2-11 Crude oil barrels spilled in Wisconsin, 2003-2022.
Source: PHMSA

6.2.6 Enbridge Spills in 2022

According to the Enbridge Safety/Accountability website (Enbridge, 2020i) in 2022 Enbridge had ten reportable spills on crude oil and liquid pipeline systems. Two of the spills occurred on Enbridge property and eight occurred offsite. Total volume released over the 17,809 miles of Enbridge pipelines that run through Canada and the United States was 1,370 barrels, of which 162 barrels were spilled on Enbridge facilities and 1,207 barrels were spilled outside of Enbridge's property. One barrel equals 42 gallons.

6.3 Spill Response & Remediation

The impacts of an oil spill can vary widely, from isolated incidents that are contained on-site to incidents that have local, regional, national, or international effects. Federal laws and policies provide for a nested hierarchical approach for addressing the specific geographic scope of an incident and its effects. Contingency plans at each level of this hierarchy enable responders to address incidents by helping to identify and coordinate the activities of the different government agencies and private organizations involved in a response.

6.3.1 Federal, State, & Operator Response Plans & Coordination

6.3.1.1 National Contingency Plan & Oil Pollution Act

The National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan) is the federal government's blueprint for responding to both oil spills and hazardous substance releases. The National Contingency Plan promotes coordination among the hierarchy of responders and contingency plans. Some key aspects of the National Contingency Plan include:

- Establishes a National Response Team and defines its roles and responsibilities, including planning and coordinating responses, providing guidance to Regional Response Teams, and facilitating research to improve response activities.

- Establishes Regional Response Teams (representatives of federal, state, and local government agencies) and their roles and responsibilities, including coordinating preparedness, planning, and response at the regional level.

- Requires notification of any discharge or release to the National Response Center through a toll-free telephone number.

- Establishes a unified command structure for managing responses to spills through coordinated personnel and resources of the federal government, state government, and responsible party. The EPA is the lead federal authority for responses in inland areas and the Coast Guard is the lead federal agency for responses in coastal areas, including the Great Lakes.

- Establishes responsibilities of federal On-Scene Coordinators, including directing all federal, state, and private response activities at the site of a discharge, and reporting on removal actions taken at a site.

- Lists the 16 federal agencies that have duties associated with responding to spills and identifies their responsibilities during response planning and implementation.

- Defines the objectives, authority, and scope of contingency plans, including the National Contingency Plan, Regional Contingency Plans, and Area Contingency Plans.

The EPA and Coast Guard have developed regional contingency plans (generally at a multi-state) level, as well as more narrowly focused area contingency plans, that provide additional direction and guidance for coordinated responses within defined geographic areas. The EPA's Region 5 Regional Contingency Plan combines the EPA's area contingency plans and takes into consideration relevant Coast Guard area contingency plans. The EPA Region 5 plan also incorporates by reference 26 plans for subareas that are defined based on proximity to large bodies of water, number of facilities, and needs for greater jurisdictional coordination.

These reference documents ensure that all responders have access to essential area-specific information and promote inter-agency coordination to improve the effectiveness of responses. Under the CWA, area contingency plans must include:

- A description of the area covered by the plan, including areas of special economic or environmental importance that might be damaged by a spill.

- A description of the responsibilities of owners, operators, and federal, state, and local agencies in removing a discharge, as well as descriptions on how to mitigate or prevent a substantial threat of discharge to ensure optimum communication and coordination during a response.

- A list of personnel, equipment, and supplies available for response.

- A list of local scientists, both inside and outside federal government service, with expertise in the environmental effects of spills of the types of oil typically transported in the area.

- A description of how the plan is integrated with other plans.

When implemented in conjunction with the National Contingency Plan, the area contingency plans must include measures to remove a worst-case discharge and mitigate or prevent a substantial threat of such discharge. The area contingency plan may also provide guidelines for conducting specific tasks such as sampling, classifying, segregating, and temporary staging of recovered waste. Other specific tasks listed include identifying prior state disposal approval, various waste disposal options, and a hierarchy of preferences for disposal alternatives.

The Oil Pollution Act, 33 USC Subch. I, was signed into law following the Exxon Valdez spill in Alaska in 1989. The law sets fines related to oil spills, ensured accountability and compliance and expanded resources for when the inevitable spill does occur. It also established the Oil Spill Liability Trust Fund, which provides compensation to federal, state, local and tribal governments for costs and damages incurred as a result of an oil pipeline release. The Trust Fund can seek reimbursement from the owner or operator of the pipeline for any funds paid out to claimants. The Trust Fund's primary sources of funding are a $0.09 per-barrel excise tax on imported and domestic oil, and civil and criminal penalties from responsible parties. ("Oil Pollution Act (OPA) Frequently Asked Questions," n.d.).

6.3.1.2 State & Local Emergency Response

The Wisconsin Department of Military Affairs has a hazardous materials response system called the statewide Wisconsin Hazardous Material Response System that is intended to assist communities (or regions) who have been overwhelmed by the effects of a hazardous substance emergency or release by providing specialized hazardous substance resources to aid the stricken communities in incident stabilization and hazard mitigation activities. Figure 6.3-1 shows a map of Wisconsin's hazardous materials response teams. The focus of the statewide system is to provide quick strike capability to ensure effective incident assessment, stabilization, and mitigation, thus reducing the threat to the public, responders, and the environment. To provide a high level of hazardous substances response capabilities to local communities, Wisconsin Emergency Management contracts and manages 21 Regional Hazardous Materials Response Teams. The teams are divided into Task Forces: Northeast Task Force, Northwest Task Force, Southeast Task Force, and the Southwest Task Force. These Task Forces are then divided into Type I, Type II, and Type III teams, all with complimentary capabilities and training requirements. The Wisconsin Hazardous Material Response System could be activated for an incident involving a hazardous substances spill, leak, explosion, injury or the potential of immediate threat to life, the environment, or property. The Wisconsin Hazardous Material Response System responds to the most serious of spills and releases requiring the highest level of skin and respiratory protective gear. This includes all chemical, biological, or radiological emergencies. Several counties have Type 4 Hazardous Materials Response Teams. These county teams respond to chemical incidents which exceed the capabilities of local fire departments but do not require the specialized training or equipment of Wisconsin Hazardous Material Response System teams. County teams could also aid surrounding counties.

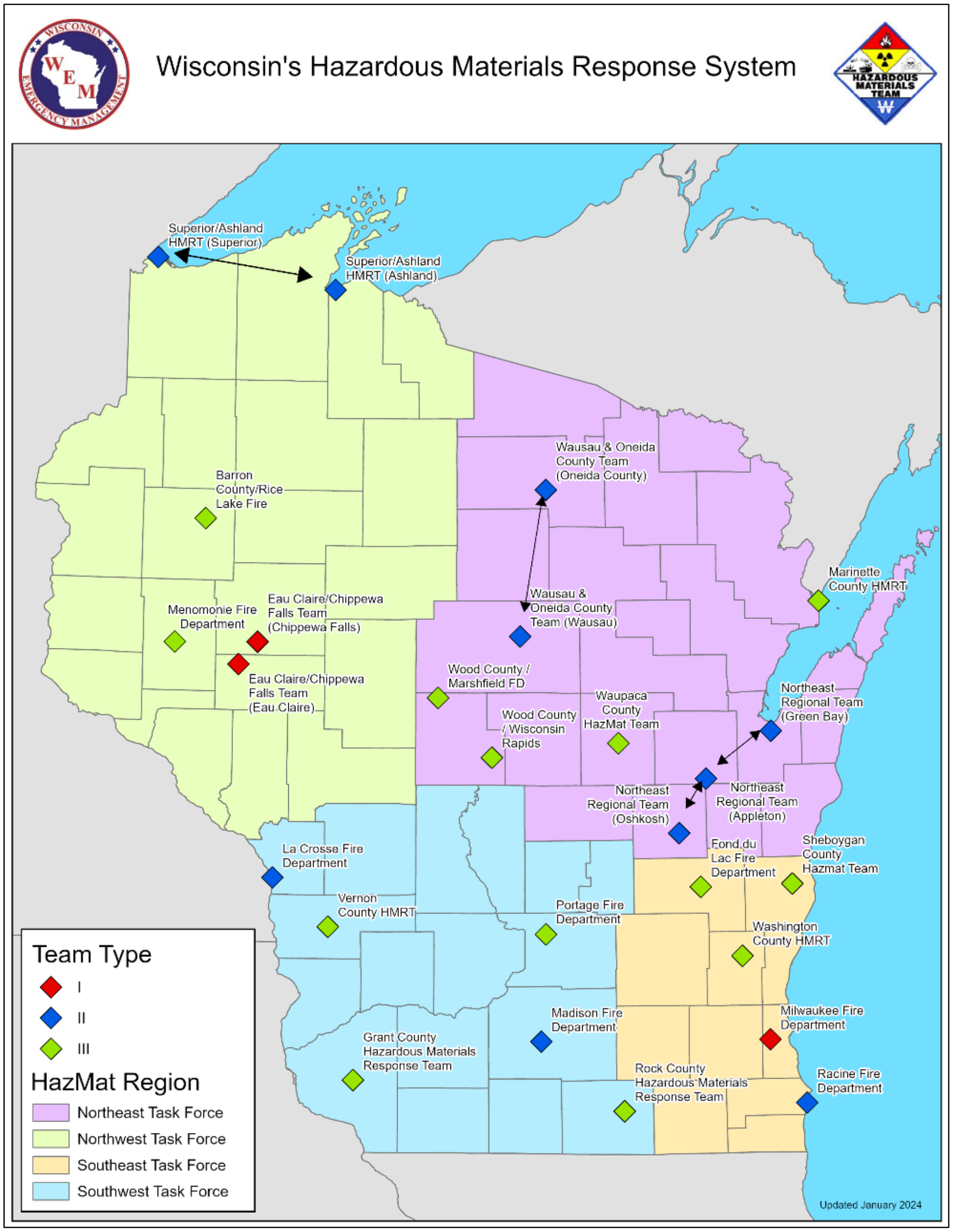


Figure 6.3-1 Wisconsin's Regional Hazardous Materials Response Teams.
Source: Wisconsin Department of Military Affairs

Local (County) Hazardous Materials Response Teams respond to chemical incidents that require a lower level of protective gear but still exceed the capabilities of traditional fire departments. Forty counties currently have Level 4 Hazardous Materials Response Teams. Those teams can aid surrounding counties and are approved by the Local Emergency Planning Committees. Figure 6.3-2 shows these teams.

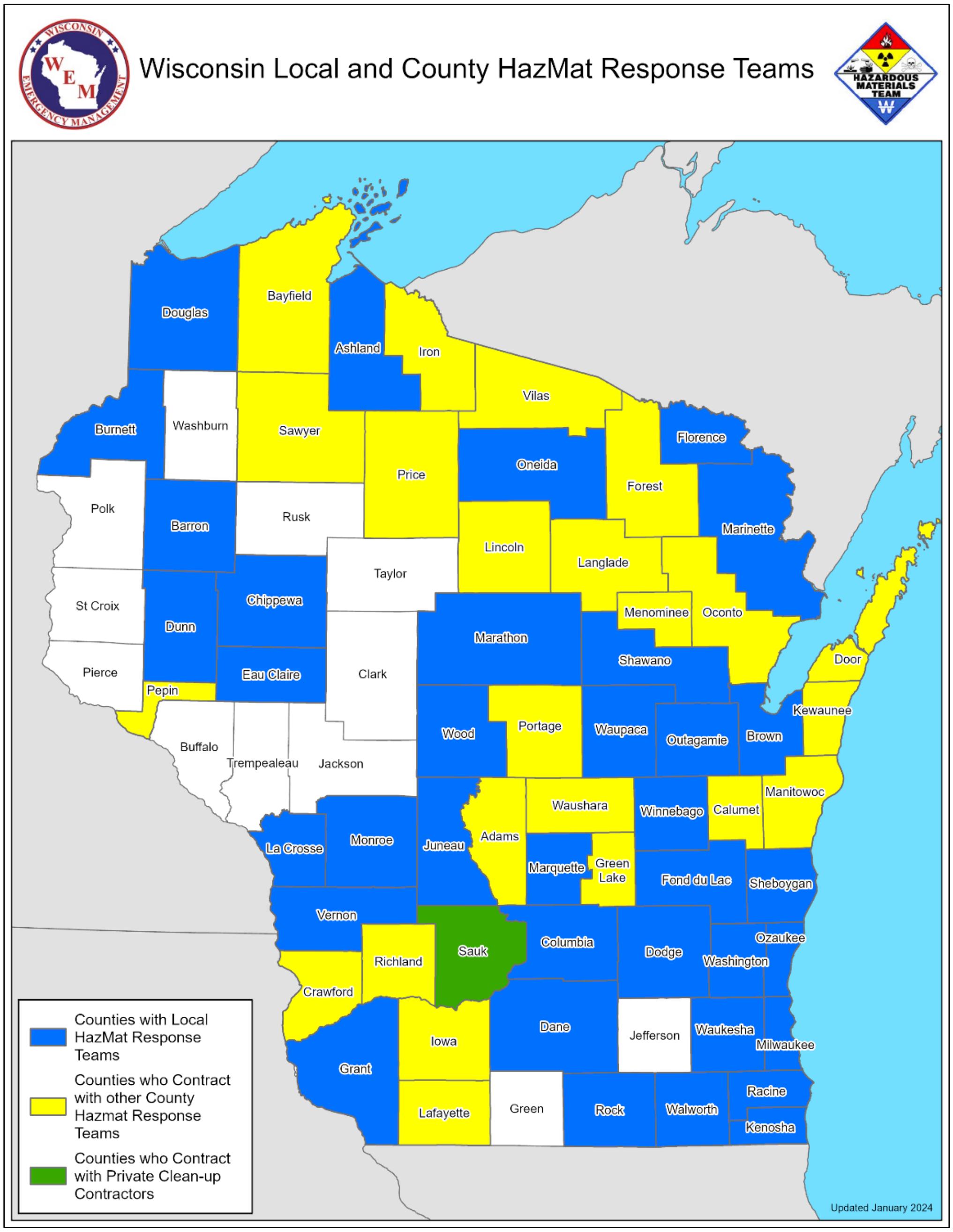


Figure 6.3-2 Wisconsin's County Hazardous Materials Response Teams.
Source: Wisconsin Department of Military Affairs

6.3.1.3 Pipeline Operator Integrated Contingency Plans

In addition to the federal agency contingency plans (Section 6.3.1.1), PHMSA regulations require pipeline operators to submit emergency response plans for "a geographic area either along a length of pipeline or including multiple pipelines… for which the operator must plan for the deployment of, and provide, spill response capabilities. The size of the zone is determined by the operator after considering available capability, resources, and geographic characteristics" (49 CFR § 194.5 "Response zone"). The response plan outlines the pipeline "operator's core plan and the response zone appendices for responding, to the maximum extent practicable, to a worse case discharge of oil, or the substantial threat of such a discharge." (49 CFR § 194.5 "Response plan"). Federal regulations outline the requirements for these response plans, including the information that must be included (49 CFR § 194.107). Various other statutes and regulations, administered by several federal agencies, include additional requirements for emergency response planning. A particular facility may be subject to one or more federal regulations. The federal government's National Response Team offers a mechanism for consolidating the multiple plans that facilities may have to prepare into a single integrated contingency plan (ICP). The National Response Team's Integrated Contingency Plan Guidance provides a suggested ICP outline as well as guidance on how to develop an ICP and demonstrate compliance with various regulatory requirements.

Enbridge has prepared two ICPs that cover its Line 5 operations: a Midwest Region Response Zone Integrated Contingency Plan (formerly titled Superior Region) and a Great Lakes Region Response Zone Integrated Contingency Plan. These ICPs serve as Enbridge's emergency response plans and guide how Enbridge responds to events that could impact the pipeline system. The ICPs contain procedures, roles, responsibilities, and guides to be followed by the company during an emergency event. Each ICP includes three core sections that are applicable across all of Enbridge's operating regions in Canada and the United States, as well as five annex sections that contain region-specific information. Enbridge makes its ICPs accessible to all Enbridge staff online and distributes controlled copies to key response management personal in each region. The Incident Management Team at a Regional office or Incident Command Post follow the ICPs in the event of a petroleum spill.

In November 2020, the U.S. District Court for the Eastern District of Michigan issued an order requiring PHMSA, when it next approved oil spill response plans for facilities operated by Enbridge in the Superior and Great Lakes regions, to explain with specificity its reasons for the approval (Case No. 17-10031). 49 CFR § 194.121 requires Enbridge to review and update its ICPs on a regular cycle. PHMSA approved Enbridge's current Midwest Region Response Zone Integrated Contingency and Great Lakes Region Response Zone Integrated Contingency Plans in May 2023.

In its approval letter, PHMSA provided additional explanation pursuant to the Court's order when approving the ICPs. PHMSA also noted that it consulted with various EPA regions and offices and the U.S. Coast Guard, as these agencies would serve as Federal On-Scene Coordinators in the event of a release within each plan's response zone. Such consultations are contemplated in 49 CFR § 194.119 (d) and were undertaken "given the particularly sensitive economic and environmental areas within the response zone." PHMSA further explained its approval process,

> "*PHMSA ordinarily evaluates response plans by applying a standard set of regulatory review criteria using a standard worksheet—based on the statutory elements. The format of the worksheet facilitates efficient identification and explanation of the required plan elements. If the plan contains the required elements, the worksheet specifies the location of each of the required elements in the plan, and PHMSA issues a letter of approval. If the plan is missing required elements or contains errors, PHMSA identifies the deficiencies or errors in the worksheet and issues a letter of correction. The letter of correction orders the operator to submit a revised plan. The format of the worksheet provides sufficient explanation of PHMSA's response plan review process. Use of the worksheet allows PHMSA to accurately and efficiently process the large number of response plans that operators submit.*"

Among other requirements, federal regulations (49 CFR Part 194, Subpart B) require each pipeline operator to:

- "submit a statement with its response plan . . . identifying which line sections in a response zone can be expected to cause significant and substantial harm to the environment in the event of a discharge of oil into or on the navigable waters or adjoining shorelines."

- "determine the worst-case discharge[1] for each of its response zones and provide the methodology, including calculations, used to arrive at the volume."
- "include procedures and a list of resources[2] for responding, to the maximum extent practicable, to a worst case discharge and to a substantial threat of such a discharge."
- "identify and ensure, by contract or other approved means, the resources necessary to remove, to the maximum extent practicable, a worst case discharge and to mitigate or prevent a substantial threat of a worst case discharge."
- "identify in the response plan the response resources which are available to respond" within specified times.

PHMSA determined that Enbridge's ICPs met each of these requirements. PHMSA's review also confirmed that the Enbridge ICPs were consistent with the National Contingency Plan and applicable area contingency plans. Since PHMSA's May 2023 approval, Enbridge's ICPs were submitted and approved again in January 2024. The PHMSA approvals remain valid for five years. If PHMSA were to find discrepancies during PHMSA inspections, or if new or different operating conditions or information would substantially affect the implementation of these plans, PHMSA would require Enbridge to resubmit revised plans.

The Great Lakes and Midwest Region Response Zone Plans use a consistent planning approach and structure. Each Response Zone has pre-identified and trained teams. However, Enbridge has explained that in a large-scale complex event, teams can be activated from other regions to respond. This constraint planning approach makes it easy for teams to be effective anywhere in the system. Personnel and equipment can be mobilized and moved between the Midwest and Great Lakes Response Zones for a quick and efficient response. Each ICP has a summary of the assets covered within the response zone or Enbridge Regional boundaries. Enbridge has several pipelines that cross state lines, as a result, different line segments are included in both the Great Lakes and Midwest Region ICPs.

Enbridge has developed a Field Emergency Response Plan (FERP) for the Midwest Region (Appendix AG). The FERP is not required by regulations, but Enbridge created it as a quick response guide for its internal response teams. As the FERP is a condensed version of the ICP that incorporates elements from both the ICP's core and the region/area-specific annex's, the elements within the FERP have been approved in the ICP. The FERP provides initial response actions, including the steps to assess the situation, report the emergency, and begin notification and standup of an Incident Management Team. Enbridge makes the FERP accessible to all Enbridge staff online and distributes hard copies to field response staff and external first responders in the region. The FERP does not contain company sensitive information or regulatory planning requirements that are not applicable during initial response by field response personal.

In addition to the primary response documents, Enbridge has also developed response tactics guides specific to inland spills and shoreline and submerged oil cleanups. Oil recovery on-water is difficult, especially after the oil weathers. Enbridge's tactics guides are not required by regulations and are not submitted to PHMSA for approval but were created as internal response guides for Enbridge's response teams to manage responses to inland spills, guide shoreline cleanups, and address submerged/sunken oil.

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[1] The "worst case discharge" is the largest of the estimated maximum release from any pipeline section within the response zone, the largest historic discharge within the response zone, and the capacity of the largest breakout tank (or battery of tanks within a single secondary containment system) within the response zone (49 CFR § 194.105 (b)(1)-(3)).

[2] Federal regulations require resources for oil spill containment (booms), oil recovery (skimmers), and temporary storage of recovered oil.

Enbridge's Inland Spill Response Tactics Guide (Appendix AG) can be used by Enbridge first-on-scene responders to select and implement containment and recovery response tactics using Enbridge-owned oil spill response equipment during the first 72 hours of a response. The quick reference guide illustrates a collection of inland spill tactics that can be applied using obtainable resources to a liquid products release until additional resources and personnel arrive on site. It includes control tactics for spills on land, small water courses, large water course, and open water. It also includes tactics to address spills in cold weather and ice conditions.

Enbridge's Shoreline Cleanup Assessment Technique Guide (Appendix AG) would help first responders assess damage to the shoreline and vegetation and how best to begin the process of cleaning up stranded oil. The Shoreline Cleanup Assessment Technique guide helps categorize the shoreline cleanup effort based on the presence of oil, safety, accessibility of the area, and the identified treatment targets. Enbridge's Shoreline Cleanup Assessment Technique guide recommends that stakeholders including regulatory agencies, tribal nations, and landholder participants approve the treatment targets and No Further Treatment recommendations when applicable. According to the Shoreline Cleanup Assessment Technique Guide, no further treatment would occur in the following scenarios:

- When further treatment would do more harm than allowing natural recovery.
- When further treatment is feasible but unreasonable or of little environmental value.
- Where access may not be possible (e.g., a steep cut bank or private property).
- Where safety concerns preclude further survey or operations activities.

Natural recovery in this plan is referring to the natural breakdown of oil by bacteria and other organisms, including photo oxidation and natural attenuation. When feasible recovery efforts outweigh the remediation costs, effort would be made to clean up the shoreline using hot and cold-water washing techniques, excavation, or cutting oiled vegetation.

The Submerged Oil Management Program (Appendix AG) would be used to assess the occurrence of submerged or sedimented oil after an oil spill. This plan includes the following priority sections:

- Submerged oil potential (identifying flow rates, sediment load in the water body, and fast and slow currents within the water body).
- Submerged oil detection and containment (installing containment systems to prevent further downstream transport, collecting samples to determine extent)
- Sunken Oil Assessment Program (identifying the areas for delineation and deposition potential, identifying where submerged/sunken oil is and may be deposited, quantifying the amount of oil)
- Submerged/Sunken Oil Recovery (prioritizing recovery areas and removal strategies)

These plans provide the framework for efficient emergency response with quickly defined roles and responsibilities for incoming emergency personnel. Having and maintaining these documents is essential as EPA notes,

> "*It is the policy of the RRT [Regional Response Team] that response actions on non-Federal lands should be monitored or implemented by the most immediate level of government with authority and capability to conduct such activities. The first level of response will generally be the responsible party (RP), followed by local government agencies, followed by State agencies when local capabilities are exceeded. When incident response is beyond the capability of the State response, EPA or USCG is authorized to take response measures deemed necessary to protect the*

> *public health or welfare or the environment from discharges of oil or releases of hazardous substances, pollutants, or contaminants. The need for Federal response is based on evaluation by the Federal OSC [On-Scene Coordinators].*"

6.3.2 Petroleum Spill Response

An inadvertent petroleum spill can threaten life, property, and natural resources with devastating effects and have potentially widespread economic impacts. Thus, an efficient and timely response that effectively draws on expertise across disciplines is essential to containing and recovering the released material. Rapid installation of containment systems would the best way to minimize complications with oil recovery especially in river environments which inherently make oil containment and recovery more difficult. The following sections outline elements of an effective response and highlight some of the challenges that could undermine such efforts.

6.3.2.1 Notification of Spills

Pipeline operators are required to report spills under 49 CFR Part 191 and 49 CFR Part 195 of PHMSA's pipeline safety regulations. Operators are required to report a spill within one hour of the release by calling the National Response Center at 1-800-424-8802. Within 48 hours, the operator must submit an update to the National Response Center, and within 30 days the operator must submit a report online through the PHMSA portal (PHMSA, 2016a). The State of Wisconsin also has its own notification Emergency Hotline number staffed that is staffed 24 hours per day, seven days per week at 1-800- 943-0003.

6.3.2.2 Difficult-to-Access Areas

Once a petroleum spill is discovered, pipeline operators need to mobilize a spill-response crew and ensure the appropriate expertise and assistance reaches the site of the spill in a timely manner. Effort would be made to act quickly after a spill occurs to divert the spill away from HCAs. However, certain areas downstream of Enbridge's proposed Line 5 relocation route and route alternatives would be difficult for spill-response personnel and equipment to access. There are areas within five miles of the proposed pipeline relocation route that would immediately be called inaccessible including the gorges around Copper Falls State Park and around Potato Falls along the Potato River. In the event of a spill affecting these areas, mechanical and manual clean-up would be virtually impossible. In addition to the obvious safety considerations associated with the gorges and waterfalls, steep banks and erosion potential could cause an emergency response crew to determine an area to be inaccessible. The remoteness of the Bad River Reservation, private land, and the lack of roads to access points along the larger rivers within the project area further contribute to the area being difficult to access. Clean-up and recovery from a major spill affecting these or other difficult-to-access areas would be difficult and could take years. Emergency response personal would have to try accessing areas above and below inaccessible areas to complete the necessary containment, recovery, and cleanup..

Spills in wetlands and marshes are known to be difficult to access and slow to cleanup and most types of active cleanup in marshes can damage the habitat. According to the NOAA shoreline assessment manual, oil in a marsh is sometimes actively cleaned up until no oil can rub off on contact which is an endpoint that limits the transfer of oil to wildlife but does not remove all oil from the environment (NOAA, 2013). The NOAA manual further clarifies that vegetation generally weathers to a dry coat within weeks, after which it is a lower threat of oiling wildlife, and removal of the dry dead vegetation could be attempted if the removal would not be excessively damaging to the habitat. Natural recovery and bioremediation are often the only available strategies in difficult to access areas. The use of dispersants applied upstream or aerially is sometimes considered, but they not likely to be used in a river environment because they decrease the oil droplet size, which in turn causes the oil to be more easily entrained; especially in river environments where variable flow exists (Horn, 2023a).

6.3.2.3 Difficult Conditions

Emergency response efforts can me limited depending on the time of the year, time of the day, and weather conditions at the time of the release. RPS modeled conservatively based recovery rates and timing to account for possible delays in driving to a site or unfavorable site conditions. The complete removal of oil may not be possible in certain environmental conditions. RPS provided spill model results that would reflect such an unmitigated spill scenario.

6.3.2.4 Rapids & Waterfalls

The most poorly understood processes related to oil spills include adherence of oil to the shoreline, oil entrainment into the water column, and breakup of oil into droplets within the water column, all of which have potentially strong effects on dispersion of the oil (Zhu, Waterman, and Garcia, 2018). The turbulence associated with rapids and waterfalls would have the potential to break up an oil slick, enhance downstream oil-sediment interactions, and enable mixing in the water column. Oil would be more likely to mix with water and sediment and to become dispersed and harder to contain after it has passed over a waterfall. There are several areas of rapids and waterfalls downstream of Enbridge's prosed waterbody crossings within the watersheds around the Bad River Reservation.

On the Bad River alone, there are three distinct waterfall areas. Red Granite Falls and Copper Falls are within Copper Falls State Park. Red Granite Falls (Figure 6.3-3) is 1.6 miles downstream and Copper Falls (Figure 6.3-4) is 5.5 miles downstream from where Enbridge's proposed pipeline would cross the Bad River. Copper Falls has an elevation change of 30 feet. Lower Falls is the third falls located on the Bad River and is in the middle of the Bad River Reservation downstream of Elm Hoist Road. Figure 3.12 in the RPS Oil Spill Report's Appendix B (EIS Appendix AH) highlights a few other sections along the Bad River where rapids are located.

Brownstone Falls (Figure 6.3-5) is also located in Copper Falls State Park but it is on the Tyler Forks River, which converges with the Bad River within Copper Falls State Park about one quarter mile below Copper Falls and also has an elevation change of 30 feet. Brownstone Falls is approximately 9.5 river miles downstream of where the pipeline would cross the Tyler Forks River.

On the Potato River, there are two waterfalls, the Upper and Lower Potato River Falls (Figure 6.3-6). These two falls are approximately one-quarter mile apart and have a combined drop of approximately 90 feet. The Upper Potato Falls is approximately three river miles downstream of where the proposed pipeline would cross the Potato River.

Figure 6.3-3 Red Granite Falls on the Bad River.
Photo: DNR

Figure 6.3-4 Copper Falls on the Bad River.
Photo: DNR

Figure 6.3-5 Brownstone Falls on the Tyler Forks River.
Photo: DNR

Figure 6.3-6 Lower Potato River Falls on the Potato River.
Source: (Town and Tourist, n.d.)

6.3.2.5 Time for Oil to Reach Areas of Interest & Spill Response Times

Once a petroleum spill is discovered, pipeline operators need to mobilize a response crew and ensure the appropriate expertise and assistance reaches the site of the spill in a timely manner. Pipeline operators' ICPs must outline where response equipment and response personnel will be staged to ensure a timely response. PHMSA regulations allow pipeline operators up to 10 hours to mobilize and have an initial response team deployed at the site of a spill. Enbridge's ICPs for its Line 5 pipeline were approved by PHMSA (Section 6.3.1.3), and Enbridge indicates that mitigations would likely to be put in place between three to 10 hours after a spill event.

Because of the dynamic nature of the rivers in the Bad River watershed, it is possible that in the event of a spill, oil could be quickly transported from an initial release site to sensitive resources relatively quickly. In some cases, this would be likely to occur before a response team could be on-site to contain the spill. The DNR compiled data from the OILMAPland model provided by Enbridge to determine how quickly oil could reach certain areas of interest (AOIs). Table 6.3-1 identifies the shortest time that an FBR spill during high flow conditions could reach the following AOIs:

- Copper Falls (within Copper Falls State Park)
- Bad River Reservation boundary
- Beartrap Creek at the point where it crosses U.S. Highway 2
- Bad River at the point where it crosses U.S. Highway 2
- Lake Superior (any point in Lake Superior including Chequamegon Bay)

Based on the spill location, some spills would not impact every AOI. The blank cells in the table indicate that the spill from the specified river crossing would not impact the corresponding AOI. The times highlighted in yellow are times that are under 30 hours. Those highlighted in red are under 10 hours. While most of the times for a FBR spill to reach th4ese AOIs are greater than Enbridge's anticipated timeframe for installing mitigations, if site conditions, weather, daylight hours, or other factors would impede response times, the effects of spill would be much greater if the oil were able to reach these AOIs. The Bad River crossing at U.S. Highway 2 AOI is important because it is the entrance to the Kakogon Sloughs which includes habitat for wild rice.

Table 6.3-1 Time for a FBR spill during high flow conditions to reach AOIs from OILMAPland model outputs.

Spill Location	Copper Falls (hrs)	Bad River Reservation (hrs)	Beartrap Creek at U.S. Highway 2 (hrs)	Bad River at U.S. Highway 2 (hrs)	Lake Superior (hrs)
Bay City Creek					6.8
Little Beartrap Creek		9.7	18.0		26.6
Beartrap Creek		10.3	18.6		27.2
White River		9.7		26.7	31.4
Marengo River		5.6		50.9	55.6
Brunsweiler River		2.6		47.5	52.2
Trout Brook		2.3		45.9	50.6
Silver Creek		3.7		41.5	46.2
Krause Creek	5.2	12.5		50.4	55.1
Bad River	6.8	14.1		52.0	56.7
Gehrman Creek	4.1	11.4		49.3	54.0
Camp Four Creek	7.0	14.3		52.2	56.9
Tyler Forks River	10.8	3.1		56	60.7
Potato River		4.6		45.7	50.4
Vaughn Creek		5.3		46.4	51.1

Many of the public comments on the DNR's Draft EIS expressed concerns about possible oil spill effects on Lake Superior. The modeled plume outlets indicate that there are locations along Enbridge's proposed Line 5 relocation route from which spills would more likely reach Lake Superior. Figure 6.3-8 illustrates the variability in the time it would take a plume of spilled oil to travel the distance downstream to Lake Superior. Travel times range from less than six hours for streams that flow directly into Lake Superior to over two days for more distant tributaries.

Oil spills that would occur on the proposed line within the Fish Creek-Frontal Chequamegon Bay watershed or the Graveyard Creek watershed would be the fastest spills to reach Lake Superior (Figure 6.3-8). The Fish Creek-Frontal Chequamegon Bay watershed includes the town of Ashland and Bay City Creek, which flows into Ashland and then directly into Lake Superior. The Graveyard Creek watershed runs between U.S. Highway 2 and Lake Superior near the town of Cedar. Spills within Beartrap Creek and Deer Creek/White River watersheds also required the quickest emergency response times to avoid oil reaching the U.S. Highway 2 crossing.

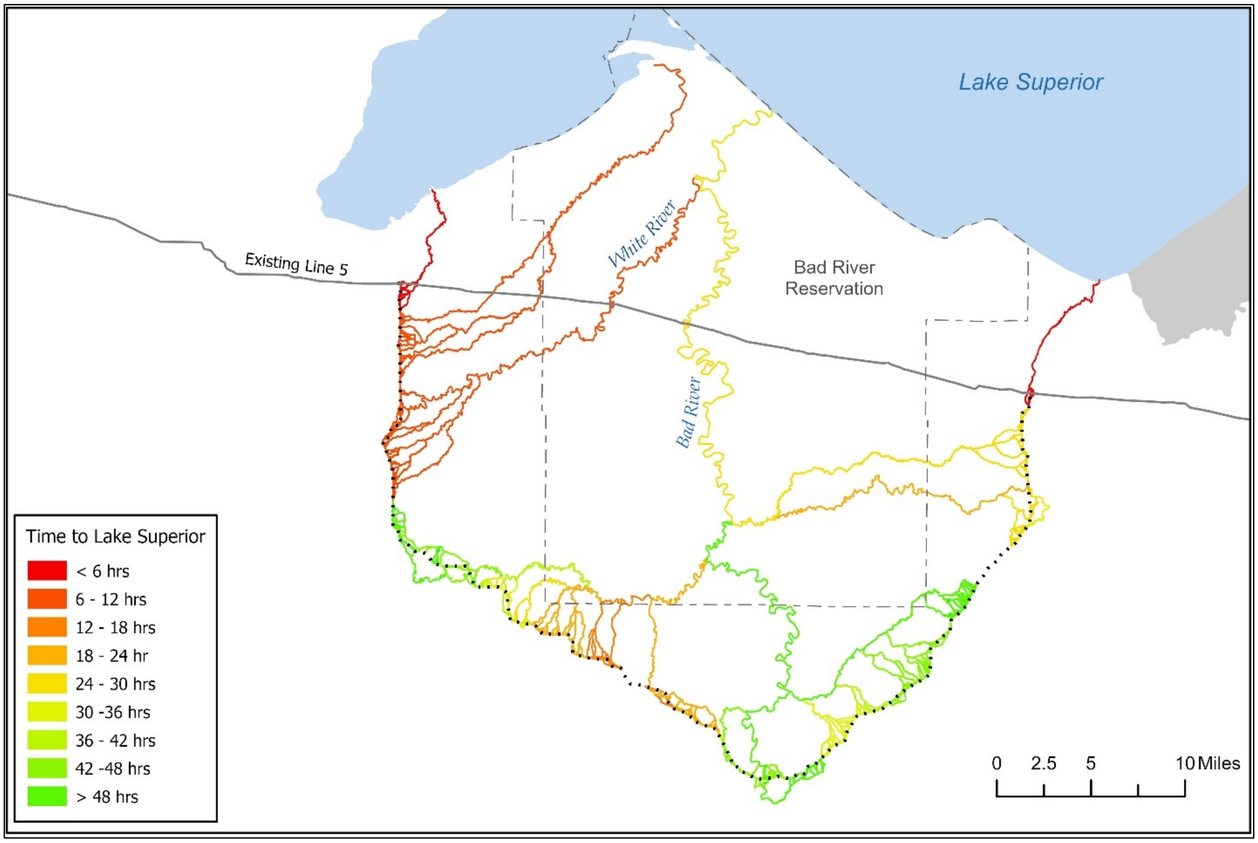


Figure 6.3-7 Full-bore release spill times to Lake Superior and modeled plume paths.

As noted in Section 6.3.2.4, there is more concern with the effectiveness of the spill response if the spilled oil is not contained before it reaches a large river disturbance like a waterfall. Table 6.3-2 highlights the instances modeled by RPS that have the potential to reach a waterfall before Enbridge's spill-response teams would be able to contain the spill. Enbridge has said it would take between three and 10 hours to install initial containment and oil recovery systems depending on the spill site. Table 6.3-2 shows some spill scenarios are likely to make it to a waterfall within three hours but in most cases less than 10 hours would be needed to reach a waterfall. As noted by the less than sign, the time that a spill would reach Red Granite Falls was not calculated by RPS but since Red Granite Falls is approximately three miles upriver of Copper Falls, a spill would reach Red Granite Falls in less time.

The OILMAPland model predicted a FBR spill could travel between one-half mile to one mile per hour depending on flow (high or average). This suggests that a spill near the crossing of the Potato River or the Bad River would likely arrive at one of the waterfalls on those respective rivers before Enbridge would be able to deploy emergency response equipment. For comparison, the spill in 2010 into the Kalamazoo River, which was during flood conditions, was estimated to be traveling at a speed of 1.25 miles per hour in the first few days after the release (Dollhopf et al., 2014).

RPS modeled a total of 732 oil release points along Enbridge's proposed Line 5 route, 248 of those release points were predicted to flow in one of the seven creeks or rivers shown in Table 6.3-2. That means that 34 percent of the spills modeled by RPS were predicted to reach one of the waterfalls in Table 6.3-2 within the times identified during a FBR spill at average or high flow.

Table 6.3-2 RPS-modeled time for a FBR spill to reach a waterfall.

River Crossing	Red Granite Falls	Copper Falls	Brownstone Falls	Potato River Falls
Krause Creek	< 3.7 to 7.7 hrs	3.7 to 7.7 hrs		
Bad River	< 4.9 to 10.1 hrs	4.9 to 10.1 hrs		
Montreal Creek	< 8 to 16.7 hrs	8 to 16.7 hrs		
Gehrman Creek			3 to 6.25 hrs	
Camp Four Creek			5 to 10.5 hrs	
Tyler Forks River			7.8 to 16.3 hrs	
Potato River				4 to 7.2 hrs

Note: Times include river flow during 95 percentile flow conditions, high flow, and average flow of an FBR spill

6.3.2.6 Oil Spill Containment & Recovery

An effective spill response depends on the availability of equipment and resources for containment and recovery of the spilled oil. As noted in Section 6.3.1.3, a pipeline operator's ICP must "include procedures and a list of resources for responding, to the maximum extent practicable, to a worst case discharge and to a substantial threat of such a discharge." The ICP must also "identify and ensure, by contract or other approved means, the resources necessary to remove, to the maximum extent practicable, a worst case discharge and to mitigate or prevent a substantial threat of a worst case discharge" and must "identify in the response plan the response resources which are available to respond" within specified times. The PHMSA regulations require resources for oil spill containment (booms), oil recovery (skimmers), and temporary storage of recovered oil. In a meeting with Enbridge's consultants and EPA staff, a PHMSA representative indicated that PHMSA's approval of Enbridge's ICP attests that the company has adequate spill-response equipment on hand along its entire Line 5 route/network.

An oil spill on land will flow overland to the lowest spot. Depending on the size of the spill it may pool on land without meeting water but since water resources are usually at the lowest points on the landscape, large spills almost always migrate to some water resource. Of the largest spills modeled using Enbridge's consultant's OILMAPland model, 81 percent were expected to intersect with at least one waterway. Once on the water, oil begins to spread out quickly. Early emergency response is extremely important as cleanup becomes more difficult as the thickness of the oil decreases to a thin sheen. River currents further complicate matters by carrying the oil sheen away from the original spill location. The Kalamazoo River spill in Marshall, Michigan, which occurred when the Kalamazoo River was experiencing flood conditions, was estimated to be traveling at a speed of 1.25 mile per hour (Dollhopf et al., 2014).

Dams and berms are used on land and occasionally in the water depending on the size of the receiving water. A berm may be constructed in a stream to encourage the spilled oil to pool in one location. As shown in Figure 6.3-8, a vacuum truck can be used to remove the oil once it has collected in an area.

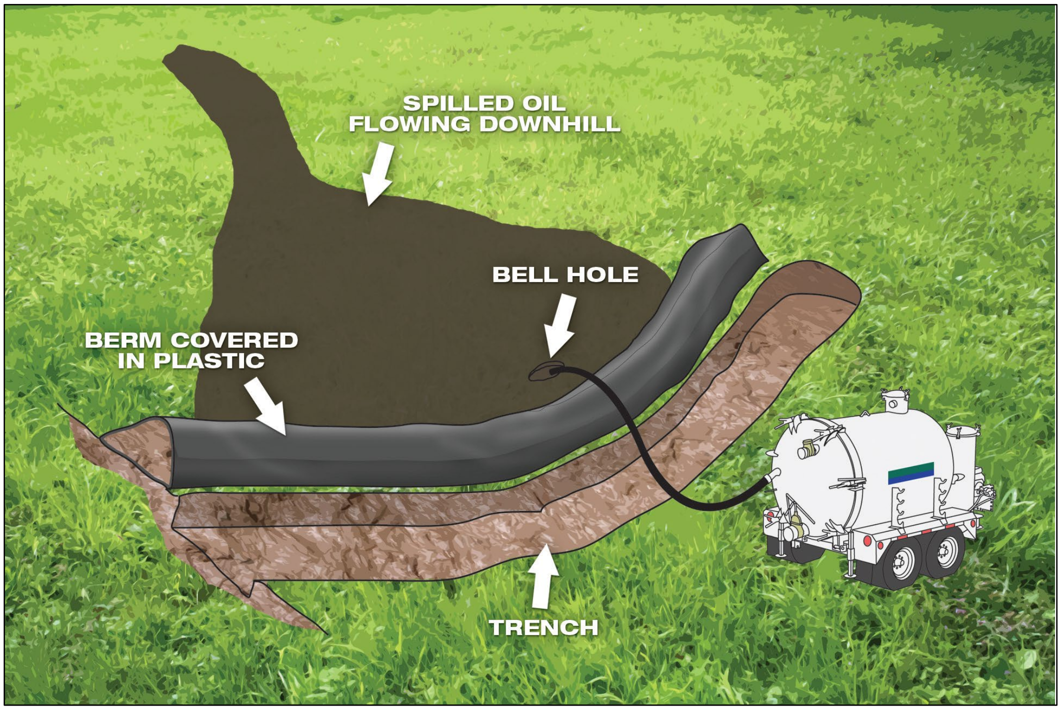


Figure 6.3-8 Enbridge inland oil spill and response tactics.
Source: Enbridge Inland Spill and Response Tactics; Appendix AG

After the pool of oil has been removed, excavation of the contaminated soil would be initiated. The removed contaminated soil would be contained in large reinforced supersacks and taken offsite for disposal. Excavated sites are then sampled to ensure all the contaminated soil has been removed and if necessary backfilled with clean material and reseeded. Depending on the depth to groundwater in the spill area, the installation of monitoring wells many be required. Because of its low viscosity, light crude can quickly penetrate sediment, including sand, making it important to know of possible groundwater-to-surface water pathways in the steeply sloped ravine area of the transition zone.

Several rivers crossed by Enbridge's proposed Line 5 relocation route, including the Bad River and the White River, intersect with the proposed pipeline 25 to 50 miles upriver of Lake Superior. Spills sites the proposed route are much farther away from Lake Superior than the existing line, which suggests a greater likelihood of sufficient time for Enbridge's emergency personnel to stop the majority of a spill from reaching Lake Superior using a variety of remediation tactics.

RPS's Oil Spill Report Operations Assessment (Appendix AH) includes the following statements which describe the assumptions used in RPS's modeling with respect to mitigation strategies and deployment times:

> *Enbridge currently maintains a high state of readiness across all areas of operations, with trained personnel having the capability to deploy a cache of Enbridge-owned equipment and conducting routine maintenance on stored equipment.* In addition, Enbridge has contracted with a number of different Oil Spill Response Organizations (OSROs) that would provide additional trained personnel, response equipment, and other resources in the event of a release.
>
> *Enbridge has specific, pre-identified Control Point (CP) locations along hydrologically-connected watercourses that could be utilized in the event of a spill. A CP is a predetermined location from where spill containment and recovery operations may be conducted. Pre-established*

> *CPs reduce the response times and enhance effectiveness for containment and recovery of released products into a watercourse. It should be noted, however, that a response is not limited by these pre-established CPs.*
>
> *Seven CPs are established on the Bad River, Six CPs established on the White River. CP represents a predetermined location from where spill containment and recovery operations may be conducted with the expectation of a high degree of success.*
>
> *Enbridge provided RPS with a series of identified tactical CPs and response equipment information to assist with modeling emergency response mitigation capabilities of containment and collection. These response options were modeled at Modeled Control Points (MCPs) within the Bad River and White River for hypothetical releases at the watercourse crossings of the Proposed Route.*
>
> *All Enbridge response personnel are field safety and response trained to meet the requirements of 49 CFR 194.117. These training include HAZWOPER, Incident Command System (ICS), Tabletop Exercises, Full Scale Equipment Deployment Exercises, Dryland Equipment Training, Boat Operation, Oil Spill Response, and Winter/Ice Tactics. Winter tactics include the prevention of oil moving downstream using physical barriers (e.g., ice slotting and the insertion of plywood barriers) to form collection areas/points. Contracted OSROs have similar qualifications.*
>
> *Additionally, Enbridge maintains ER equipment at locations along its Right-of-Ways (ROWs).*

Enbridge has identified Control Points along the proposed Line 5 relocation route. These predetermined locations from where spill containment and recovery operations may be conducted with the expectation of a high degree of success. For example, Enbridge identified seven Control Points on the Bad River and six on the White River. For each Control Point, Enbridge has developed detailed site-specific information including recommended tactics for spill response actions to provide the highest probability for properly establishing containment/recovery and to ensure that sensitive resources are protected. RPS used this information (Figures 6.3-9 6.3-10) in its assumptions about mitigated responses.

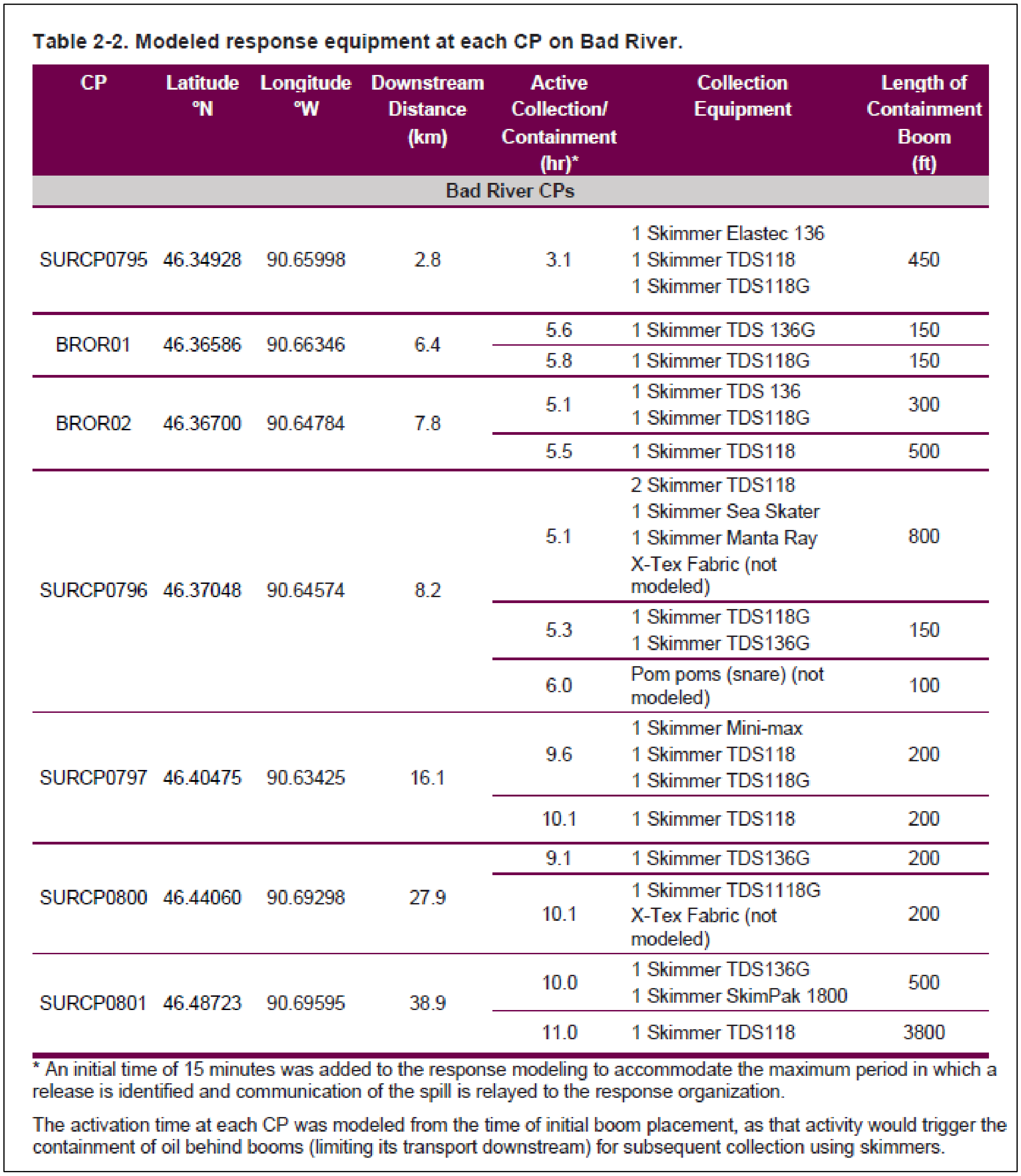


Table 2-2. Modeled response equipment at each CP on Bad River.

CP	Latitude °N	Longitude °W	Downstream Distance (km)	Active Collection/ Containment (hr)*	Collection Equipment	Length of Containment Boom (ft)
Bad River CPs						
SURCP0795	46.34928	90.65998	2.8	3.1	1 Skimmer Elastec 136 1 Skimmer TDS118 1 Skimmer TDS118G	450
BROR01	46.36586	90.66346	6.4	5.6	1 Skimmer TDS 136G	150
				5.8	1 Skimmer TDS118G	150
BROR02	46.36700	90.64784	7.8	5.1	1 Skimmer TDS 136 1 Skimmer TDS118G	300
				5.5	1 Skimmer TDS118	500
SURCP0796	46.37048	90.64574	8.2	5.1	2 Skimmer TDS118 1 Skimmer Sea Skater 1 Skimmer Manta Ray X-Tex Fabric (not modeled)	800
				5.3	1 Skimmer TDS118G 1 Skimmer TDS136G	150
				6.0	Pom poms (snare) (not modeled)	100
SURCP0797	46.40475	90.63425	16.1	9.6	1 Skimmer Mini-max 1 Skimmer TDS118 1 Skimmer TDS118G	200
				10.1	1 Skimmer TDS118	200
SURCP0800	46.44060	90.69298	27.9	9.1	1 Skimmer TDS136G	200
				10.1	1 Skimmer TDS1118G X-Tex Fabric (not modeled)	200
SURCP0801	46.48723	90.69595	38.9	10.0	1 Skimmer TDS136G 1 Skimmer SkimPak 1800	500
				11.0	1 Skimmer TDS118	3800

* An initial time of 15 minutes was added to the response modeling to accommodate the maximum period in which a release is identified and communication of the spill is relayed to the response organization.

The activation time at each CP was modeled from the time of initial boom placement, as that activity would trigger the containment of oil behind booms (limiting its transport downstream) for subsequent collection using skimmers.

Figure 6.3-9 Control point equipment used for a "mitigated" release in RPS's models for the Bad River.

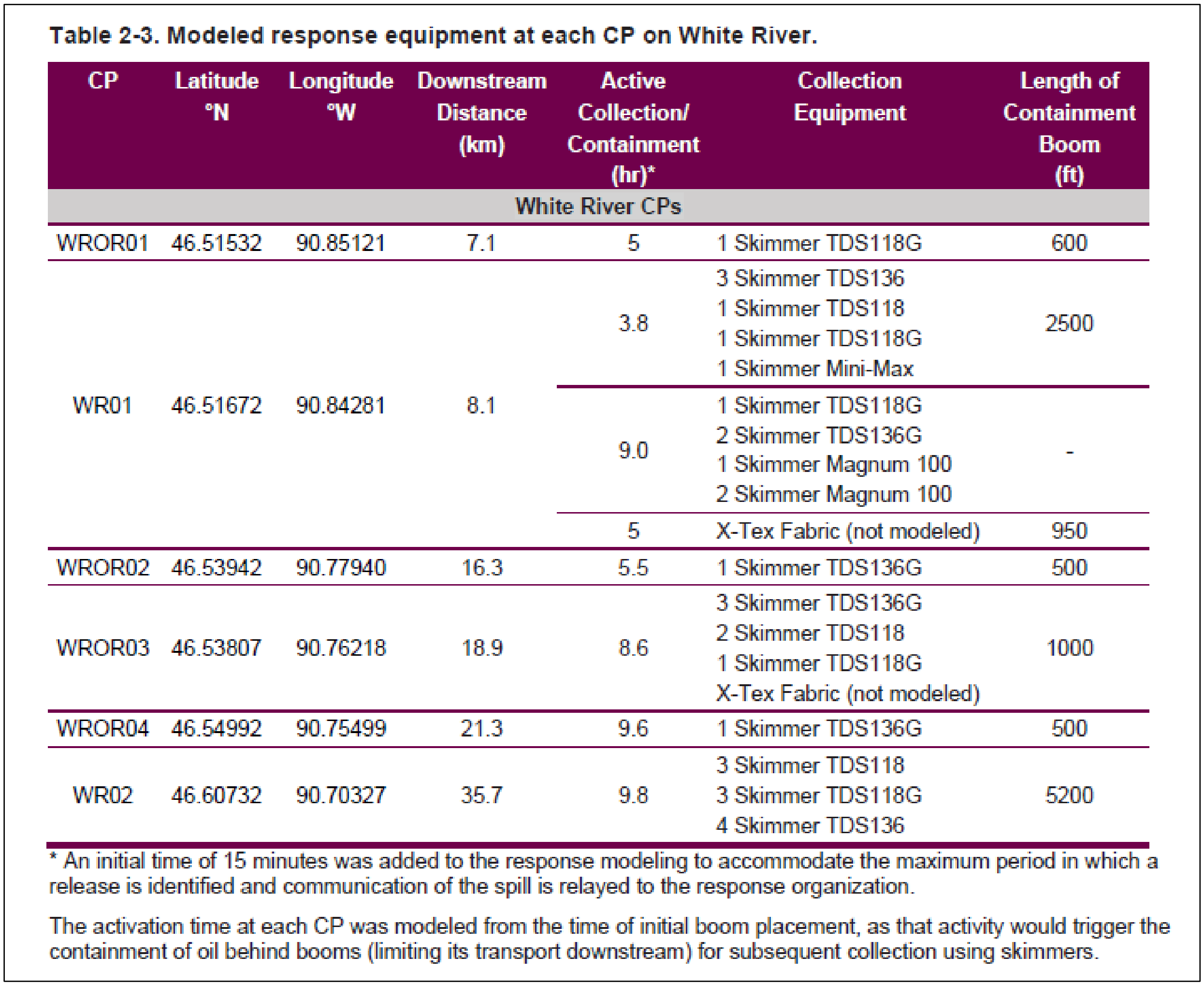


Table 2-3. Modeled response equipment at each CP on White River.

CP	Latitude °N	Longitude °W	Downstream Distance (km)	Active Collection/ Containment (hr)*	Collection Equipment	Length of Containment Boom (ft)
White River CPs						
WROR01	46.51532	90.85121	7.1	5	1 Skimmer TDS118G	600
WR01	46.51672	90.84281	8.1	3.8	3 Skimmer TDS136 1 Skimmer TDS118 1 Skimmer TDS118G 1 Skimmer Mini-Max	2500
				9.0	1 Skimmer TDS118G 2 Skimmer TDS136G 1 Skimmer Magnum 100 2 Skimmer Magnum 100	-
				5	X-Tex Fabric (not modeled)	950
WROR02	46.53942	90.77940	16.3	5.5	1 Skimmer TDS136G	500
WROR03	46.53807	90.76218	18.9	8.6	3 Skimmer TDS136G 2 Skimmer TDS118 1 Skimmer TDS118G X-Tex Fabric (not modeled)	1000
WROR04	46.54992	90.75499	21.3	9.6	1 Skimmer TDS136G	500
WR02	46.60732	90.70327	35.7	9.8	3 Skimmer TDS118 3 Skimmer TDS118G 4 Skimmer TDS136	5200

* An initial time of 15 minutes was added to the response modeling to accommodate the maximum period in which a release is identified and communication of the spill is relayed to the response organization.

The activation time at each CP was modeled from the time of initial boom placement, as that activity would trigger the containment of oil behind booms (limiting its transport downstream) for subsequent collection using skimmers.

Figure 6.3-10 Control point equipment used for a "mitigated" release in RPS's models for the Bad River.

Three response mitigation factors have the largest influence on the geographic extent and magnitude of effects following a release of oil: (1) the amount of time required to set up an active Control Point, (2) the amount of oil that is able to be contained, and (3) the rate of removal or collection. In the most ideal situation following a release, Control Points would be set up as rapidly as possible and collection efficiencies would be maximized.

RPS described its use of this information as follows:

> *Individual information sheets were compiled for each successive downstream CP, providing planned site specific equipment lists, deployment layouts, and the associated timings for activation of each (Enbridge, 2022a). The timings factored in mobilization and transport from staging locations, through deployment at the timepoint that containment and collection would begin. The activation times at each CP reflect the sum of a 2- hour notification time and the location-specific travel time based on a 35 miles per hour (mph) speed average from the staging location to the CP access. The use of a conservative 35 mph average speed reflects planning standards as identified in the 2021 guidelines for the U.S. Coast Guard OSRO Classification Program (as per 33 CFR § 154), which considers potentially adverse travel conditions (e.g., winter snow, severe storm) that might impact the ability to access a CP location. For the purposes of modeling, an additional 15*

> *minutes was added to account for the period of time under which a release was identified and communication of the spill was relayed to internal responders and external OSROs. It is likely that in a real-world release, these communications could be completed in less time.*
>
> *As described in Section 2.1.1 recovery capacity volumes and effectiveness for various response equipment (e.g., oil skimmers and boom) to be employed by Enbridge are variable, but have been rigorously tested at Ohmsett to develop nameplate recovery rates following ASTM standards. Nameplate capacities are thought to be unrealistic in many real-world oil spill cases due to circumstances or environmental conditions that may be far from optimal operational conditions and therefore could reduce collection efficiency. This accounts for variables such as degree of emulsification, weather conditions, sea state, available daylight hours, fouling of gear with ice/debris, and any number of other factors that could reduce collection efficiency. Therefore, the United States Coast Guard (USCG) typically derates the nameplate capacity by 80% (i.e., collection is assumed to be 20% of nameplate recovery rate) or more in estimating a recovery capacity for planning purposes (Table2-1). For this modeling study, RPS used the USCG recommendation and conservatively derated all nameplate capacities by 80% (or 20% efficiency collection rate) for all scenarios simulated under non-winter conditions. For winter conditions, the response equipment was further derated to 85% of nameplate capacity (or 15% efficiency collection rate). This additional reduction (to three-quarters the collection rate of the previously derated values) reflects the uncertainty around other winter-specific limitations that could be encountered, such as weather conditions causing temporary work stoppage; unsafe ice conditions; limitations on plywood J-slotting technique; slow work caused by bulky winter clothing; slow work caused by slip trip fall risks; and equipment issues or maintenance needs due to winter conditions.*

Actual response mitigation activation is anticipated to begin at the first Control Point within 3.1 to 3.8 hours (see Section 2.1.3 of the Oil Spill Report).

> *Activation timing and tactics of response were not adjusted for flooding (or overbank) conditions. In the event of a release under these conditions, Enbridge would consider condition-specific access and response needs, which may differ from those outlined here. Staging sites may be accessed by several different types of vehicles (e.g., tracked vehicles, helicopters, etc.) with the capacity to transport a wide range of response equipment including, but not limited to, additional boom for wider river deployments. The trailers at staging sites are already equipped with longer boom lengths than required for normal flow conditions to accommodate wider-than normal, high flow conditions.*
>
> *Together, the conservatively-based recovery rates and timing used in this modeling depict scenarios where emergency response efforts and success could be reasonably lower than might occur in real-world circumstances. The modeling is further conservative because it also does not account for full-scale OSRO deployment, dynamic readjustment of CP layouts or locations, or emergency response mitigation techniques other than direct containment through skimming (e.g., submerged oil recovery techniques, sorbent or protective booming, shoreline cleanup).*

As outlined in the RPS Oil Spill Operations Assessment Report, there are three main oil recovery methods: mechanical recovery (oil contained using containment boom, physical barriers, or skimmers), non-mechanical recovery (biological remediation or in-situ burning), and manual recovery (use of shovels, rakes, buckets etc.). Operators have several methods of oil spill containment and cleanup. Spills that occur on land are typically remediated by a combination of containing the spill using boom, berms and trenches and recovery of the spill through oil skimmers, vacuum trucks, and absorbents materials.

In addition to modeling the extent of the spill, RPS also modeled how quickly a hypothetical oil spill would be contained and removed (as discussed above). Oil recovery is aimed at recovering the greatest amount of oil in the quickest amount of time in the least aggressive manner. While effort is made to remove all the oil in the environment, recovery efforts will be stopped when further oil removal would result in excessive habitat disruption, increasing erosion potential or mixing oil deeper into the ground the decision is made stop oil recovery. According to the NOAA's Shoreline Assessment Manual: the best cleanup strategy is often not the one that removes the most oil; rather, it is the strategy that removes oil that poses a greater risk of injury than would result from cleanup. Less intrusive methods or natural recovery are often preferable (NOAA, 2013).

The main methods for removing oil from surface water include using absorbent materials in the form of absorbent boom and absorbent pads. Boom is a long snake like material that is about 8" in diameter and floats on water. Since oil for the most part floats on water in calm, nonturbulent conditions, containment boom can effectively contain the oil and prevent it from continuing downstream. Often a set of three or four containment booms are placed along a river so that any oil passing beyond the first containment systems will be captured by one of the downstream booms. It is best practice to deploy these types of containments in a wide, calm section of the river. Absorbent pads are much smaller sections of absorbent material that act like an oversized highly absorbent paper towel. Absorbent pads are more frequently used to soak up small puddles of oil.

Figure 6.3-9 shows an example of containment boom used to contain a surface oil spill and prevent it from moving downstream. Oil entrained from mixing action in the upstream rapids would likely pass beneath the surface boom.

Figure 6.3-9 Deployment of a containment boom in a river.
Source: RPS Operations Assessment: Oil Spill Report; Appendix AH

6.3.2.7 Skimmers & Vacuum Trucks

Spills that occur on rivers and lakes require special techniques for cleanup. Booms are typically used to contain a spill in a certain location and can also be used to divert oil away from sensitive areas (Figure 6.3-9). Booms can also be used to surround a spill on water for recovery of the oil. In addition, cleanup crews may use skimmers to skim and collect oil off the water's surface. Skimmers remove floating oil from the water's surface and store it in containers for further processing and disposal. Skimmers are typically only effective in calm waters. They are best used in open water upriver of a containment boom where the surface oil is contained and slightly thicker. During remediation efforts, emergency response personnel may construct temporary dams to contain the oil in one area. Pumps could then be used to continue moving the water at the bottom of the river downstream while minimally disrupting the surface water, allowing the surface oil to pool and be more easily captured. Skimmers are very effective for removing oil from open water but do not function well in rocky, cobbled streams or in areas with thick vegetation. Figure 6.3-10 shows an oil skimmer removing surface oil.

Vacuum trucks can also quickly collect large amounts of oil. Vacuum trucks can be used on land when oil has pooled or in the water, although they are best suited for locations with minimal water. If water is vacuumed up with the oil it can be separated out later using an oil/water separator, but operators generally strive to remove as little water as possible.

Figure 6.3-10 An oil skimmer being used to remove surface oil on water.
Source: RPS Oil Spill Report- Operations Assessment Oil Spill Report, Appendix AH

6.3.2.8 In-situ Burning

Occasionally, in-situ burning may be allowed (typically, in remote locations). In-situ burning eliminates large volumes of oil in a short period, but adversely affects the ecosystem by destroying vegetation and leaving behind residue from unburned oil, burned oil, and burned vegetation that typically require additional cleanup. In-situ burning is not a clean burn and can have adverse effects on local air quality. Burning is not attempted without of the approval of company, local, and state authorities.

6.3.2.9 Oil Recovery in Ice-covered Conditions

During winter conditions in northern Wisconsin the rivers are likely to be covered in ice. As stated in Enbridge's Inland Spill and Response Tactics Guide, finding and delineating a spill under the ice can be a challenge. Oil can seep through cracks in surface ice into the water below where it pools and slowly begins migrating downstream. Depending on the thickness of the ice, oil can get trapped within the ice or absorbed by snow. It is difficult to detect the oil in these situations and in some cases removal efforts are paused and monitored until spring when the ice melts and cleanup can resume. According to the RPS report, ice also has the ability to act as a barrier and prevent spilled oil from entering a river (Horn, 2023b). However, if an ice-covered river is the lowest point on the landscape, the oil will eventually flow to and begin to collect at that point.

During a winter spill, it would be assumed that the oil plume reaches the ice-covered river or waterbody and slowly seeps through the ice until it reaches the water below. While it is possible for ice to extend to the bottom of the river in calm shallow areas, usually the ice is no more than a few feet thick, with the water still freely moving below. When the oil seeps down below the ice, it pools on top of the water and spreads out to an equilibrium thickness under the ice based on the balance between surface tension and buoyancy (Keevil and Ramseier, 1975). According to the RPS report, the equilibrium thickness of Bakken crude oil was determined to be 1.9 mm. Once that equilibrium thickness is reached, the oil slick is assumed to move slowly downriver at the natural rate of the current maintaining that oil thickness. Spills in the winter are less likely to dissipate to a thin sheen unless there are waterfalls or some sort of river disturbance that would cause a break in the ice causing the oil plume to separate.

Complications with plume identification and removal in ice covered conditions include determining if the ice is safe to work on. Many winter recovery tactics involve using augers and installing oil recovery pumps in in the middle of the river, which is accessible only if the ice is sufficiently thick. Delineation of the spill is more readily achieved if most of the river is accessible and multiple holes can be drilled to identify the extent of the spill, as depicted in Figure 6.3-11. Once the spill has been delineated under the ice, a pump can be used to remove the oil pooled under the ice as illustrated in Figure 6.3-12. Figure 6.3-13 shows a method for containing the spill using plywood. A saw or multiple auger holes bored in succession could allow for the installation of this kind of barrier.

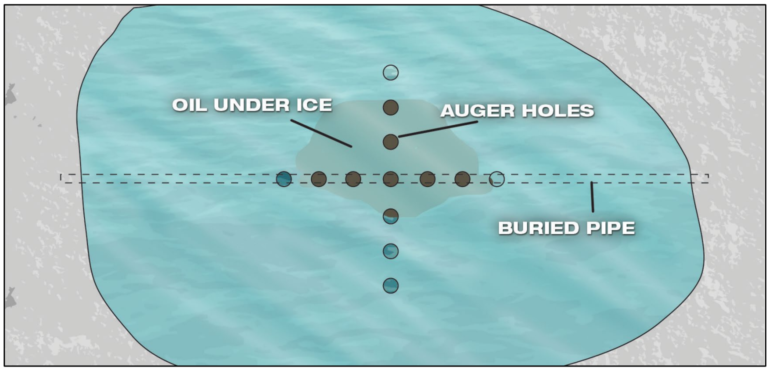


Figure 6.3-11 Under ice spill detection.
Source: Enbridge Inland Spill and Response Tactics Guide; Appendix AG

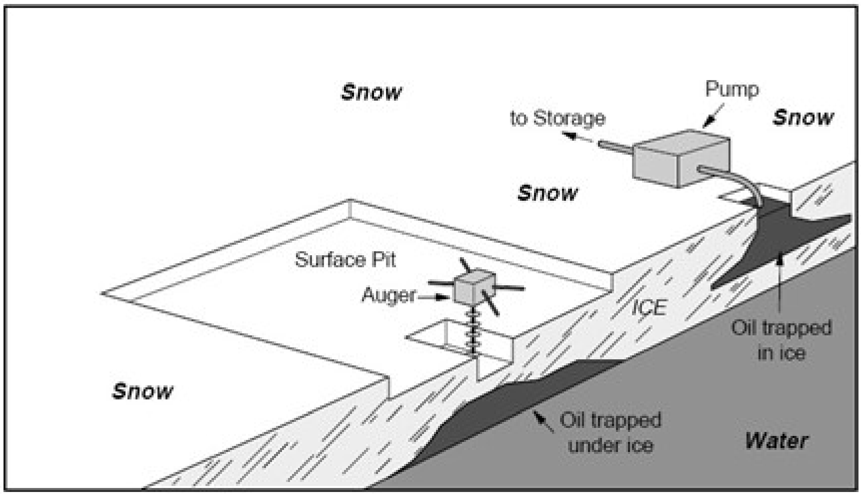


Figure 6.3-12 Under ice oil removal.
Source: Region 5 Regional Response Team

While the oil plume may migrate slowly downstream, winter conditions in general have the lowest river flow rates (meaning the oil would not flow downriver as quickly in the winter). However, late winter and early spring can include some degree of flooding. While a winter spill may not move as quickly downstream, late winter in northern Wisconsin might be one of the more difficult times to quickly respond to a spill. Late winter has the potential for the ice to be insufficiently stable for emergency recovery personnel to walk on and floating ice chunks also make it more difficult to use fair-weather containment strategies such as containment booms. Late winter is more likely to see higher stream velocities as ice and snow melt contribute to higher and faster flow conditions. During winter breakup and spring melt there is potential for a combination of flooding, ice jams, log jams, and ice cover which would complicate response tactics and planned access routes to pre-identified control points.

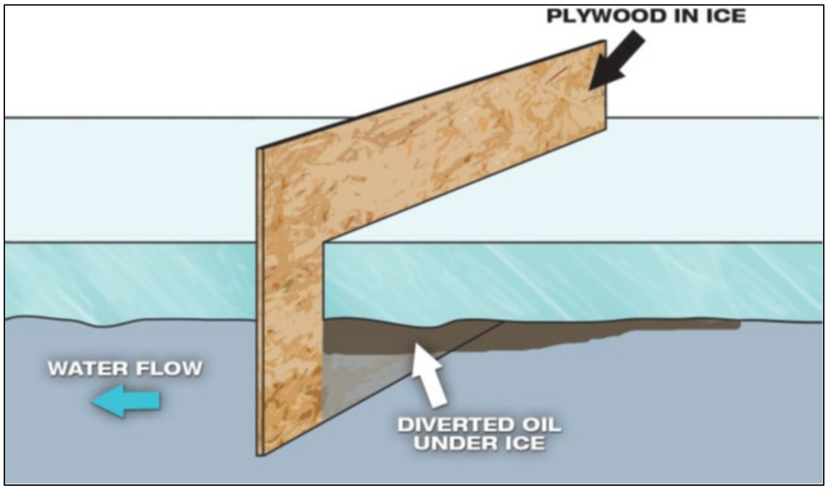


Figure 6.3-13 Under ice spill containment.
Source: Enbridge Inland Spill and Response Tactics Guide; Appendix AG

In the modeling done on the White River during winter ice covered conditions (January), the surface plume was not expected to make it to Lake Superior over the four-day model period for any of the mitigated or unmitigated scenarios. However, the quantity of total dissolved hydrocarbons were the highest with all the winter time releases. This is because evaporation was expected to be zero in these ice-covered conditions, resulting in the more volatile hydrocarbons–which are also the more water-soluble hydrocarbons (benzene, toluene, ethylbenzene, and xylene) mixing in the water column. Once these water-soluble fractions of the oil have dissolved into the water column, it would be difficult to remove them and they would be likely to flow all the way to Lake Superior. According to Enbridge's consultants, "Emergency response activities to [capture] dissolved hydrocarbons are typically not possible and is one of the main reasons why surface floating, shoreline, and sedimented oil are targeted for response, specifically to remove oil so that does not have a chance to dissolve into the water column." (Enbridge Feb 1, 2024, response to DNR information request). A rapid emergency response is extremely important to contain as much of the oil while it is on the surface as possible. Once stranded on the shoreline or dissolved in the water column, it is much more difficult to remove from the environment.

Enbridge's Inland Spill Response Tactics Guide (Appendix AG) provides guidance for oil spill responses in cold weather and ice-covered conditions.

6.3.2.10 Submerged Oil Recovery

After complications related to the Kalamazoo River diluted bitumen spill in 2010 resulted in submerged oil recovery continuing for four years after the spill occurred, it was determined that more research was necessary around the subject of oil-sediment interactions in rivers and the formation, transport, and deposition of oil particle aggregates (OPAs). In particular, it was determined that more information is needed to determine what conditions lead to oil sticking to sediment and being unable to resurface, and how best to clean up future oil spills where OPA formation occurs. Once an oil slick is broken up by river turbulence, especially near rapids, falls, and log jams or during floods, all types of oil in the water column can mix with river sediment and be transported, deposited, and resuspended to downstream areas.

The use of gabion baskets and hydrophilic materials like X-Tex curtains below the water surface are examples of submerged oil assessment and recovery techniques. Once OPAs form and settle on the bottom of the river, the recovery techniques become more limited. If OPAs settle on the river bottom, they can stay in that part of the river for months or even years, only resurfacing if not covered by more sediment or when a large enough river disturbance such as a flood causes a remixing of the river. If OPAs settle along river margins in shallow water, there is a high potential that disturbance of the sediment would result in oil being released and travelling to the surface. In some cases, remediation would include dewatering the river and dredging the OPA contaminated areas or using a mechanical agitator to stir up the settled OPAs so they can be collected once they are resuspended in the water column. In the Kalamazoo River spill cleanup, some of the submerged oil was left in place and assumed to be slowly remediated by natural attenuation (U. S. Environmental Protection Agency (EPA), 2016). Natural attenuation is the process by which natural occurring organisms slowly break down the oil in the immediate environment. This process was first studied extensively after a spill in northern Minnesota occurred near Bemidji in 1979. While natural attenuation could be a viable option, the EPA suggests long-term monitoring of environmental and benthic organism effects should be considered along with the potential for extreme weather to remobilize the sunken oil and re-contaminate the river (U. S. Environmental Protection Agency (EPA), 2016).

Enbridge's Guide for its Submerged Oil Management Program (Appendix AG) provides guidance for addressing submerged oil following a spill.

6.3.3 Remediation

Remediation refers to long-term cleanup and monitoring. Final remedial action of affected oil, sediments, groundwater and surface water can be prolonged actions including environmental investigations and various forms of in-situ or ex-situ remedial action. Remediation of spilled crude oil or other hazardous spill material is typically accomplished by one of the following methods (PHMSA, 2016b):

- Low-temperature thermal desorption (LTTD)–also known as low-temperature thermal volatilization, thermal stripping, and soil roasting–is an ex-situ remedial technology that uses heat to physically separate petroleum hydrocarbons from excavated soils.
- Vacuum trucks may be employed to vacuum concentrated oils from pools or puddles.
- Absorbing sponges or dry chemicals may be used to soak up excess oil.
- Bioremediation–the use of biological agents, such as bacteria or plants, to remove or neutralize contaminants–can help clean ground water contaminated with gasoline, solvents, and other contaminants. Often, the bacteria active in bioremediation are already present in the soil or aquifer, and the process takes place naturally. In some cases, however, the rate of bioremediation is too slow to effectively clean up a plume of contaminated water before it gets to a spring, well, lake, or stream. In those cases, the rate of bioremediation can sometimes be enhanced by adding a substance that acts like a fertilizer to make the bacteria grow and feed more rapidly.
- Excavation–Direct excavation and subsequent disposal of contaminated soil and sediment can quickly remediate contamination. Restoration of excavated areas can vary in difficulty and is considered before choosing this option.
- Gas–usually air or oxygen–may be pressurized and injected into wells installed within the saturated zone, to volatilize contaminants dissolved in groundwater, present as non-aqueous phase liquid, or sorbed to the soil matrix. Volatilized contaminants migrate upward and are removed, typically through soil vapor extraction. This method is most applicable for volatile organic contaminants in relatively moderate to high-permeability geologic materials.
- In-situ flushing, also known as injection/recirculation or in-situ soil washing, is the general injection or infiltration of a solution into a zone of contaminated soil/groundwater, followed by down-gradient extraction of groundwater and contaminants. This is followed by above-ground treatment and/or re-injection. Solutions may consist of surfactants, co-solvents, acids, bases, solvents, or plain water. An excellent understanding of the hydrogeologic regime is essential in employing this method, and it is best applied to moderate to high-permeability soils. This process may be used for a variety of organic contaminants, including non-aqueous phase liquid, as well as some inorganic contaminants.
- In-situ stabilization/solidification, also known as in-situ fixation, or immobilization, is a process of alteration of organic or inorganic contaminants to an innocuous and/or immobile state, by injection of stabilizing agents into a zone of contaminated soil/groundwater. Contaminants are physically bound or enclosed within a stabilized mass (solidification), or their mobility is reduced through chemical reaction (stabilization). Excellent understanding of the hydrogeologic regime is essential in this process as well. This process is best applied to moderate to high-permeability soils and may be used for a variety of organic and inorganic contaminants.

6.3.4 Insurance and Liability

Specific terms of liability insurance are not available as they are treated as “trade secrets” of pipeline operators. A Duluth News Tribune article from September 5, 2018, reported that Enbridge carries a $940 million policy. Enbridge has access to multiple sources of financial resources to fund the response to and remediation of a release. Enbridge is able to draw down cash from operations, issue debt, or acquire commercial paper as a result of its strong credit rating. Enbridge claims that it has the assets needed to fund the containment, remediation, and cleanup activities necessary in the event of a full-bore release/oil spill from Line 5 in Wisconsin. The State of Michigan, through the 2018 Second and Third Agreements, has confirmed the financial ability of the Enbridge entities that are subject to those agreements, to respond to a worst-case discharge from Line 5.

With some exceptions, federal law makes oil pipeline operators like Enbridge liable for the costs associated with removing discharged oil from the pipeline it owns or operates (33 USC § 1321(f)). Enbridge could be liable for "any costs or expenses incurred by the Federal Government or any State government in the restoration or replacement of natural resources damaged or destroyed as a result of a discharge of oil or a hazardous substance..." (33 USC § 1321(f)(4)). Additionally, the Oil Pollution Act, 33 USC Subch. I, provides compensation through the Oil Spill Liability Trust Fund to federal, state, local and tribal governments for costs and damages incurred as a result of an oil pipeline release. The Trust Fund can seek reimbursement from the owner or operator of the pipeline for any funds paid out to claimants. The limit of liability for pipeline operators is $725,710,800 (33 CFR § 138.230(c)). For comparison, Enbridge was required to pay out $177,000,000 in settlement fees after the Kalamazoo River oil spill. One hundred ten million dollars was required to improved 2,000 miles of pipelines in the Midwest region to prevent spills in the future and $62 million was for Clean Water Act violations, and $5.4 million in unreimbursed costs incurred by the government in conjunction with the cleanup (U. S. Department of Justice, 2016).

6.4 Modeled & Historical Effects

6.4.1 Behavior of Crude Oil Releases

Crude oil is not a uniform substance, and its physical and chemical properties can vary widely. Crude oil can be classified as light, medium, and heavy. In general, lighter crude oils are more volatile and more water soluble, while heavy crude oils are of a thicker consistency (high viscosity) and are less flammable. As detailed in Table 1.3-1, Enbridge Line 5 transports approximately 505,000 barrels of oil and NGLs a day, on average. Of this, approximately 70 percent (345,000 bpd) is synthetic light crude, 13 percent (approximately 81,000 bpd) is Bakken crude, and 14 percent (74,000 bpd) is NGLs (Section 1.3.1). These products are shipped in separate batches; they are not mixed. Synthetic light crude and Bakken are both light crudes, characterized by low density, high evaporation rates, high water solubility, and consistently low viscosity over a range of temperatures.

Once the oil is released into the environment, it goes through two transformation processes: weathering and movement, both of which overlap and influence the other in different ways (Fingas, 2014). Weathering is the process of oil breaking down into many different forms. Evaporation is an example of one of the processes oil goes through once released into the environment. Evaporation results in the lightweight oil molecules turning into gas and, in many cases, produces a strong smell. Up to 75 percent of the oil can evaporate during weathering. The less volatile oil molecules become more viscous as they weather, turning the oil into a dark, sticky tar-like material that can adhere to vegetation and rocks, and can be difficult to remove from the environment. Figure 6.4-1 illustrates some oil fate and transport processes. Some of the ways oil breaks down in the environment are described in the following sections and Figure 6.4-2 shows oil weathering processes. For a more detailed explanation of all the ways oil moves and interacts with the environment following a spill, see Appendix AH.

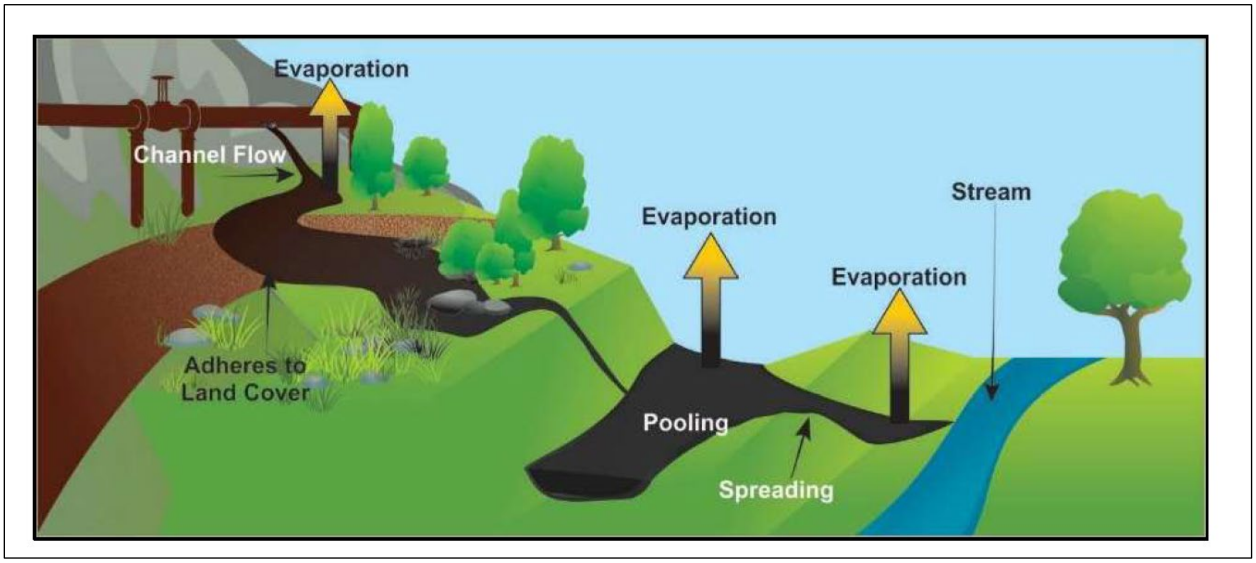


Figure 6.4-1 Concept diagram of land transport depicting the possible fate of oil.
Source: RPS Oil Spill Report; Appendix AH

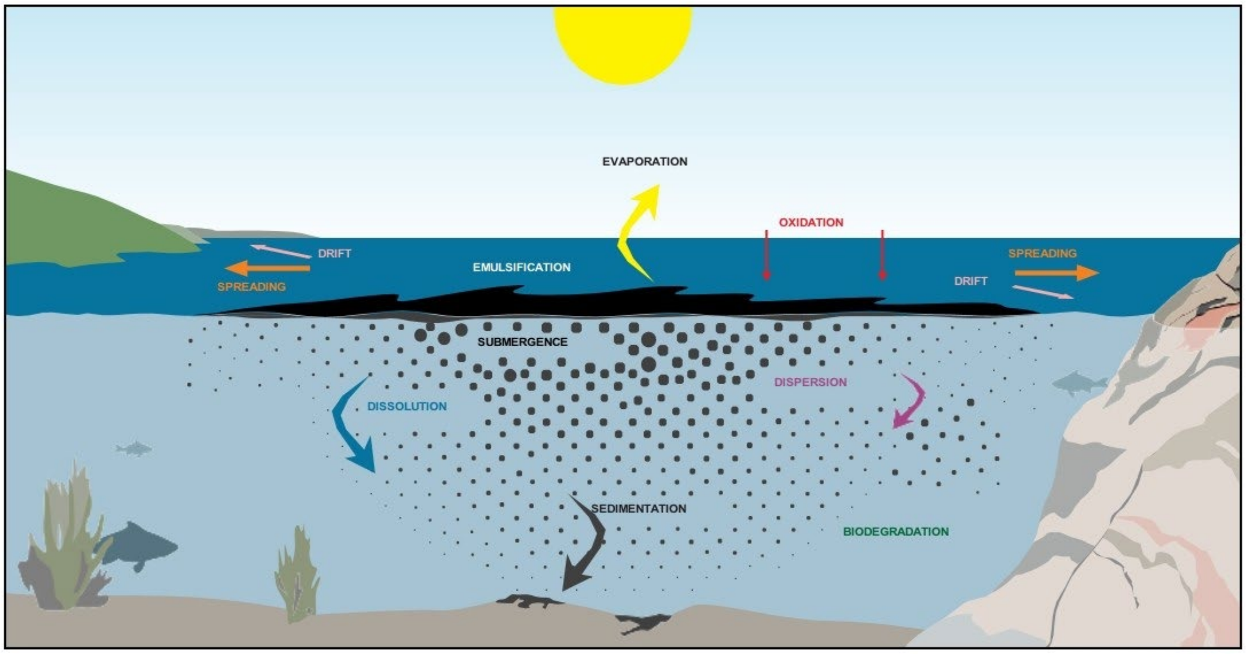


Figure 6.4-2 Oil weathering processes on and in water.
Source: (Environment and Climate Change Canada, 2023)

6.4.1.1 Evaporation

"Evaporation begins immediately after a release, and is the single most important process during the first few hours to two days after the release that results in reduction of volume of the spilled crude oil" (John Mitchell, 2015). Evaporation rates are very high for light crude oil, between 30 percent and 50 percent, especially in open water situations where the oil can spread out quickly to a thin layer. Generally, warmer temperatures, greater sunlight exposure, higher winds, and turbulence promote evaporation. While wind and increased temperature increase evaporations rates, wind greater than 14 miles per hour or water turbulence from waves or rapids can cause the oil slick to start to separate, and isolated oil droplets can form. While evaporation may continue in windy conditions, the formation of oil droplets can result in oil becoming entrained within the water column, which significantly prolongs remediation efforts (F. A. Fitzpatrick, Boufadel, et al., 2015; Gouvernement du Quebec, n.d.). In the winter, oil spills can seep under the ice, limiting evaporation due to the ice cover.

6.4.1.2 Entrainment & Sedimentation

“Sedimented oil” forms when oil, or portions of oil, stick to sediment. This happens from turbulence in rivers caused by flooding, rapids, falls, dams, log jams, or wind that causes the oil droplets to separate from the surface slick and then mix with sediment in the water column, or with sediment on the banks or bed of a river (Figure 6.4-3). Once the oil adheres to sediment or organic particles, the density may exceed one ppm and the oil particle aggregates can be transported, deposited, and resuspended similar to river sediment (F. A. Fitzpatrick, Johnson, et al., 2015). The settling of oil particle aggregates occurs in portions of a river with slow currents, such as pools, impoundments, bank margins, side channels, and oxbows. These characteristics are common in the streams and rivers in the Bad River watershed. Oil droplets can also break into smaller droplets and dissolve in water (Figure 6.4-3). These characteristics would likely result in the need for submerged oil detection, monitoring, and recovery for both light and heavy crude oil spills (F. A. Fitzpatrick, Johnson, et al., 2015). The toxicity of river sediment with oil particle aggregate deposition varies with concentration of the oil, chemicals associated with the type of oil, and oil breakdown products.

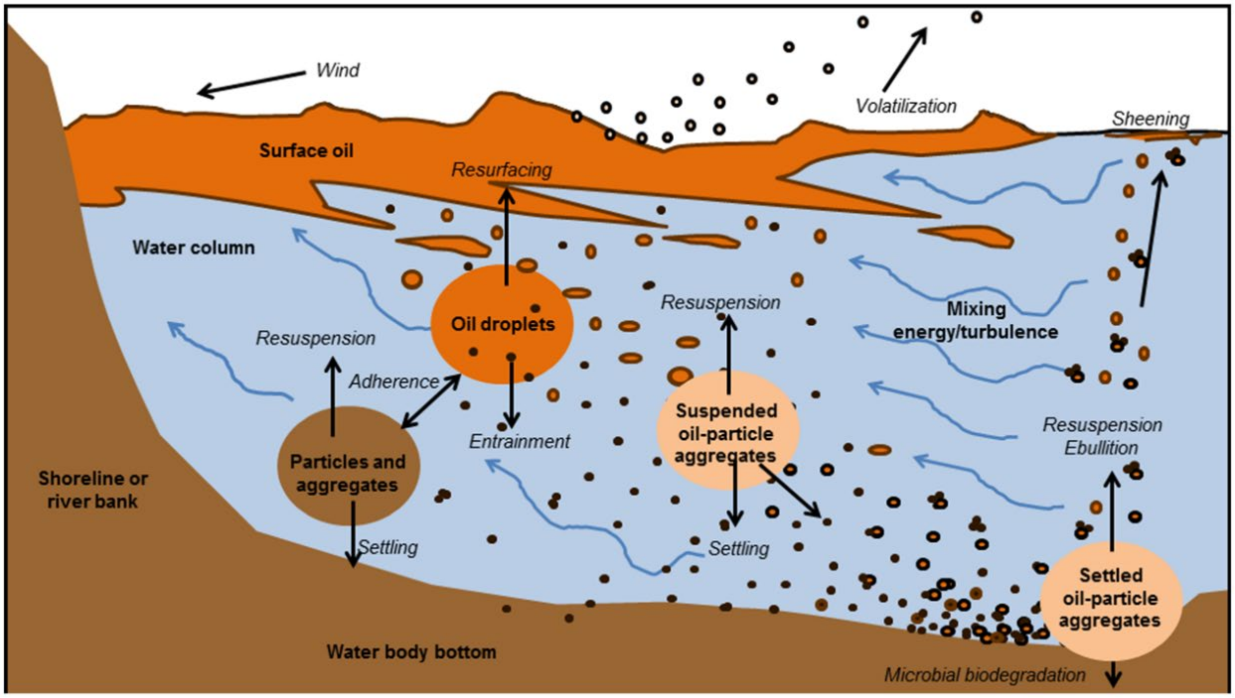


Figure 6.4-3 Breakup of surface oil into oil droplets and mixing with sediment and organic material, and possible processes after formation of oil-particle of settling, resuspension, breakup, and biodegration.

Source: (F. A. Fitzpatrick, Boufadel, et al., 2015)

6.4.1.3 Dissolution

Dissolution is another way oil changes once it is in the environment. This process also involves oil droplets separating from a surface slick and mixing with the water column, but instead of staying as whole oil droplets, dissolution is the process of the oil breaking up into smaller oil molecules, some of which are soluble in water. Once the oil has broken apart, the dissolved hydrocarbons readily mix with water, and the in-water toxicity increases, the result is a die-off of in-water organisms. The RPS report uses an acute toxicity threshold of 50 μg/L for average sensitivity groups and five μg/L for sensitive species. While benzene, toluene, ethylbenzene, and xylene (BTEX) are known to be toxic to all organisms including humans, polycyclic aromatic hydrocarbons (PAHs) are generally considered more of a concern. PAHs are slightly less soluble in water but are also less volatile, making them more likely to last in the environment longer instead of evaporating within the first eight hours of the spill (Horn, 2023a). The most toxic components of oil to pelagic (fish, plankton, amphibians) and benthic (invertebrates, algae) organisms are lower-molecular-weight compounds, which are both volatile and soluble in water, especially the aromatic compounds (French-McCay, 2004).

6.4.1.4 Degradation

Degradation is another common way for oil to change once it is in the environment. This process includes "oil components changing either chemically or biologically to another compound and it includes breakdown by bacteria and other organisms, photo oxidation by solar energy and other chemical reactions" (Horn, 2023a). Degradation occurs on surface floating oil, oil deposited on the shore, entrained oil and dissolved hydrocarbons in the water column, and oil in the sediments (Horn, 2023a). Natural attenuation is an example of natural oil degradation in the environment. Multiple studies of natural attenuation suggest that, while the majority of the microorganisms would be unable to survive oil spill contamination, there will be some hydrocarbon-tolerant microorganisms that would survive and, within a few weeks, would multiply, allowing for natural bioremediation of the spilled oil (Truskewycz et al., 2019). In some instances when an area is inaccessible or remediation of an environment would further damage the site, the decision is made to stop emergency response efforts and allow the oil to be slowly broken down by the microorganisms within the environment.

6.4.2 Spill Fate & Transport Simulations

To better understand the potential impacts of an oil spill in the project area, Enbridge provided oil spill fate and transport simulations for multiple points along the proposed Line 5 relocation route and route alternatives. The two models used for this analysis were OILMAPLand (Section 6.4.2.2) and SIMAP (Spill Impact Model Application Package; Section 6.4.2.3), which are models used to predict the trajectory of a spill, the effects of a spill, and how the oil would breakdown in the environment (Horn, 2020b). These models simulate how oil would move on land and in water including identifying locations where oil may be found after an inadvertent release.

Figure 6.4- shows the outputs of both models along Enbridge's proposed relocation route under a RARV scenario (334 bbl spill) in average stream flow conditions. The SIMAP-modeled surface thickness (mostly less than 1/8 inch) is mapped on top of the OILMPALand plumes for the Bad River and White River. OILMAPLand is a simpler model and is most appropriate for larger-scale broad evaluations of the relative effects of different spill scenarios on sensitive resources (Section 6.4.2.2). The DNR used these plumes to evaluate the potential effects of this spill scenario on environmentally sensitive streams along Enbridge's proposed Line 5 relocation route and route alternative (Section 6.4.4.1, Table 6.4-11). The 12-hour extent of the OILMAPLand plume corresponds to typical spill-response and mitigation times. The SIMAP model shown in the map explicitly accounted for mitigation.

Figure 6.4- show the outputs of both models along Enbridge's proposed relocation route under an FBR spill scenario in high stream flow conditions. In this scenario, the SIMAP-modeled surface thickness extends well past the extent of the OILMAPLand plume for the Bad River, but not as far as the OILMAPLand extent for the White River. This reflects the difference between those two rivers: the Bad River being faster flowing and more turbulent, the White River being more quiescent with many more wetlands along its shores, which could strand oil. As with the HARV average flow scenario, the DNR used the SIMAPLand plumes from the FBR high flow scenario to evaluate the relative effects on environmentally sensitive streams and wetland natural community types along Enbridge's proposed relocation route and the route alternatives (Sections 6.4.4.2, Table 6.4.4.3, Section 6.4.4.3, and Table 6.4-12). This scenario represents a less likely but more damaging scenario. As with the HARV scenario, the 12-hour extent of the OILMAPLand plume corresponds to typical spill-response and mitigation times. The SIMAP model shown in the map explicitly accounted for mitigation. Figure 6.4-5 shows an unmitigated, FBR, high stream flow scenario.

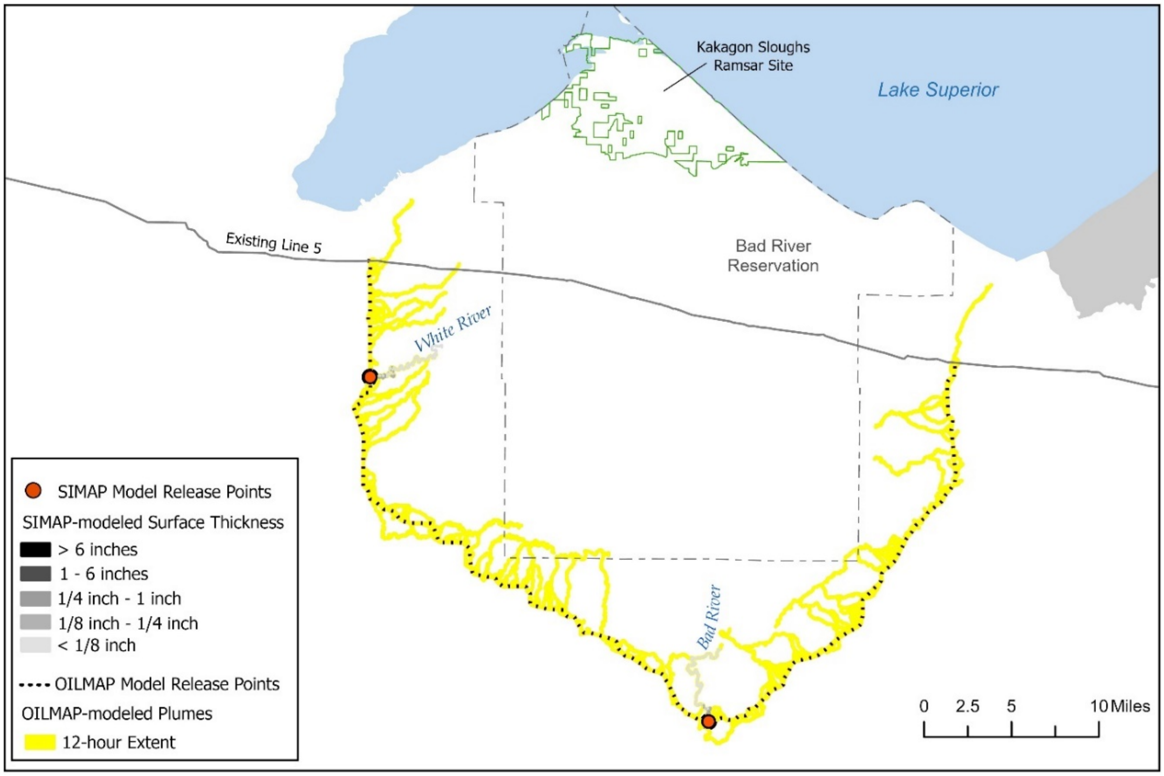


Figure 6.4-4 SIMAP surface thickness and OILMAPLand plumes as modeled by RPS for a mitigated RARV scenario under average stream flow conditions.
Data source: RPS

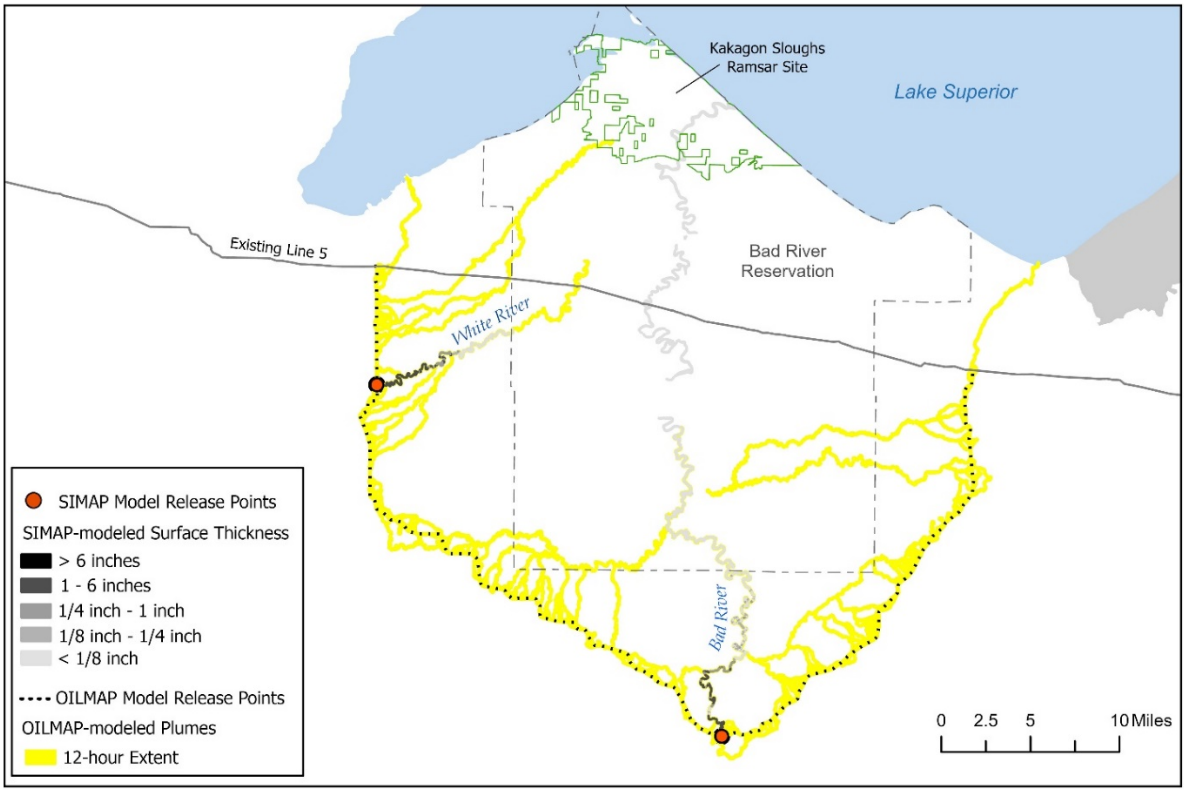


Figure 6.4-5 SIMAP surface thickness and OILMAPLand plumes as modeled by RPS for a mitigated FBR scenario under high stream flow conditions.
Data source: RPS

6.4.2.1 Modeled Rivers in the Project Area

There are six large rivers, and seven prominent creeks in the project area (Table 6.4-1; Section 5.7.3). All these rivers and creeks flow into either the Bad River or Beartrap Creek and from there, flow through the Kakagon and Bad River Slough and directly into Lake Superior. Bay City Creek is the only creek that the proposed pipeline would cross that does not flow into the Bad River and Kakagon Sloughs and instead flows though the City of Ashland and into Chequamegon Bay on Lake Superior. The proposed pipeline route would be located outside of the Bad River Reservation, but the route would pass through multiple watersheds, all of which flow to Lake Superior.

Table 6.4-6 Large rivers and prominent creeks crossed by Enbridge's proposed Line 5 relocation route and route alternatives.

Large rivers	Prominent creeks
White River	Bay City Creek
Brunsweiler River	Beartrap Creek
Marengo River	Little Beartrap Creek
Bad River	Vaughn Creek
Tyler Forks River	Krause Creek
Potato River	Scott Taylor Creek
	Gehrman Creek

The Bad River and White River were used as two representative rivers by RPS in its SIMAP model to show how a spill might impact the area and how quickly it might be able to enter Lake Superior. Example OILMAPLand simulations were run for a set spacing of 100 meters along the proposed pipeline route to show multiple impacts to downstream areas along all sizes of channels and streams.

6.4.2.2 OILMAPLand

OILMAPLand is an oil spill model that was used by Enbridge's consultants to predict how an oil spill would move from land to water along Enbridge's proposed Line 5 relocation route, especially in headwaters and small to medium streams. OILMAPLand is a simplified model that is best used in planning and to quickly inform emergency response related activities in the event of a spill. OILMAPLand is a 2-dimentional modeling system used to simulate the flow of oil from identified rupture points along the pipeline. The OILMAPLand model has three components, including the overland release model, the surface water transport model, and the evaporative model that defines the weathering of oil in the environment under specified conditions (Horn and Fontenault, 2018). OILMAPLand was used to compare Enbridge's proposed relocation route to the three route alternatives and to identify specific HCAs and AOIs that may be affected during an oil spill along each route. Hypothetical oil spill points every 100 meters were simulated along Enbridge's proposed route and along the three route alternatives and the projected path the oil would take at all those different spill locations. The OILMAPLand model is not able to provide entrainment and dissolution rates that can be linked to terrestrial and aquatic toxicity like the SIMAP modeling tool (Section 6.4.2.2), but it does track the expected extent of the oil spill from each oil release point. For the proposed route it was identified that 81.7 percent of largest spills modeled would reach a waterbody in 12 hours or less (Horn, 2023b). Waterbodies are more likely to transport the oil farther, resulting in an increase in overall impact to the terrestrial and aquatic ecosystems.

Figure 6.4-6 shows a representation of multiple release points in the OILMAPland model with the possible extent of the largest spill modeled along Enbridge's proposed route, the existing Line 5 route, and the route alternatives. This figure shows the possible spill trajectories up to 12 hours after a spill assuming no remediation has been put in place. The light green is the trajectory of Enbridge's proposed relocation route and includes 732 different hypothetical release points on that route.

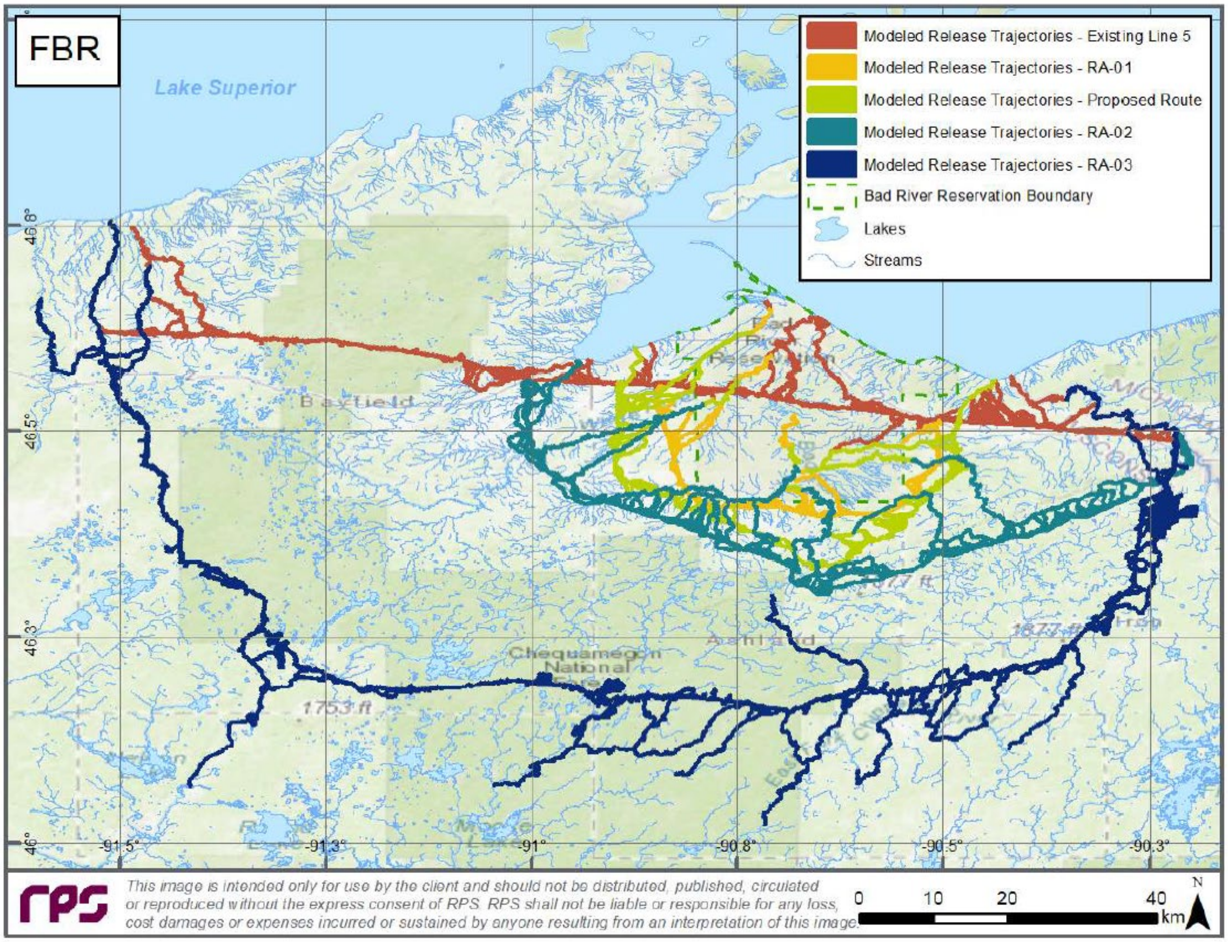


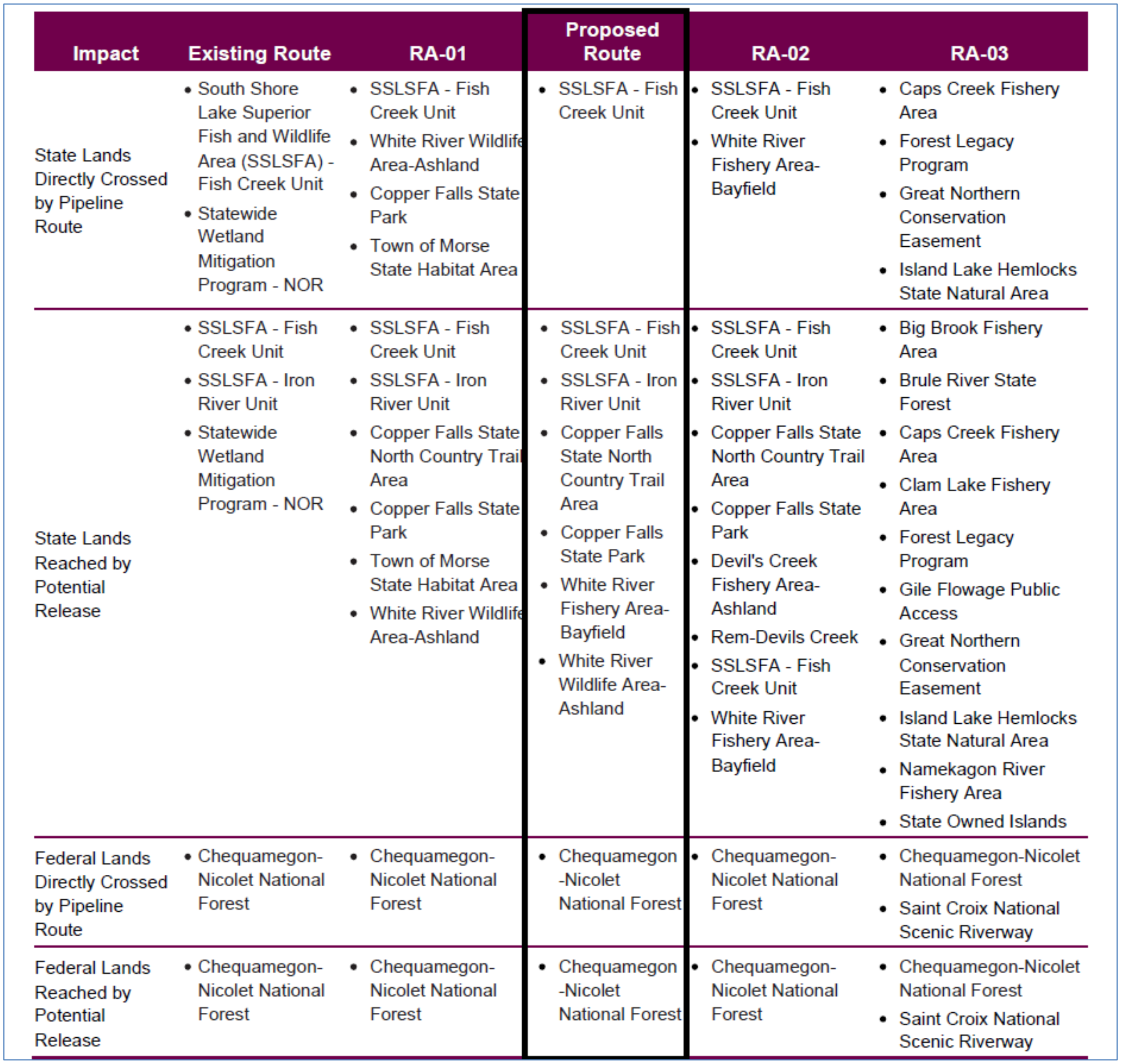
Figure 6.4-7 Modeled release trajectories under high river flow conditions for a FBR modeled using OILMAPland for all pipeline routes.

Some trajectories may not be visible as they are underneath trajectories for another route.

Source: RPS Technical Appendix C; Appendix AH

Based on the OILMAPLand trajectories shown in Figure 6.4-6, Enbridge's consultant was able to compile a list of HCAs and AOIs that would be impacted based on each of Enbridge's route alternatives. Table 6.4-2 and Table 6.4-3 from the RPS Report show HCAs and state lands that are predicted to be impacted by the proposed route and each route alternative. Appendix C of the RPS Report (Appendix AH, Part 6) further calculated the number of miles the pipeline would directly and indirectly impact an HCA or an AOI for each proposed route. At the end of the OILMAPLand report each proposed route was ranked based on total length of pipeline to be built, length of pipeline in wetlands, impact-based on mileage of impacts to HCAs and AOIs, and potential for a spill to reach water (Table 6-1 of Appendix AH, Part 6).

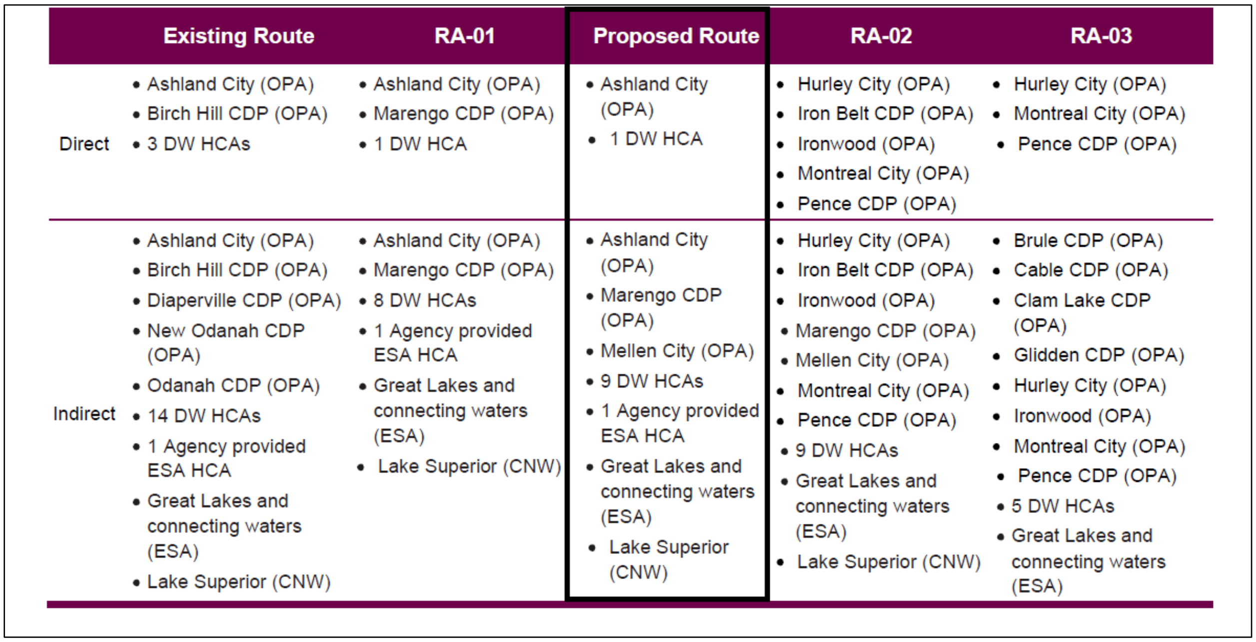
Table 6.4-8 Unique federal and state AOIs predicted to be impacted by a FBR modeled using OIL-MAPland for each route alternative.



Impact	Existing Route	RA-01	Proposed Route	RA-02	RA-03
State Lands Directly Crossed by Pipeline Route	• South Shore Lake Superior Fish and Wildlife Area (SSLSFA) - Fish Creek Unit • Statewide Wetland Mitigation Program - NOR	• SSLSFA - Fish Creek Unit • White River Wildlif Area-Ashland • Copper Falls State Park • Town of Morse State Habitat Area	• SSLSFA - Fish Creek Unit	• SSLSFA - Fish Creek Unit • White River Fishery Area-Bayfield	• Caps Creek Fishery Area • Forest Legacy Program • Great Northern Conservation Easement • Island Lake Hemlocks State Natural Area
State Lands Reached by Potential Release	• SSLSFA - Fish Creek Unit • SSLSFA - Iron River Unit • Statewide Wetland Mitigation Program - NOR	• SSLSFA - Fish Creek Unit • SSLSFA - Iron River Unit • Copper Falls State North Country Trai Area • Copper Falls State Park • Town of Morse State Habitat Area • White River Wildlif Area-Ashland	• SSLSFA - Fish Creek Unit • SSLSFA - Iron River Unit • Copper Falls State North Country Trail Area • Copper Falls State Park • White River Fishery Area-Bayfield • White River Wildlife Area-Ashland	• SSLSFA - Fish Creek Unit • SSLSFA - Iron River Unit • Copper Falls State North Country Trail Area • Copper Falls State Park • Devil's Creek Fishery Area-Ashland • Rem-Devils Creek • SSLSFA - Fish Creek Unit • White River Fishery Area-Bayfield	• Big Brook Fishery Area • Brule River State Forest • Caps Creek Fishery Area • Clam Lake Fishery Area • Forest Legacy Program • Gile Flowage Public Access • Great Northern Conservation Easement • Island Lake Hemlocks State Natural Area • Namekagon River Fishery Area • State Owned Islands
Federal Lands Directly Crossed by Pipeline Route	• Chequamegon-Nicolet National Forest	• Chequamegon-Nicolet National Forest	• Chequamegon-Nicolet National Forest	• Chequamegon-Nicolet National Forest	• Chequamegon-Nicolet National Forest • Saint Croix National Scenic Riverway
Federal Lands Reached by Potential Release	• Chequamegon-Nicolet National Forest	• Chequamegon-Nicolet National Forest	• Chequamegon-Nicolet National Forest	• Chequamegon-Nicolet National Forest	• Chequamegon-Nicolet National Forest • Saint Croix National Scenic Riverway

Source: Appendix C of RPS Oil Spill Report; Appendix AH

Table 6.4-9 Unique HCAs predicted to be impacted by a FBR modeled using OILMAPland for each route alternative.



	Existing Route	RA-01	Proposed Route	RA-02	RA-03
Direct	• Ashland City (OPA) • Birch Hill CDP (OPA) • 3 DW HCAs	• Ashland City (OPA) • Marengo CDP (OPA) • 1 DW HCA	• Ashland City (OPA) • 1 DW HCA	• Hurley City (OPA) • Iron Belt CDP (OPA) • Ironwood (OPA) • Montreal City (OPA) • Pence CDP (OPA)	• Hurley City (OPA) • Montreal City (OPA) • Pence CDP (OPA)
Indirect	• Ashland City (OPA) • Birch Hill CDP (OPA) • Diaperville CDP (OPA) • New Odanah CDP (OPA) • Odanah CDP (OPA) • 14 DW HCAs • 1 Agency provided ESA HCA • Great Lakes and connecting waters (ESA) • Lake Superior (CNW)	• Ashland City (OPA) • Marengo CDP (OPA) • 8 DW HCAs • 1 Agency provided ESA HCA • Great Lakes and connecting waters (ESA) • Lake Superior (CNW)	• Ashland City (OPA) • Marengo CDP (OPA) • Mellen City (OPA) • 9 DW HCAs • 1 Agency provided ESA HCA • Great Lakes and connecting waters (ESA) • Lake Superior (CNW)	• Hurley City (OPA) • Iron Belt CDP (OPA) • Ironwood (OPA) • Marengo CDP (OPA) • Mellen City (OPA) • Montreal City (OPA) • Pence CDP (OPA) • 9 DW HCAs • Great Lakes and connecting waters (ESA) • Lake Superior (CNW)	• Brule CDP (OPA) • Cable CDP (OPA) • Clam Lake CDP (OPA) • Glidden CDP (OPA) • Hurley City (OPA) • Ironwood (OPA) • Montreal City (OPA) • Pence CDP (OPA) • 5 DW HCAs • Great Lakes and connecting waters (ESA)

Source: Appendix C of RPS Oil Spill Report; Appendix AH

6.4.2.3 SIMAP

SIMAP is a 3-dimensional Lagrangian modeling system developed to predict the trajectory, fate, and acute effects of released hydrocarbons on land and in water (Horn and Fontenault, 2018). SIMAP was used by Enbridge's consultants to predict the impacts of a hypothetical oil spill directly into the Bad River and White River at Enbridge's proposed Line 5 crossing locations (Figure 6.4-2). SIMAP provides an in depth understanding of oil in the environment and estimates the distribution of whole oil and groups of oil components on the water surface, on shorelines, in the water column, on sediments, and evaporated to the atmosphere (Horn and Fontenault, 2018). The SIMAP model was used in larger rivers where specific stream inputs are available and incorporated into the model, including shoreline habitat, current speeds, suspended solids, oil acute toxicity, etc. Small rivers and streams are less likely to have USGS gauge stations or regular monitoring data on flow, biodiversity, flood conditions, etc. With these additional attributes, the model can identify the biological effects an oil spill would be likely to have on specific habitats including mortality rates of impacted aquatic and terrestrial organisms.

For the SIMAP models, the spill location for each river modeled was at the location where Enbridge proposes crossing the Bad River and White River. Enbridge's proposed pipeline crossing intersects the Bad River approximately 50 river miles upriver from Lake Superior near the town of Mellen. The proposed pipeline would cross the White River approximately 25 miles upriver from Lake Superior, downstream of the hydroelectric dam near where Highway 112 crosses the White River. The crossing of the pipeline on the White River is much closer (half the distance in river miles) from where the pipeline crosses the Bad River. As noted elsewhere, the Bad River is faster flowing and more turbulent, while the White River is more quiescent with many more wetlands along its shores, which could strand oil.

SIMAP is a sophisticated spill modeling tool, but like all models it is bound to certain restrictions. Since an oil spill into a river environment is dependent on the specific river conditions at the time of the release, it is hard to make assumptions on how a large spill might impact some of the surrounding areas. The goal of the SIMAP simulations was to illustrate the worst oiling conditions for what could potentially reach

Lake Superior. Three flow scenarios were simulated, including high flow, average flow, and low flow under ice.

The high flow (but not overbank) simulation was meant to show the fastest and furthest downstream extent of surface oil and sheen and oiled shoreline. The high flow was chosen specifically to keep flows from spreading out into overbank areas, which would potentially decrease the furthest extent of the oil reaching Lake Superior.

The winter low flow simulation with ice cover was expected to slow the movement of the oil and reduce weathering. Normally, high evaporation rates associated with light crude oil would be expected to reduce the spill volume by around 40 percent within the first four to eight hours. With ice cover the evaporation-related reduction of spill volume is zero percent. The main goal of the winter low flow model is to highlight worse case for the maximum dissolved hydrocarbons within the water column and the corresponding impact to aquatic species. Some assumptions are made during the winter model that are not always realistic, namely that the river would be continuously covered in ice. While the river mostly would be ice covered in winter, on the Bad River there are several waterfalls that are not going to be ice covered which would cause some inconsistencies in the winter oil spill model. The model also predicts no effects during the winter to mammals and waterfowl. This also assumes complete ice coverage of the river which may not be the case as ice can be unpredictable and oil can get caught in pockets or crevices. These models are meant to provide a more complete picture of what could be expected during and oil spill but should not be used as exact predictions of how an oil spill in these rivers would progress.

The model during average river flow shows how slightly slower river flow rates than the high flow results in an increase in oil exposure time to organisms. This average flow scenario balances downstream transport, exposure duration, entrainment, and dissolution, not necessarily highlighting the extremes but providing an example of how all the variables may be affected to some degree. The SIMAP model does not include the formation, transport, or deposition of oil-particle aggregates.

6.4.2.4 Modeled River Flow Rates

For the OILMAPand model runs, a range of velocities were attributed to four flow scenarios including a highest flow, high flow, annual average, and low flow (Table 6.4-1).

Table 6.4-1 Simulated stream velocities.

Flow	Steam velocities (meters/second)	Description of stream velocities
Highest flow	0.40 to 0.80 m/s	Represents the 95 percentile of flow velocity range throughout the watershed under this flow condition.
High Flow (April)	0.23 to 4.3 m/s	Monthly average stream velocity for the month of highest stream flow.
Annual Average (June)	0.19 to 0.32 m/s	Represented by the annual average stream velocity for the year. Lower than the high flow, but higher than the low flow velocity.
Low Flow (January)	0.12 to 0.25 m/s	Represented by the monthly average stream velocity for the month of lowest streamflow.

Source: OILMAPLand Modeling Memo January 30, 2024

For the SIMAP models, three different river flow rates were modeled: low (January), average (June), and high (April) flow. The flow rates were calculated using the single stream velocity for one drainage basin and applying that velocity to all stream segments within that basin (Horn, 2023a). The high river flow was calculated by identifying which month out of the year had the maximum average velocity and using that monthly average (Horn, 2023a). It should be noted that this high flow is not representative of a high flow that may occur after a storm event but instead is an average of high flows over one month. It was determined that April had the highest average flow rate throughout the year, although October was also a time of relatively high flow. In general, spring (March through May) is a time when high flow conditions, including flooding, are expected within the project area (Section 5.7.3). The average flow was determined by the monthly mean velocity and was best represented by the water flow in June. The low river flow was determined by looking at the month that represented the minimum average monthly velocities which was determined to be January (Horn, 2023a). January also provided a river with ice covered conditions which was an important variable to include in the modeling.

The modeling mostly suggests that the higher the flow, the faster the oil plume would move downstream. However, depending on the height of the water in the river, absorbent shorelines with thick vegetation were sometimes predicted to be exposed and sometimes under water. The amount of exposed wetland or vegetated bank greatly influenced the extent of shoreline affected by the spilled oil. Table 6.4-2 summarizes modeled scenarios.

Table 6.4-2 Bad River and White River SIMAP spill scenarios.

Bad and White River spill scenarios modeled in SIMAP				
Spill site	**Spill event & response**	**River flow**	**Month**	**Volume spilled (bbl)**
Proposed Line 5 Pipeline Crossing of Bad River & White River	FBR Unmitigated	High	April	9,874 (Bad River) 8,517 (White River)
		Average	June	
		Low	January	
	HARV Unmitigated	High	April	1,911
		Average	June	
		Low	January	
	RARV Unmitigated	Average	June	334
	FBR Mitigated	High	April	9,874 (Bad River) 8,517 (White River)
		Average	June	
		Low	January	
	HARV Mitigated	High	April	1,911
		Average	June	
		Low	January	
	RARV Mitigated	Average	June	334

As mentioned earlier in the historical spills section, the oil spill into the Kalamazoo River in 2010 was an example of a spill that occurred during flood conditions that resulted in stranded oil throughout floodplains, backwaters, riparian wetlands, and other overbank areas. The entire 2.25 mile shoreline of the Talmadge Creek which flows into the Kalamazoo River had to be excavated completely after the adjacent wetlands were cleaned up due to the presence of remaining oil in the banks and bed of the creek (Dollhopf et al., 2014). In the Kalamazoo River oil spill, the flood waters were also able to move the leading edge of the spill downstream quickly. It was estimated that the spill plume was traveling at a speed of 1.25 miles per hour in the first few days after the release (Dollhopf et al., 2014). The Kalamazoo River spill provides an example of how flood conditions can have variable results. While a significant amount of oil is likely to strand upriver on shoreline, flood conditions also indicate the ability for swift transport of the oil plume downstream. The lack of a model showing an oil spill during flood conditions for Enbridge's proposed Line 5 pipeline relocation provides an incomplete picture of potential environmental impacts and cleanup scenarios needed. This is especially relevant in this part of Wisconsin where the rivers flood frequently and pipelines may rupture during floods.

6.4.2.5 River Variability

One of the conditions that changes during high flow is the water level within the river. In most cases, the higher flow results in an oil plume being able to move faster downstream, resulting in the greatest extent of downstream damage. Oil is more likely to stick to vegetation, especially low-lying wetland vegetation and less likely to stick to sandy or rocky shorelines. At high flow with more water in the river, vegetation gets covered allowing the water and oil to move more quickly downstream.

Many of the rivers in the project area originate south of the Penokee/Gogebic Range which is a small ridgeline that runs through Iron and Ashland counties inland from Lake Superior about 20 miles. This changing topography results in different shorelines as the rivers run north to Lake Superior. The upriver portions of the rivers have much steeper riverbanks with rocky substrates that the rivers have carved through overtime. This is especially notable on the Copper, Tyler Forks, and Potato rivers. As the rivers flow north, the rocky uplands are no longer present and much of the landscape changes to low-lying flood plain with red clay sand banks that easily erode. There is also an increase in wetlands and bogs with wide meandering rivers as the rivers get closer to Lake Superior. The river landscape with the steep riverbanks closer to where the spill would occur, indicate that the oil is more likely to move quickly downstream and spread out more as it reaches the mouth of the river closer to Lake Superior.

In the historical spills section (Section 6.4.3), the spill in the Chaudière River near Quebec is highlighted as an example that resulted in oil mixing with sediment and settling at the bottom. One of the reasons that the Chaudière River spill resulted in high sedimented oil was due to the variable flow of the river, which was identified as being between 11 to 470 cubic meters per second (de Santiago-Martín et al., 2015). Looking at the USGS gauge station (USGS 04027000) on the Bad River near Elm Hoist Rd and comparing it to the USGS gage station USGS 04027000) on the Marengo River (approximately five river miles before the Marengo converges with the Bad River) the discharge rates on the Marengo River and Bad River also show a variable flow to be between 82 to 359 cubic meters per second (Section 5.7.6).

Figure 6.4-10 Shoreline variability along the White River.
Photos: Lucas Mulhall, DNR (Left) Georgia Moriarty, DNR (Right)

Figure 6.4-10 shows the shoreline variability present along the White River. The first photo (left) shows the White River within one-half mile of Enbridge's proposed pipeline crossing near Highway 112. The second photo (right) shows the White River within one-half mile of the confluence with the Bad River near U.S. Highway 2. The upriver photo shows a much rockier shoreline with exposed bedrock in some areas whereas the downriver photo shows the sedges and grasses in a flat, flood prone landscape. It would be expected that oil would move quickly over the rocky upriver portion and would be more likely to be retained in the sedge meadow vegetation downriver. Turbulent flows through the rocky rapids would likely break up the slick and cause the oil to mix into the water column, allowing for faster formation of oil particle aggregates and dissolution.

While that is what happened in most of the oil spill models provided by Enbridge, the unmitigated spill on the White River during a FBR release at high flow showed an unexpected result. The oil did not progress quickly down the river and instead got trapped in a wetland area that, at lower water levels, is not exposed. It was explained in the RPS Report (Table 4-8 of RPS's Appendix B; Appendix AH), at high river flow conditions, wetlands covered more than 50 percent of the White River, whereas under average flow conditions, the exposed shorelines on the White River was much less able to absorb oil as more than 90 percent of the shoreline consisted of sand and mud (Horn, 2023a). In this case, the average flow conditions on the White River showed the oil plume having the maximum reach from the spill location, in an unmitigated release, reaching Lake Superior in approximately three days (Table 4-2 of RPS's Appendix B; Appendix AH) (Horn, 2023a). This is a helpful example to highlight that the oil spill does not always behave as predicted and different environmental conditions can result in different areas being more or less impacted.

The Bad River being the most extreme example of the changing river shoreline (Figure 6.4-8) with Copper Falls (right) providing an example of the rocky upland terrain in the upstream portion of the river compared to the wild rice bed habitat located at the mouth of the Bad River (left). The point where Enbridge's proposed Line 5 pipeline relocation would cross the Bad River is approximately 50 feet wide, and where the Bad River enters Lake Superior, it is approximately 500 feet wide.

Figure 6.4-11 he Bad River. Left: 5 miles from the mouth at Lake Superior. Right: in Copper Falls State Park.
Photos: Georgia Moriarty, DNR

6.4.2.6 Mitigated & Unmitigated Oil Spills

Enbridge's oil spill model simulations included predictions of spill trajectories for both mitigated and unmitigated scenarios. A mitigated spill is a spill that is actively cleaned up by emergency response personnel as quickly as possible after the unintentional release. Enbridge anticipates that after identifying a spill, emergency response personnel could be onsite actively attempting oil containment and removal as fast as 3.1 hours after the initial release (Horn, 2023a) and that most of the surface oil would be removed in one to three days. This is assuming that all the mitigations were able to be put in place at the preidentified remediation control points in the expected timeframes, which according to Enbridge's February 1, 2024, response to a DNR information request ranged from three to 10 hours depending on the control point locations (Section 6.3.2.5). PHMSA regulations require a response within 10 hours. Mitigation efforts include three main target cleanup locations: the surface oil plume (usually the largest concentration of whole oil), total hydrocarbons (THC) on shorelines and on sediments, and THC dissolved (oil that has mixed with water).

An unmitigated spill is a spill that is unable to be cleaned up as quickly as anticipated. It is not uncommon that accessibility is limited due to proximity to roads or, weather-related hazards including poor visibility, snow cover, or flooding. Inclement weather may hinder flyover operations, such as the delayed response in 2014 following a release of Bakken crude oil from a barge collision on the Mississippi River during heavy fog (NOAA, 2014). Enbridge notes that it is unlikely that an oil spill would go four days without mitigation. However, historical spills have shown that sometimes environmental, human error, or safety can get in the way of responding quickly to an oil spill. Identifying the worst-case scenario is done by looking at the unmitigated spills. Figure 6.4-9 illustrates the worst-case scenario modeled by RPS for Enbridge's proposed relocation route: An unmitigated, full-bore rupture under high-flow conditions. The map shows SIMAP-modeled surface oil thickness for the Bad River and the White River overlaying the OILMAPLand plumes modeled for four days under high-flow conditions.

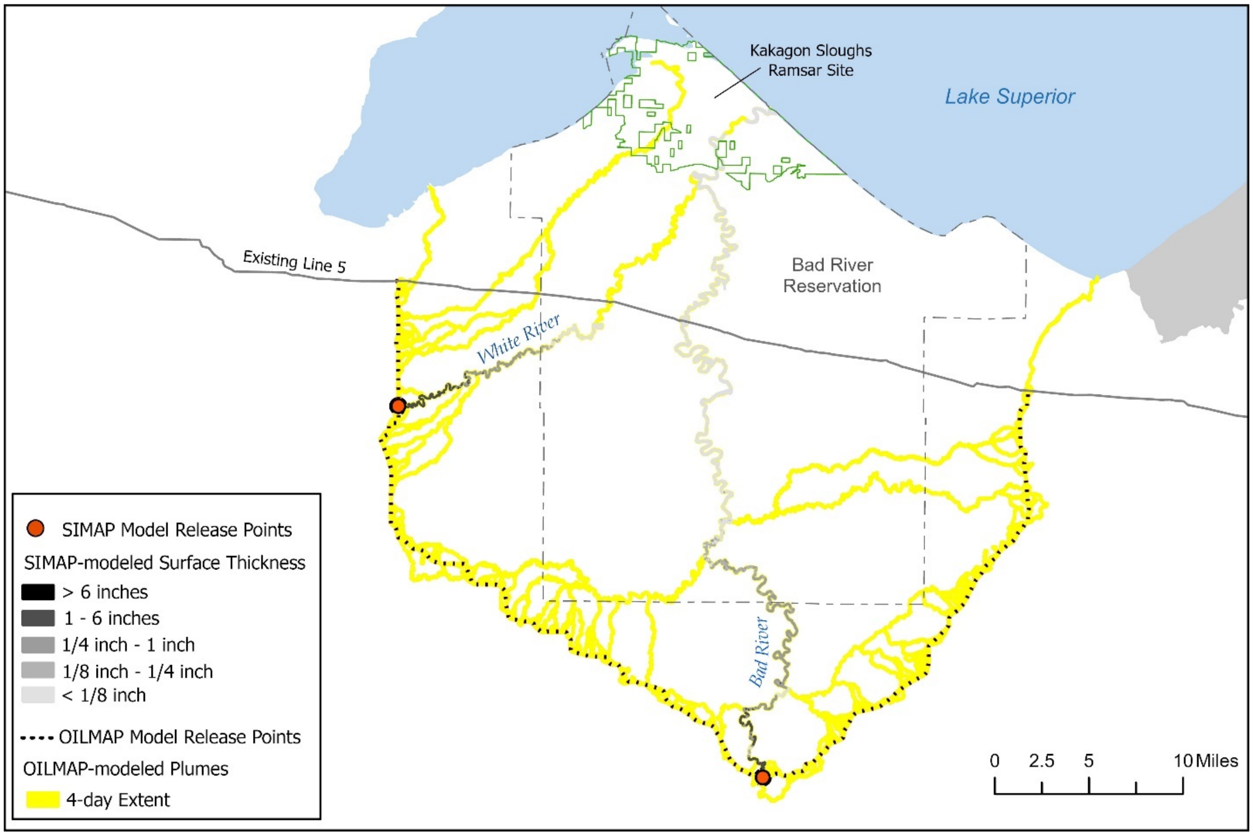


Figure 6.4-12 SIMAP surface thickness and OILMAPLand plumes in an unmitigated FBR spill scenario under high-flow conditions.

The SIMAP models show the concentrations and fate of oil in those three-target locations for each spill type modeled. Even though the concentrations are low, it is important to note that even during a mitigated spill for the Bad River that after four days some oil is predicted to make it to Lake Superior in the form of surface oil, dissolved hydrocarbons, and total hydrocarbons on shoreline and on sediments.

- Surface Oil – On the Bad River, three3 out of the seven modeled scenarios showed a thin sheen of surface oil reaching Lake Superior even during a mitigated spill (these included FBR spills during average and high flow, and a HARV spill during high flow). On the White River, during a mitigated spill, all modeled scenarios showed no surface oil reaching Lake Superior.

- Total Dissolved Hydrocarbons – Total dissolved hydrocarbons reached Lake Superior in six out of seven of the modeled spill scenarios during a mitigated spill on the Bad River. On the White River mitigation worked slightly better and in three of the seven modeled spills for dissolved hydrocarbons reached Lake Superior.

- Total Hydrocarbons on Shore and on Sediments – On the Bad River three out of 10 of the mitigated spills had oil on the shoreline or on the sediment lining the rivers all the way to Lake Superior. These included during a FBR spill at high and average flow during a HARV spill during high flow). For THC on shore and on sediments for the White River, one of the 10 modeled scenarios during a mitigated spill reached Lake Superior (FBR spill during average flow, oil on sediment was predicted to reach Lake Superior within four days).

The fact that oil from the Bad River would reach Lake Superior in less than four days, even with a mitigated spill, highlights how important the successful installation of mitigation strategies within the first day would be in stopping the oil from reaching Lake Superior. Model simulations of the White River show that surface oil would be upstream of the Bad River confluence after four days, even though the distance to Lake Superior is much shorter (25 miles instead of 50 miles). In general, because of how the wetlands were included in the shorelines for high flow simulations and the lower velocities of the White River, the unmitigated and mitigated simulations for the White River show that within four days surface oil was upstream of the Bad River confluence and not reaching Lake Superior.

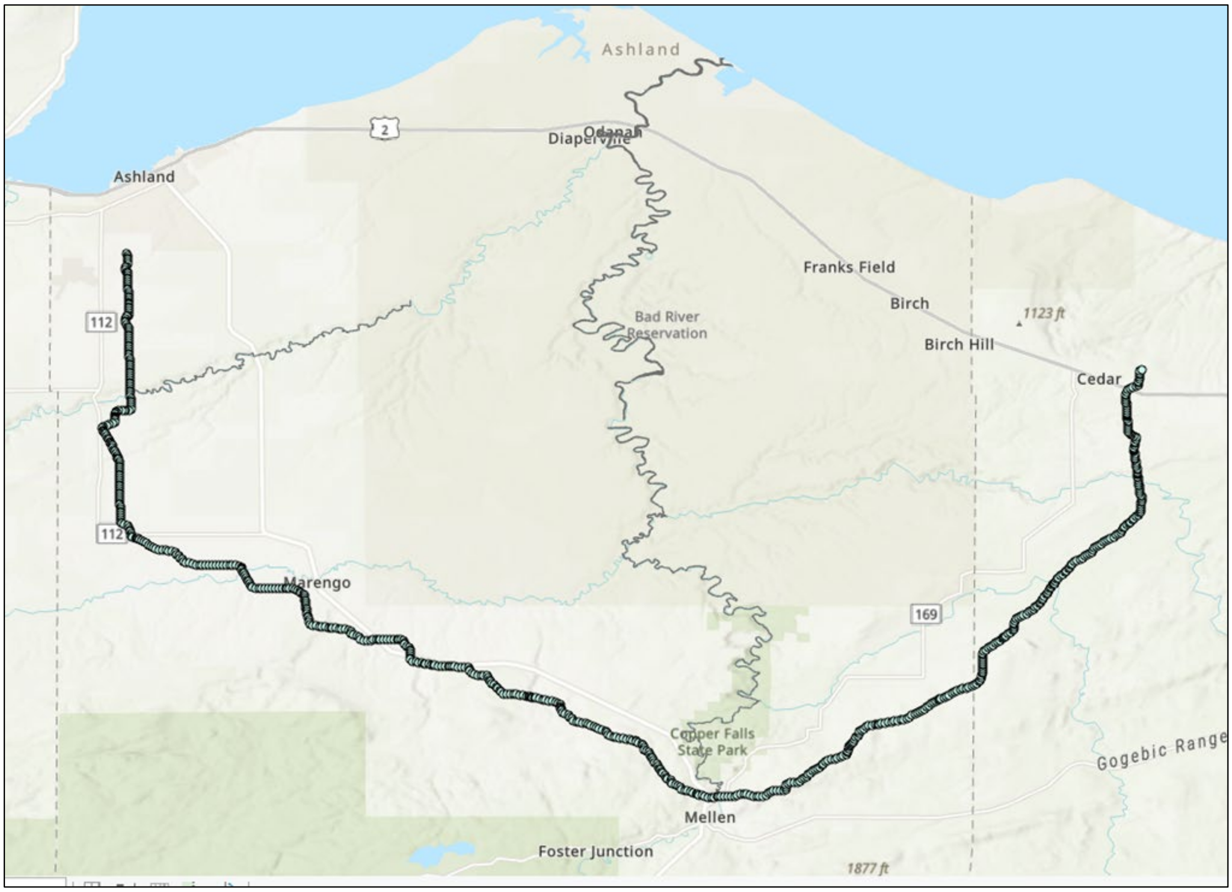


Figure 6.4-13 Limitations of response and oil containment tactics extent of surface oil in mitigated spill high flow scenarios along the White River and Bad River from 4-day SIMAP model simulation.

6.4.2.7 Surface Oil

The oil on the surface of a waterbody is called a surface oil plume and is usually the greatest concentration of oil after a spill. Since oil and water do not readily mix with each other without some sort of agitation (wind, turbulence, etc.) most of the oil pools on top of the waterbody tend to spread into a thin film across the water extending as far as possible. This surface oil plume in ideal conditions (without waterfalls, rapids, vegetative roughness, and large wood) can be relatively easy to contain with conventional cleanup techniques such as absorbent boom configurations Section 4.3.2.6). The problems with oil recovery arise when either mitigations cannot be put in place quickly (due to weather, time of day, etc.) or when the oil does not stay on the surface and either becomes entrained in the water column, adheres to the sediment, or strands on the shore and adjacent overbank areas. A quick response targeting the surface oil plume is the most important area to focus on during the cleanup efforts, but techniques must be implemented immediately to document entrainment of oil in the water column.

The models for surface oil identify that on both the White River and Bad River in an unmitigated FBR under average river flow conditions “the majority of oil was predicted to form surface slicks that would move downstream, stranding on shorelines and evaporating, with the potential for 35 percent to 39 percent of the release to remain on the surface or enter Lake Superior.” The mass balance graphs below show the same exact spill on the Bad River, one that is mitigated and one that is not.

The unmitigated spill (Figure 6.4-14) shows that after four days of a FBR spill on the Bad River, up to almost 40 percent of the oil could make it to Lake Superior as surface oil (about 3,900 barrels), 10 percent would likely stand on the shoreline and 50 percent would have evaporated. The mitigated spill (Figure 6.4-15) shows a similar amount of oil evaporating (40%) and stranding on shore (5%) but the surface oil is almost completely removed after 2.5 days in the mitigated scenario. The mass balance graphs show that successful installation of mitigation strategies would be hugely successful in stopping the surface oil from reaching Lake Superior in that model scenario.

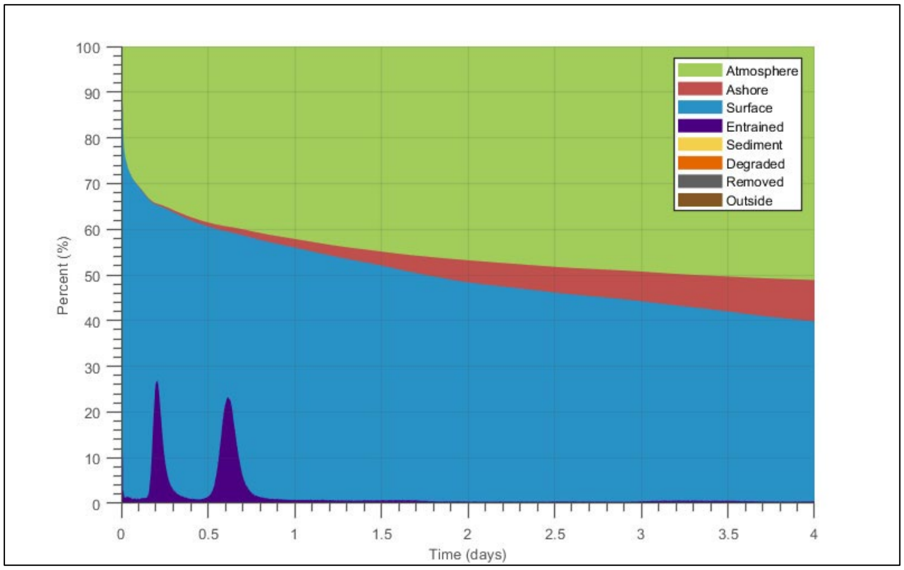


Figure 6.4-14 Oil mass balance graph for the unmitigated FBR scenario in average river flow conditions modeled in June at the Bad River channel location.
Source: Appendix B of RPS’s Oil; Appendix AH

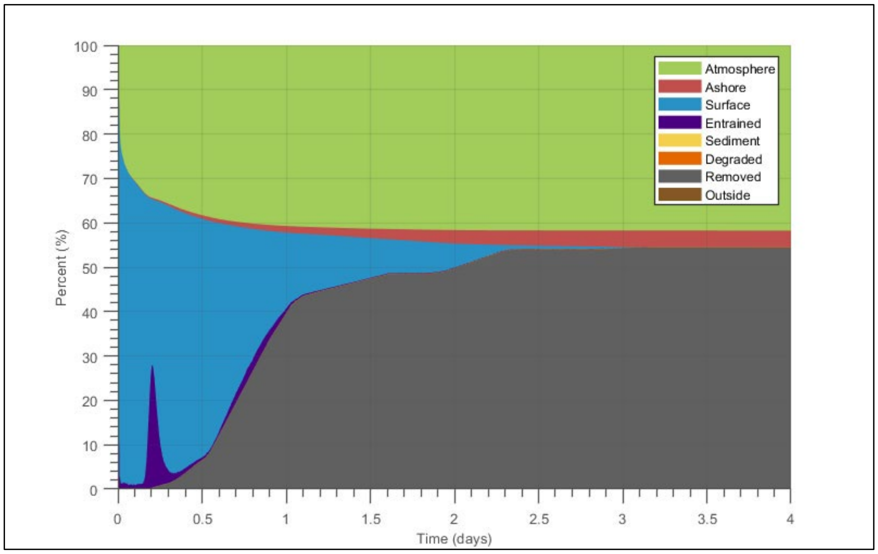


Figure 6.4-15 Oil mass balance graph for the mitigated FBR scenario in average river flow conditions modeled in June at the Bad River channel location.
Source: Appendix B of RPS's Oil Spill Report; Appendix AH

For the White River average flow FBR simulation, the surface oil was thickest (100-1000 µm) at the U.S. Highway 2 crossing and the mouth of Lake Superior. This was due to the fact that the release location on the White River is approximately half the distance upstream and the White River is a narrower, lower flow waterbody (Horn, 2023a).

6.4.2.8 Dissolved Hydrocarbons

Dissolved hydrocarbons are difficult to remove from the environment. Effort is made to remove the surface oil prior to any large waterfalls or river disturbances to limit the amount of oil that becomes dissolved or entrained in the water column. In nearly all the FBR spills on both rivers, dissolved hydrocarbons made it to Lake Superior at concentrations greater than 100 ug/L regardless of whether or not the spill was mitigated. This concentration was identified at that level at a point in time, as the oil plume moved down the river. The concentration reached that level at locations all the way down the river but the whole river did not have high levels of dissolved hydrocarbons all at the same time. The RPS report used 50 µg/l as the acute toxicity for the average sensitivity of in-water species and five µg/l was used for the acute toxicity for sensitive in-water species. The size of the spill and flow rate were the biggest contributing factors in determining the in-water effects of dissolved hydrocarbons.

Table 6.4-3 RPS-modeled oil stranded on shoreline shown in barrels.

Release volume (barrels)	Flow rate	Oil stranded on shoreline (barrels)
Bad River		
Unmitigated spill		
FBR (9,874)	High	5,944
FBR (9,874)	Avg	900
HARV (1,911 bbl)	High	1242
HARV (1,911 bbl)	Avg	660
RARV (344 bbl)	Avg	183
Mitigated spill		
FBR (9,874)	High	**2,863**
FBR (9,874)	Avg	**296**
HARV (1,911 bbl)	High	**611**
HARV (1,911 bbl)	Avg	**57**
RARV (344 bbl)	Avg	**38**
White River		
Unmitigated spill		
FBR (8,517 bbl)	High	5,067
FBR (8,517 bbl)	Avg	1,330
HARV (1,911 bbl)	High	1,242
HARV (1,911 bbl)	Avg	898
RARV (344 bbl)	Avg	177
Mitigated spill		
FBR (8,517 bbl)	High	**2,895**
FBR (8,517 bbl)	Avg	**425**
HARV (1,911 bbl)	High	**1223**
HARV (1,911 bbl)	Avg	**1223**
RARV (344 bbl)	Avg	**41**

6.4.2.9 Total Hydrocarbons Stranded on Shore/Sediments

For total hydrocarbons stranding on shore, the difference in river flow conditions had a significant effect on how much oil stranded on the shoreline. During high flow on both the rivers, more vegetation was exposed and able to catch the surface oil causing more of the oil to strand on the shoreline instead of continuing to move downstream. However, during average flow, the shoreline on both rivers was assumed to be predominately mud and sand resulting in minimal surface oil sticking to the shoreline and instead moving downstream as shown in the mass balance graph in Figure 6.4-16. RPS did not estimate how long it would take to remove the oil that became stranded on the shoreline after a spill. However, as shown in

Table 6.4-3, the most difficult spills to clean up would be those that occurred during high flow but all spills including mitigated spills would require substantial cleanup of the shoreline.

The amount of shoreline draped with oil after an oil plume moves down a river could range from centimeters to feet. During floods or very high-water conditions, the oil could recede some amount during the spill causing the oil to coat a few feet of shoreline but in most cases, the oiled shoreline would only be a few centimeters. However, the concentration on the shoreline was predominately the highest concentration reported, greater than >500g/m^2 the whole length of the oiled shoreline. This is because the model shows the maximum concentrations and as the surface oil continues to move down the river, a single point on the shore might be hit by the surface plume many times. Unlike the surface plume that shows a slow decrease in thickness as it gets farther away from the spill site, the shoreline shows the highest concentration on the shoreline nearly the full spill extent.

As stated previously, the removal of surface oil from a contained environment can be relatively straightforward as identified in the 2022 Keystone pipeline spill in Kansas. In terms of impacts to the environment, and difficulty in cleaning up the spill, it is the oil that becomes stranded on the shoreline or oil that attaches to sediment that can end up being problematic and extend the emergency response activities.

To further highlight the concern of impacts of oil stranding on the shore, the DNR took a closer look at the mitigated spills modeled by RPS. As can be seen in Table 6.4-4 in certain scenarios during high flows, even when mitigations were attempted, they were not able to be implemented fast enough or close enough to the spill site to successfully keep the shoreline from soaking up a lot of the surface oil. In the mass balance graph with mitigations in place approximately 12 hours after the spill on the White River, 30 percent of the oil (red portion of the graph) is already expected to be stranded on the shoreline (Figure 6.4-16). The RPS report identifies that this is due to some wetlands becoming exposed due during high flow upriver of the first location where installation of emergency response was able to be installed in the model.

Figure 6.4-16 highlights the fate of the spilled oil during a hypothetical spill where mitigation is expected to be put in place within the expected time frames. The three fates highlighted in this graph are the percent of oil that has evaporated into the atmosphere, the percent that has stranded on the shoreline, and the percent that has been removed after a period of time, after the spill. Figure 6.4-16 only shows spills where mitigations would be expected to be put into place. The point of this table is to show that even during mitigated spills, prompt remediation is necessary to limit the amount of oil that would strand on the shoreline. Only 12 hours after a HARV spill, 70 percent of the spilled oil is predicted to be stranded on the shoreline on the White River and 35 percent of the spilled oil is predicted to be stranded on the shoreline on the Bad River.

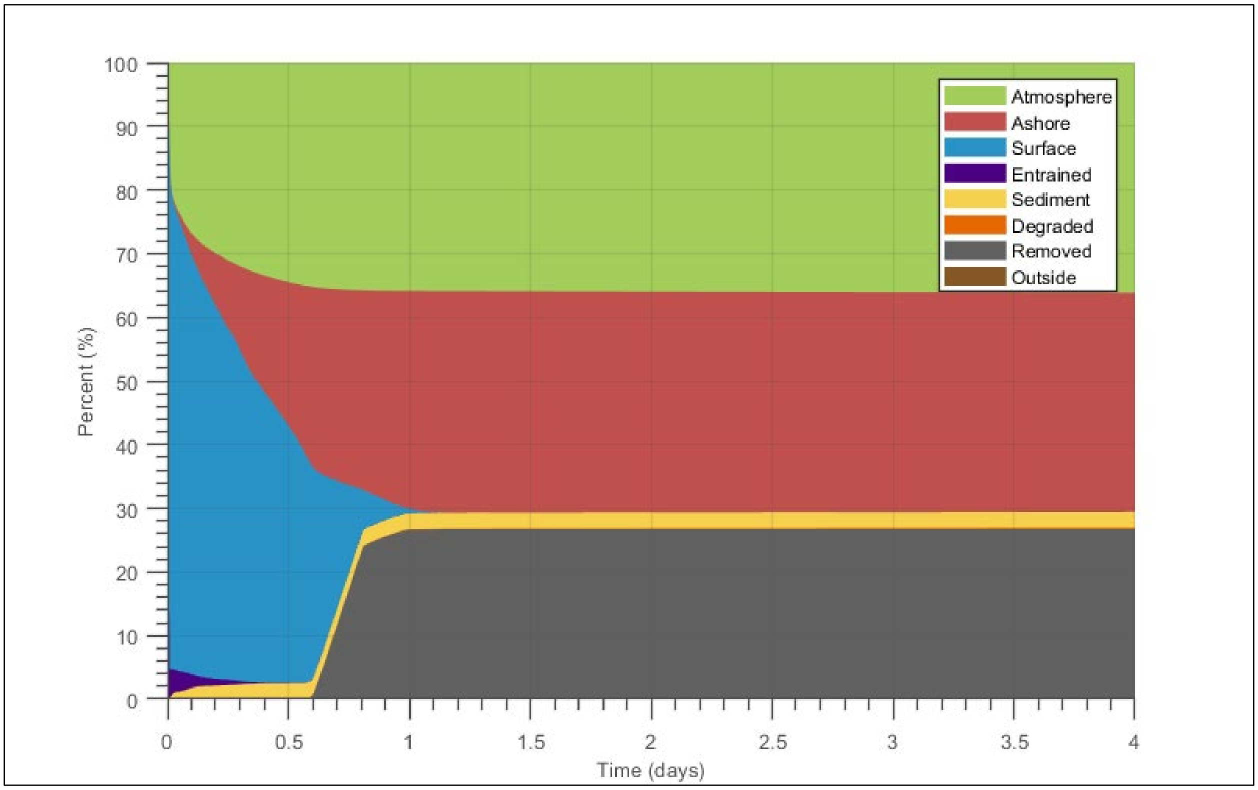


Figure 6.4-16 Oil mass balance graph for the mitigated FBR scenario in high river flow conditions modeled in April at the White River channel location.
Source Appendix B of RPS's report; Appendix AH.

Table 6.4-4 Mitigated spills on the Bad River and White River.

River	Flow	Release volume	% in atmos-phere	% surface oil removed	% stranded onshore	Time after spill
White	High	FBR	30	30	35	1 day
White	Avg	FBR	45	50	5	2 days
White	Low	FBR	0	100	0	1 day
White	High	HARV	30	0	70	12 hrs
White	Avg	HARV	40	40	10	1 day
White	Low	HARV	0	100	0	18 hrs
White	Avg	RARV	40	40	20	1 day

River	Flow	Release volume	% in atmos-phere	% surface oil removed	% stranded onshore	Time after spill
Bad	High	FBR	35	35	30	1.5 days
Bad	Avg	FBR	40	55	5	3 days
Bad	Low	FBR	0	100	0	1 day
Bad	High	HARV	33	32	35	12 hrs
Bad	Avg	HARV	40	55	5	1 day
Bad	Low	HARV	0	100	0	12 hrs
Bad	Avg	RARV	40	50	10	1 day

6.4.2.10 Oil Particle Aggregates

The formation of oil particle aggregates is a concern due to the high chance of an oil spill reaching a river within Enbridge's proposed project area. The turbulence in rivers is sufficient to entrain surface oil into the water column. Mixing is further enhanced by waterfalls, rapids, log jams, and wind. The mixing energy, also referred to as the energy-dissipation rate in a river environment is higher than in the open sea under regular waves (Boufadel et al., 2019). Furthermore, once oil droplets are mixed with water, additional breakup is likely, and the smaller the size of the oil droplets, the higher their probability for colliding with sediment particles and forming OPAs (Boufadel et al., 2019). The SIMAP and OILMAPLand models do not include modules for oil droplets to adhere to suspended sediment and form oil-particle aggregates. In 2022, research was released which cast some doubt on the ability of current oil spill modeling systems to adequately capture the extent of oil settling on sediments. Included in that study, were the two models used by RPS: OILMAPLand (a 2-dimensional model) and SIMAP (a 3-dimensional model). "We note that sedimentation (oil mineral aggregate formation and transport) is absent in all the 2-dimensional and in most 3ideimensional oil spill models and the 3-dimensional models that include sedimentation usually describe it with simple coefficients and do not have detailed sedimentation algorithms (Zhong, 2022)."

Past studies have shown that once OPAs form, they can be transported, deposited, and resuspended depending on flow conditions and currents. The OPA settling on the river bottom is of particular concern for emergency response personnel as it is difficult to identify, difficult to remove, and poses a concern for later contamination if a storm caused the settled OPA concentration to continue moving down river. In the coastal marine environment, the formation of OPAs has been found to improve removal of stranded oil from low-energy intertidal environments and is a natural self-cleansing process that enhances recovery rates following a spill (Lee, 2002). In contrast, in lowland rivers with gentle gradients, naturally formed OPAs can lengthen oil spill cleanup times and require deployment of less conventional and more costly sediment remedial measures (Dollhopf et al., 2014).

The RPS model showed a relatively low quantity of oil (between zero and four percent of the spill volume) settling on riverbed sediment during all the modeled oil spill scenarios (Table 6.4-). The White River which overall is a slower moving river had a greater quantity of oil sticking on sediment than the Bad River. On the Bad River, "less than 15 barrels of oil was predicted to settle across the suite of Bad River scenarios due to the greater overall current velocities which were above the depositional threshold (M. Horn 2023a). The Bad River was not included in the table below because of the low quantities predicted to strand on sediment.

Since the Enbridge oil spill into the Kalamazoo River where an estimated 10 percent (approximately 2,000 bbl) of the spill was assumed to be lost to submergence (F. A. Fitzpatrick, Boufadel, et al., 2015), there has been an increase in research into how OPA formation occurs. However, few studies have been able to explain how the oil would break up and degrade after an OPA has formed, specifically if it would settle, or if the OPA would separate from the sediment and resurface further downstream. Additionally, the diversity in OPA size (a few micrometers to thousands of micrometers) introduces a complexity into OPA formation and fate which led to the conclusion, that accurate modelling of OPA formation and transport is still at an early stage of research and the ability of the models to accurately predict either process is limited (Zhong, 2022).

The RPS modeling did not predict a lot of oil settling on the sediments on either the White River or the Bad River but there is concern as to the ability for SIMAP and OILMAPland to accurately predict that variable. Due to the model limitations around predicting OPA formation and transport in a river environment, and what has been documented historically from river spills, the OPA formation in the project area is a concern and may occur at a higher rate than predicted in these models.

Table 6.4-17 RPS-modeled sediment on oil in the White River.

Release volume (barrels)	Flow	Sedimented oil (barrels)
Unmitigated spill		
FBR (8,517 bbl)	High	350
FBR (8,517 bbl)	Avg	42
HARV (1,911 bbl)	High	70
HARV (1,911 bbl)	Avg	70
RARV (344 bbl)	Avg	13
Mitigated spill		
FBR (8,517 bbl)	High	255
FBR (8,517 bbl)	Avg	42
HARV (1,911 bbl)	High	57
HARV (1,911 bbl)	Avg	114
RARV (344 bbl)	Avg	27

Note: Bad River not included in this table because less than 15 bbl was predicted to settle on sediments in all the modeled scenarios.

Heavy crude oil called bitumen, was the type of oil that spilled into the Kalamazoo River which spurred a lot of studying in OPA formation of bitumen, however, lighter crude oils such as Bakken crude are also capable of forming OPAs. A study completed in 2015 compared bitumen oil to conventional crude oil (sweet, sour, light, medium, and heavy crude) in a laboratory setting. A tank containing light crude oil, sediment, and water was agitated for a period to simulate wave action in a natural water environment. After the agitation, the tank was allowed to rest, and the oil was observed before another round of agitation and settling occurred. The results of the test showed that the light crude oil submerged after the first agitation, showed some sign of floating after the first rest period. but then submerged again after the second agitation and did not resurface after the second rest period (Zhou, n.d.). This study suggests that in a river scenario, if there is an area in the river that becomes very still with minimal flow after a high velocity area such as a waterfall, there is a high chance that oil would submerge in the high velocity area and stay submerged in the low velocity area of the river. It also identified that the settling of the OPA occurred after the second agitated area however, in a river setting it is likely that there would be many sections of high flow followed by low flow sections suggesting a high chance of OPA formation in rivers. The train derailment in Lac-Mégantic, Quebec, is an example of a OPA formation occurring from Bakken crude in the Chaudière River.

The low flow sections of the river are critical in determining if a river is susceptible to OPA formation and the OPAs sticking to the bottom of the river. The RPS reports suggest that not more than 350 barrels would likely be lost to sedimentation in all the scenarios run on the Bad River and White River. The White River was more likely to have oil adhere to sediment because it naturally has a slower flow rate compared to the Bad River. The Bad River has relatively high flow consistently throughout the river including multiple waterfalls resulting in fewer chances for sedimented oil to stay submerged. On the Bad River the oil droplets were predicted to mix as they passed over the waterfalls in Copper Falls State Park but then resurface in the calmer areas downriver of the Falls. From there they were predicted to strand on shorelines rather than stick to the bottom of the river. According to the RPS report, 28 percent of the oil was predicted to entrain into the water column as it passed over Red Granite Falls and then Copper Falls. The Bad River is known to have a high sediment load compared to other rivers but he higher current speeds reduce the chance for the sedimented oil to settle on the bottom and instead stay suspended, resurface, break down in the water, or strand on the shore. This was identified by less than 15 barrels of oil stranding on sediments in all the RPS oil spill models completed on the Bad River. On the White River, the sedimented oil was predicted to be higher. In the White River, up to 70 bbl of the HARV and 350 bbl of the FBR were predicted to settle on the river bottom (Horn, 2023a).

6.4.2.11 Summary of Modeled Results on Bad River

The following paragraphs describe the worst case for each of the variables (surface oil, oil stranded on shoreline, and hydrocarbons dissolved in water) that were modeled in the SIMAP model.

Worse Case Unmitigated Spills -Bad River

> Unmitigated Surface – Average and high flow FBR spills are similar for worse case. In both river flows the surface oil can reach Lake Superior in an unmitigated spill.
>
> Unmitigated Shore – High flow FBR spill would cause the most amount of oil to strand on the shoreline (5,944 barrels). However, as was the case with the unmitigated high flow spills on the White River, during high flow, the spilled oil is predicted to strand upstream in wetlands and only make it to a few miles upstream of the U.S. Highway 2 crossing and is not predicted to line the shoreline all the way to Lake Superior.
>
> Unmitigated Dissolved – Average flow FBR has the largest effect on in water species because the spill can reach the entire river and have the longest exposure time during average flow. However, all FBR spills regardless of flow had similar results in terms of extent of the river contaminated with dissolved hydrocarbons greater than 100ug/L.

Worse Case Mitigated Spills -Bad River

> Mitigated Surface – In a mitigated spill, high and average flow produce similar results. The downstream transport of the surface oil during an FBR spill would reach the U.S. Highway 2 crossing at concentrations above 10 um and Lake Superior at concentrations above one um, both of which are considered a thin sheen.
>
> Mitigated Shore – During high flow, an FBR spill resulted in the greatest amount of oil stranding on the shore (2,895 barrels). For downstream transport, the average flow was slightly worse. During an FBR spill during average flow, the shoreline was coated with oil greater than 500 grams per square meter all the way to Lake Superior but the number of barrels of oil draping that length of shoreline during average flow was only 296 barrels.
>
> Mitigated Dissolved – Average flow FBR has the largest effect on in water species because the spill can reach the entire river and have the longest exposure time during average flow. Mitigation is not very successful in capturing dissolved hydrocarbons. FBR spills during low flow also are able to reach Lake Superior.

6.4.2.12 Summary of Modeled Results from White River

The following paragraphs describe the worst case for each of the variables (surface oil, oil stranded on shoreline, and hydrocarbons dissolved in water) that were modeled in the SIMAP model.

Worse Case Unmitigated Spills -White River

> Surface Spill – The largest spill volume (FBR spill of 8,517 bbls) during average flow conditions, FBR surface oil can travel the farthest downstream in average flow. In such a scenario, it would be possible for between 35 percent and 39 percent of the oil plume to make it to Lake Superior. In this scenario, it is estimated that it would take 78 hours for the surface oil plume to reach Lake Superior. Enbridge predicts that it would take between 3.1 and 3.8 hours to set up mitigations on the White River; therefore, it would be unlikely that environmental factors would inhibit spill cleanup efforts for 78 hours. When mitigations are put in place at the expected time intervals, the surface oil plume is not expected to reach Lake Superior.
>
> Unmitigated Shoreline – An FBR spill during high flow would cause the most amount of oil to strand on the shoreline (5,067 bbl). However, during high flow, the spilled oil is predicted to strand upstream in wetlands on the White River and would not impact Lake Superior. A spill during average flow, less oil (1,330 bbls) would coat the shoreline, but it would be distributed the entire length of the White River at concentrations greater than 500 grams per square meter.. This is because during average flow, the banks of the White River are less vegetated, and a small amount of oil would strand the whole length of the river rather than a large amount of oil getting contained upriver.
>
> Unmitigated Dissolved – Average flow FBR has the largest effect on in water species because the spill can reach the entire river and have the longest exposure time during average flow. However, all FBR spills, regardless of flow, had similar results in terms of extent of the river contaminated with dissolved hydrocarbons above 100 ug per liter.

Worst Case Mitigated Spills -White River

> Mitigated Surface – In a Mitigated spill, high and average flows produce similar results. The downstream transport of the surface oil spill during average flow would reach slightly farther (at most two river miles farther) than an FBR spill during high flow.
>
> Mitigated Shore – During high flow both FBR and HARV spill volumes result in a the most oil being stranded on the shore (due to wetlands upriver being exposed with high water). As far as downstream transport is concerned, the shoreline is oiled until approximately 10 river miles downstream of the pipeline crossing, at concentrations above 500 grams per square meter for both high and average flows.
>
> Mitigated Dissolved – Average flow FBR has the largest effect on in water species because the spill can reach the entire river and have the longest exposure time during average flow. Mitigation is not very successful in capturing dissolved hydrocarbons. FBR spills during low flow also are able to reach Lake Superior.

6.4.2.13 Oil Spills During Low River Flow

Winter conditions provide an additional set of circumstances that change how the oil interacts with the environment causing difficulty in delineation and cleanup of an oil spill. While the water flow is much slower in the winter, snow and ice cover make identifying and delineating the size of a spill more difficult. As was identified in the Yellowstone River spill in Glendive Montana that occurred in January 2015, the oil flowed under the ice, mixed with the flowing water under the ice and within 1 day, visible oil sheen was identified 59 river miles downstream (Peronard, 2015)

In February 2015, after a train derailment near Mount Corbin West Virginia, Bakken crude was spilled into the Kanawah River during an active snow storm. Much of the Bakken crude oil caught fire in the accident but the oil that did not burn was observed frozen in the river ice. Testing of water downstream was initiated to try to delineate the spill but was largely unsuccessful in the early stages of the release making it difficult to identify the extent of the spill (National Oceanic and Atmospheric Administration (NOAA), 2022).

RPS's SIMAP models showed the submerged oil plume being contained upriver, far from Lake Superior. This is consistent with a recent study done on Lake Eerie that identified that ice cover conditions limit the movement of an oil spill (Y. Song, 2024). However, lake currents are much different than river flows, and winter spills in the Yellowstone and Kanawah River highlight that transport under the ice makes delineation of the spill difficult and unpredictable which would increase the chances of an oil spill reaching Lake Superior undetected. The RPS report identifies that a spill into the White or Bad River would take between 44 and 87 hours to reach Lake Superior depending on river flow conditions.

An example of an unusual set of winter conditions that occurred on the Bad River in 2019 after a record snowfall year, resulted in an ice jam on the Bad River during the spring thaw and caused major flooding. The ice chunks from the Bad River and White River thawed while the ice on Lake Superior and at the mouth of the Bad River remained frozen. As the river ice loosened and began moving toward Lake Superior it began to dam up as it encountered the solid ice at the mouth. This caused a large ice jam near the bridge where the Bad River crosses U.S. Highway 2 which resulted in significant flooding upriver of the highway. Members of the Mashkiiziibii Natural Resources Department recounted that the flow of the Bad River reversed for a period during the ice jam event and began flowing upriver.

Evaporation is less likely in winter conditions as the oil can become trapped under the ice preventing evaporation from occurring and causing some of the volatile water-soluble components of oil including BTEX and PAHs to become entrained in the water column. In the oil spill models done by Enbridge, it was assumed that in the low flow January spill models, no evaporation would occur and the retention of oil to the shoreline would be very low (Horn, 2023a). It was also assumed that since the pipeline is underground and the river would be completely covered in ice in January, all the oil would stay submerged under the ice and the leading edge of the oil plume would travel downriver completely submerged. This resulted in the model showing no surface or shoreline mortality effects on dabbling waterfowl, wetland wildlife, terrestrial wildlife, or fur barring mammals. While impacts to fur bearing mammals would be limited in the winter, beavers are somewhat active in the winter and their lodges are usually accessible to the water below the ice. Additionally, some birds and mammals attempt to catch fish in ice covered conditions and could experience impacts from submerged oil.

The in-water affects were evaluated during low flow for pelagic fish, demersal and planktonic organisms but were lower than the in-water affects during average and high flow for the same size spill. This was because during average flow, the oils spill was able to extend farther downstream having a greater overall effect on these species.

A spill during the winter is helpful in identifying effects on species when evaporation is limited. RPS reported that "in all winter time scenarios no evaporation was simulated, and all the soluble fractions (of oil) were predicted to dissolve, resulting in the highest in-water concentrations and potential downstream movement to Lake Superior." While the in-water concentrations of dissolved oil and oil droplets is likely to be the highest in the winter, the in-water sediment load is likely to be the lowest in the winter making it less likely that the oil droplets would adhere to sediment and sink to the bottom. Data from the USGS gages in Odanah and Mellen showed suspended particle matter concentrations during high, average, and low river flow conditions for the Bad River ranging from 4 ppm to 191 ppm (Horn, 2023a). This suggested that the formation of oil particle aggregates is less likely in the winter but dissolved hydrocarbons would still be of concern. While dissolved hydrocarbons are in higher concentrations in the winter, RPS modeling showed mitigation efforts unsuccessful at removing dissolved entrained oil within the water column during all seasons and all flow levels. "Dissolved hydrocarbons were predicted to have the potential to reach Lake Superior in two to four days depending on river flow conditions" (Horn, 2023a).

6.4.2.14 Complications during Flood & Ice Conditions

As was noted in the oil spill reports provided by Enbridge, a model of overbank flood conditions was not included in the Bad River or the White River SIMAP simulations. However, in April 2022, Enbridge released results of oil spill modeling simulations during flood conditions for the existing Line 5 pipeline crossing on the Bad River (Figure 6.4-18). This report shows how the location where the Bad River crosses U.S. Highway 2 is significant in that if oil reaches that point, it has effectively reached Lake Superior and the wild rice beds in the Kakagon and Bad River Sloughs. At the U.S. Highway 2 crossing, the Bad River's currents are influenced by bidirectional flows and backwater from Lake Superior storm surge and seiche oscillations. This is best shown by looking at the river during flood conditions, but a similar effect can occur even without a flood due to elevated lake levels and seiche effects. The seiche effects act similarly to an ocean tide, only with limited predictability and with multiple highs and lows daily. As can be seen in Figure 6.4-18, during flood conditions all the Kakagon Slough and floodwaters from the Bad River can also reach Chequamegon Bay. Ice cover usually lasts longer in Chequamegon Bay than Lake Superior, which affects how ice jams form and break up as well as how floodwaters from the Bad River during spring melt are distributed and stored in the Sloughs.

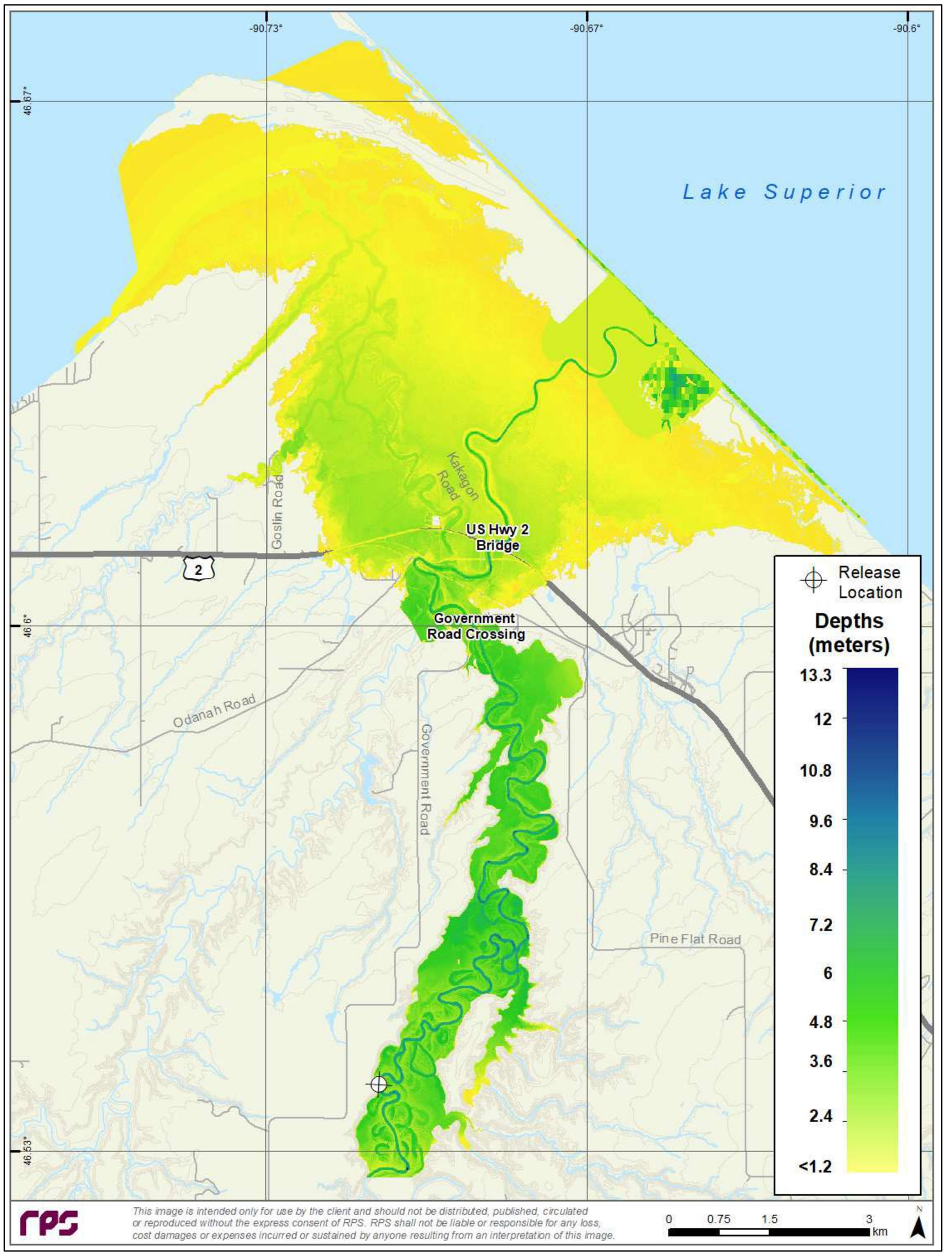


Figure 6.4-18 Flood conditions near the mouth of the Bad River.
Source: RPS Matt Horn Rebuttal report

Lake Superior water levels fluctuate due to many factors, primarily related to precipitation and evaporation of water in the area throughout the year. Prior to 2014, Lake Superior had record low lake levels, but levels have been much higher in the past decade with record highs in 2016. Members of the Mashkiiziibii Natural Resources Department described being unable to harvest wild rice in 2007 and 2012 due to low water levels. These fluctuations in lake levels make it difficult to fully predict how oil might spread once it reaches the sloughs.

In Figure 6.4-18 the water level is high enough to allow mixing between the Bad River and the Kakagon River, indicating that oil would be able to spread into a thin sheen covering the extent of the estuary and then spilling into both the main part of Lake Superior and Chequamegon Bay. While the mixing of oil within the estuary is more likely in flood conditions, it is also possible that with overbank conditions, more oil would be able to strand along the shore and vegetation upriver and a smaller quantity of oil would be able to reach this sensitive area.

In addition to the impact that could occur to the wild rice beds, the Kakagon and Bad River Sloughs (Figure 6.4-19) is a designated Ramsar site, one of 40 designated wetlands of international importance in the United States, and it provides necessary and rare feeding, resting, and nesting habitat for both migrating and local populations of birds and protects the wild rice beds that are becoming increasingly fragmented on Lake Superior.

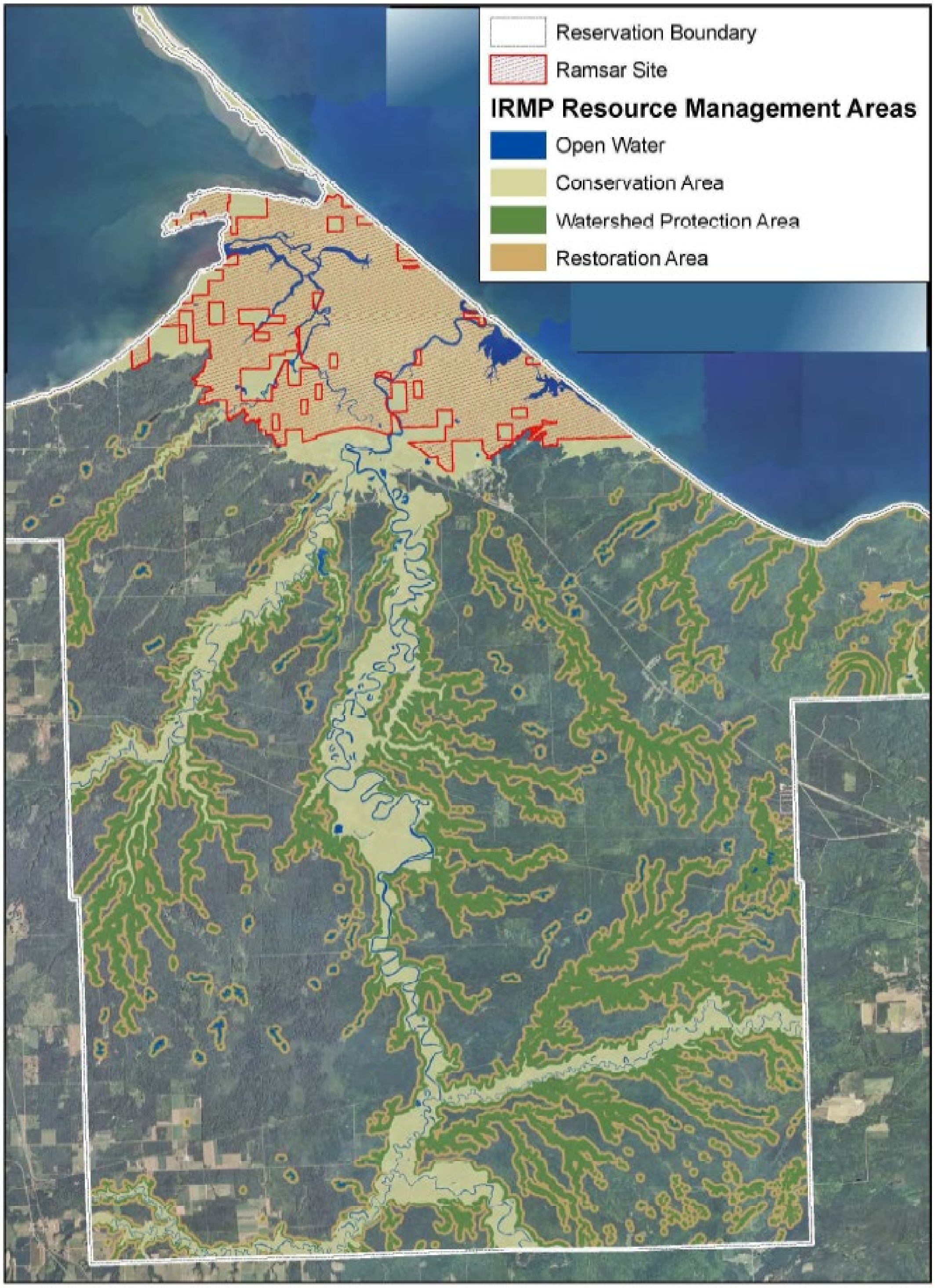


Figure 6.4-19 Kakagon and Bad River Sloughs- Ramsar Site
Source: Water Resources Bad River Natural Resources Department

6.4.3 Historical Spill Impacts

RPS modeling predicted that a spill that is unable to be mitigated until 12 hours after the release has over an 80 percent chance of ending in a waterbody (See Table 6.4-5).. With the prevalence of remote rivers in the project area, the waterbody that is likely to be impacted is a river.

Table 6.4-5 Total number of unmitigated FBR releases modeled for each route alternative and the percentage that were predicted to reach at least one body of water.

Route	Total Releases Modeled Along Route Alternative	Releases Reaching Water	Percent of Releases Reaching Water	Length of Pipeline with Potential for Releases to Reach Water (km)
Existing Route	1,052	816	77.6%	76.3
RA-01	1,330	1,100	82.7%	101.8
Proposed Route	1,452	1,187	81.7%	109.2
RA-02	1,426	1,189	83.4%	110.1
RA-03	1,688	937	55.5%	93.5

Source: RPS Oil Spill Report- Technical Appendix C, Table 5-6

Oil spills into river environments are more unpredictable and difficult to successfully remediate. When mitigations are put in place quickly and landscapes such as rivers and wetlands are minimally impacted, containment of spills can be relatively straightforward. However, with the high chance of a waterway being impacted in the proposed project area, identifying the factors that would make spills behave abnormally, producing the worst-case outcome, help clarify the impacts that could occur. Not all locations are equal in terms of environmental impacts on the land. Some areas are more pristine and have rare or protected ecosystems and necessarily should receive more protection than others. Five examples of spills of crude oil into rivers are summarized below.

6.4.3.1 Kalamazoo River Spill near Marshall Michigan - 2010

On July 26, 2010, a 30-inch Enbridge pipeline carrying diluted bitumen (dilbit) ruptured near Marshall, Michigan. The spill discharged 20,071 barrels of crude oil much of which flowed into a wetland and Talmadge Creek and downstream into the Kalamazoo River. The cause of the pipeline rupture was due to cracks in the pipeline from corrosion that had been detected but not repaired.(National Transportation Safety Board, 2012).

There were a few factors that contributed to the Kalamazoo River spill being considered the worst inland oil spill in U.S. history (Williams, 2015). To start, the release volume was especially large due to human error, the spill occurred during flood conditions, and the river conditions resulted in a portion of the oil getting entrained in the water column. The high release volume was due to human error, which resulted in a delay in the discovery of the pipeline rupture. According to the National Transportation Board Accident Report, despite a drop in pressure and adequate system detection alarms, it took 17 hours for Enbridge to recognize that the pipeline had ruptured (National Transportation Safety Board, 2012). The failure in detecting the spill occurred because the rupture occurred during a planned shutdown of the pipeline and the operators mistakenly assumed the alarms were identifying an incomplete re-filling (also known as column separation) of the pipeline after the shutdown period. The pipeline was restarted twice during the 17-hour period after the rupture and operated for 1.5 hours before the leak was officially detected (National Transportation Safety Board, 2012).

While initial surface oil spill cleanup activities were effective (EPA, 2016), it was discovered that a portion of the spilled oil had submerged over the 38 miles of the Kalamazoo River. The flood conditions allowed oil to cover the floodplain, backwaters, and overbank areas consisting of forested floodplains, islands, and wetlands. A new process had to be developed to identify and characterize initial oiling conditions in these areas and to re-assess the areas after cleanup. The overbank surveys also documented oil in the alluvial gravel near the water table and tree root zone underlying floodplain soils.

According to the investigation details in the National Transportation Safety Board, the severity of the environmental consequences from the Kalamazoo spill were related to three planning and regulatory failures. 1) Enbridge's failure to identify and ensure the availability of well-trained emergency responders with sufficient response resources, 2) PHMSA's lack of regulatory guidance for pipeline facility response planning, and 3) PHMSA's limited oversight of pipeline emergency preparedness that led to the approval of a deficient facility response plan. These failures led to many complications both in identifying the spill and the type of oil released as well as successful remediation of the spill. This spill put a spotlight on some oversights that may have occurred due to the rapid increase in demand for crude oil around 2010, and the relatively few large inland spills that that had occurred up to that point.

This spill resulted in a $177 million settlement and required action from Enbridge to prevent further spills in the Great Lakes Region. $110 million was required to improved 2,000 miles of pipelines in the Midwest region to prevent spills in the future, $61 million was for Clean Water Act violations, and $5.4 million was to reimburse the government after funds were used to from the Oil Spill Liability Trust Fund (U. S. Department of Justice, 2016). The settlement agreement puts in place requirements for the installation of advanced leak detection and monitoring equipment. Under the settlement, Enbridge committed to the following measures:

- implement an enhanced pipeline inspection and spill prevention program,
- implement enhanced measures to improve leak detection and control room operations,
- commit to additional leak detection and spill prevention for a portion of Line 5 that crosses the Straits of Mackinac,
- create and maintain an integrated database for the Lakehead Pipeline System,
- enhance its emergency spill response preparedness programs by conducting four emergency spill response exercises to test and practice Enbridge's response to a major inland oil spill,
- improve training and coordination with state and local emergency responders by requiring incident command system training for employees,
- provide training to local responders,
- participate in area response planning and organize response exercises;
- hire an independent third party to assist with review of implementation of the requirements in the settlement agreement (U. S. Department of Justice, 2016)

This spill has contributed to more safety awareness around pipeline operation and has spurred more research into crude oil spills into freshwater environments, including formation, fate, and transport of oil-particle aggregates in rivers. A multiple-lines-of-evidence approach, based on several scientific initiatives, was needed to determine the distribution and fate of the submerged oil. These included detailed geomorphic mapping of the river, temperature effects on resuspension, biodegradation, mapping techniques for submerged oil, simulations of fate and transport, oil chemistry procedures, quantification of remaining oil, and a net environmental benefits assessment. The use of oil spill modeling to predict and respond to oil spills has become a helpful and relied upon resource when accessing oil spill impacts since 2010.

6.4.3.2 Keystone Pipeline Spill Washington Kansas- 2022

In December 2022, 12,937 barrels of crude oil was spilled from a rupture of the Keystone Pipeline near Washington, Kansas, onto farmland that flowed into nearby Mill Creek. After investigation into this incident, it was determined that the pipeline rupture occurred due a faulty weld that over time caused a crack (Kite, 2023). A pressure drop was noted in the line carrying diluted bitumen followed by an immediate shutdown of the line. According to the EPA, the spill initially impacted three miles of Mill Creek. The installation of an underflow dam at a bridge three miles downstream allowed recovery efforts to contain the oil and the use of skimmers, vacuum trucks and heavy equipment and light stands allowed for around the clock recovery efforts (Pritchard, n.d.). The oil recovery phase of bulk oil extended for over a month and was completed on January 29, 2023 (Pritchard, n.d.). Additional oil recovery, including dewatering the impacted section of Mill Creek and removing submerged oil, impacted sediment, and oil impacted vegetation, continued until May 2023, at which point efforts changed to stream restoration (Pritchard, n.d.). In early June 2023, the impacted areas of Mill creek were filled back up with water and monitored for sheen. No sheen was noted, and all dams and contaminated areas were removed. The cleanup of this spill was considered complete approximately six months after the original spill (Pritchard, n.d.). Figure 6.4-20 shows the spill and cleanup efforts.

The cleanup efforts for this project included the use of the dams to contain and remove the contaminated water followed by dewatering the creek to remove contaminated soils and sediment. Road access to the site was relatively easy and the slow current at the impacted area allowed for ideal conditions for deployment of oil skimmers and containment booms. According to PHMSA, all the spilled oil was recovered after cleanup activities were complete. This does not imply that there were not environmental impacts but, for the quantity of oil that was spilled, the remediation went extremely well.

The spill volume of the Keystone Pipeline in Washington, Kansas, is slightly larger than the spill volumes modeled in the RPS Report for the White and the Bad River, which were 8,517 and 9,872 barrels respectively. The rupture was identified to have originated from a faulty weld during the installation of the pipeline in 2010. This spill in an example of an unpredictable incident could happen to any pipeline anywhere, in uplands, slopes, or water.

The spill occurred in December when the river was at a relatively low flow period. The low flow (but not ice-covered river) coupled with the quick mobilization of emergencies services for environmental cleanup activities resulted in limited downstream transport of the oil (approximately 3.5 river miles of Mill Creek). According to the EPA site contact for the Mill Creek spill, final impact reports, including impacts on wildlife are still in development, but no wetlands were impacted during this spill.

Figure 6.4-20 Oil spill into Mill Creek near Washington. Kansas. 2022.
Top Left: Area Impacted by the pipeline rupture and subsequent oil discharge into Mill Creek; Top Right: Dams and intakes for water diversion system; Bottom Left: Mill Creek oil recovery operations; Bottom Right: A dewatered sections of Mill Creek taken from the creek bed
Source: (Pritchard, n.d.) (Photo credit EPA)

A spill volume of this size into the rivers around the Bad River Reservation, is likely to be more harmful to the environment than the Mill Creek spill was for the following reasons:

- Remote area – While the Mill creek spill was in rural farmland, the proposed reroute of Line 5 is in a remote area with minimal road access to aid in cleanup operations, especially if the spill migrates onto the Bad River Reservation. Enbridge has outlined specific control points, which are identified locations along the White and the Bad rivers that could be accessed in the event of a spill. The White River can be accessed easily approximately 5 river miles down from pipeline crossing on Highway 13, but beyond that there is no easy road access to the river until it reaches the Bad River approximately 20 miles downstream. The Bad River also becomes more difficult to access starting in Copper Falls State Park. The park does have some river access points, but the river also passes through a gorge area near the falls that is completely inaccessible. Elmhoist Road is approximately 25 river miles downstream on the Bad River and is an access point for reaching the Bad River approximately halfway from the proposed project to the shoreline of Lake Superior.

- Current speed and waterfalls - The current in the upstream sections (closer to a possible spill source) of the rivers in the project area are fast with intermittent rapids and waterfalls. Red Granite Falls is approximately 1.6 miles downstream from the proposed pipeline, and Copper Falls, which is a 29-foot waterfall, is approximately 5.5 river miles downstream from the proposed pipeline both of which are on the Bad River. Upper and Lower Potato River Falls are approximately 2.75 miles downstream from the proposed pipeline on the Potato River and cumulatively include about a 90 ft drop. The high turbulence from these water falls at such close proximity (a few miles) of a potential spill site, increases the risk of having the spilled oil entrain in the water column and form oil particle aggregates.

- Proximity to Protected Areas – The Kakagon and Bad River Sloughs comprise a wetland complex that was designated as a Ramsar site in 2012, which is a Wetland of International Importance. All the major rivers that the pipeline would cross along the proposed route flow into the Kakagon and Bad River Sloughs and then into Lake Superior. While it is not certain that a successfully mitigated spill would reach the Kakagon and Bad River Sloughs, approximately 18 river miles from the nearest river spill site (Beartrap Creek), it is an area that is known for its pristine nature and is connected to the natural wild rice beds, which are of immeasurable importance to the people of the Bad River Band.

6.4.3.3 Chaudière River- Lac-Mégantic, Quebec - 2013

In 2013 in the town of Lac-Mégantic, Quebec, an estimated 38,095 barrels of Bakken light crude oil was spilled after a tragic train derailment turned into an environmental disaster (de Santiago-Martín et al., 2015). The incident resulted in an explosion and much of the released oil burned, causing 47 deaths and significant damage to the town. The remaining oil that did not catch on fire, spilled into a lake and the Chaudière River, initiating emergency response cleanup of the river.

This incident highlighted two distinct properties of Bakken crude oil. It is highly flammable, and it can adhere to suspended solids in rivers and lakes and then sink, making remediation efforts difficult. After this incident, PHMSA released an updated advisory reminding emergency responders that Bakken crude oil poses significant fire risk if released from a pipeline or tank car (Congressional Research Service, 2014).

While floating oil was found up to 49 miles downriver of the spill, complications with remediation of this spill occurred due to a portion of the oil mixing with the sediment and collecting on the bottom of a 20-mile stretch of the river (de Santiago-Martín et al., 2015). While much of the contaminated areas showed significant improvement after the initial cleanup efforts, the sediment in areas of the river with slow current continued to show elevated levels of oil contamination three years after the spill (Gouvernement du Quebec, 2017). This spill is an example of Bakken crude being susceptible to mixing with sediments and forming oil particle sediments that are much harder to clean up as they often travel submerged underwater, missing the surface oil containment systems.

The Chaudière River has similar characteristics to the Bad River. It is relatively shallow, low gradient, has variable flow, easily floods, and often has high sediment content in the river at any given time. Sedimentation of spilled oil occurs when oil droplets interact with and attach to suspended organic material and either sinks or remains suspended underwater. This process is more common in freshwater environments as water density is lower than in saltwater (Gouvernement du Quebec, n.d.).

In November 2015, 2.5 years after the train derailment, the Quebec Environment Ministry released a report saying that “there was a marked drop in total weight of the river’s fish and in some parts of the river as many as 47% of fish they collected had an external deformation” (Woods, 2016). The report identified the train accident and the release of Bakken crude into the river as the most likely source of the rise in fish deformities. Among the more common deformities found in fish taken from the Chaudière River was the erosion of the fins, which can occur after a fish comes into direct contact with contaminated sediment. (Woods, 2016).

6.4.3.4 Husky Energy Oil Release into the North Saskatchewan River- 2016

In July 2016, approximately 1,415 barrels of blended heavy crude oil spilled from a 16” diameter pipeline near Maidstone, Saskatchewan, and 40% of the spilled volume (566 barrels) flowed into the North Saskatchewan River. The spill occurred approximately 500 feet away from the North Saskatchewan River. An investigation into the spill identified that the south slope of the North Saskatchewan River, where the pipeline crossing was located, is episodically unstable, and shifting ground led to the break in the pipeline (Saskatchewan Energy and Resources, 2016). The geotechnical findings concluded that the slope movement that lead to the buckling in the pipeline was likely due to a combination of a high precipitation event, surface topography that impeded drainage, and the instability of the cretaceous clay along the slope (Saskatchewan Energy and Resources, 2016).

It was noted that the pipeline break occurred approximately 12 feet away from where the HDD section of the pipeline that was installed under the river ended. At the time of the pipeline installation in 1997, mitigations were not put in place to account for slope movement because the geotechnical assessment at the time of pipeline installation concluded that the slope movement was inactive. There were two pipelines installed next to each other using the same ROW, a 16-inch and an 8-inch diameter. Only the 16-inch diameter pipeline failed. It was assumed that, because of its smaller size the 8-inch diameter pipeline was more flexible and was able to withstand the bank movements without breaking.

The initial oil plume was reported to have been seen for hundreds of kilometers downstream. A year later, assessment and cleanup of remaining oil on shorelines and the riverbed continued. Due to the dynamic nature of river flows and sediment movement in the braided sandy river system, stranded oil along the shoreline was eroded and transported downstream or buried in the riverbed and ephemeral sand bars. The amount of weathering and degradation varied downstream.

Husky Energy was fined $3.8 million for the incident.

6.4.3.5 Bridger Pipeline Release into the Yellowstone River- 2015

A pipeline leak of Bakken crude oil occurred in the Yellowstone River, near Glendive, Montana, in January 2015. The leak was detected by operators who noticed abnormal pressure readings on the pipeline. Using the distance between block valves, it was estimated that between 48 and 1190 barrels of Bakken crude oil was released into the river during this incident. Due to the ice-covered river at the time of the release, cleanup efforts were minimally effective as it was difficult to spot the oil plume that had moved below the ice. One day after the release, oil sheen was noted 59 miles downstream of the river (Peronard, 2015).

The drinking water at the Glendive water treatment plant which is located next to the Yellowstone River approximately 6 river miles downstream of the spill location, was shut down on two occasions due to water levels being contaminated with Bakken crude oil. The first shutdown of the water treatment plant occurred within a few days of the spill, the second occurred a few months after the spill when some oil that evidently had become trapped in the ice of the river began to melt and migrate downriver (Peronard, 2015).

This spill example highlights the difficulty in spill delineation and cleanup under frozen conditions, and that some components of Bakken Crude, including BTEX and PAHs are water soluble and can impact important water sources, including drinking water.

To better understand the anticipated impacts of an oil spill in the project area, Enbridge provided oil spill fate and transport simulations for multiple points along the proposed Line 5 relocation route and route alternatives. The two models used for this analysis were OILMAPLand and SIMAP (Spill Impact Model Application Package), which are models used to predict the trajectory of the spill, the effects of a spill and how the oil would breakdown in the environment (Horn, 2020b). These models simulate how oil would move on land and in water including identifying locations where oil may be found after a release.

6.4.4 Anticipated Environmental & Human Impacts

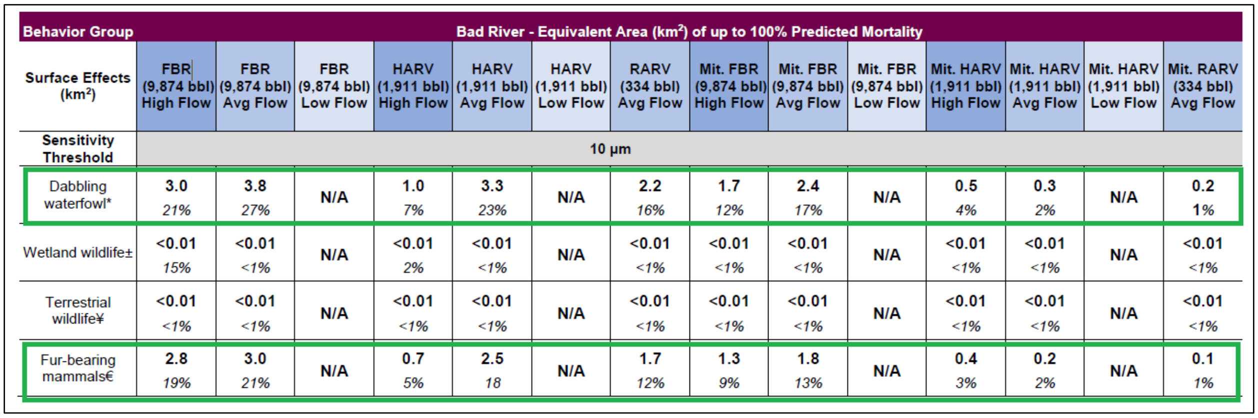
This section addresses the anticipated impacts to the human environment, including consequences to specific resources that are anticipated as a result of an unanticipated petroleum spill. The range of impacts considered for each resource includes the effects of the initial event and the effects of the likely responses to that event.

6.4.4.1 Model Results

The Enbridge fate and transport models are limited to toxicity to aquatic species for the Bad River and White River SIMAP spill scenarios. There would be additional human, terrestrial, riparian, and subsurface impacts not included in the modeling. Since pipeline ruptures happen underground, oil can contaminate the surrounding soil, groundwater, and surficial habitat. Once the spill reaches surface water, it can spread quickly downstream and begin impacting in-water species as well as the amphibian, reptile, fur and waterfowl species associated with water. The four behavior groups that were included in the Enbridge spill simulations were dabbling waterfowl, wetland wildlife, terrestrial wildlife, and fur-bearing mammals. Surface oiling effects on the Bad River were the most impactful regardless of mitigation or flow for dabbling waterflow and fur-bearing mammals. Average flow on the White River resulted in the most die off in all the behavior groups. For the Bad River, dabbling waterflow and fur-bearing mammals had relatively high rates of habitat mortality throughout the whole river regardless of flow and mitigation (outlined in green in Table 6.3-9). The wetland wildlife habitat was affected to a much greater extent on the White River then on the Bad River.

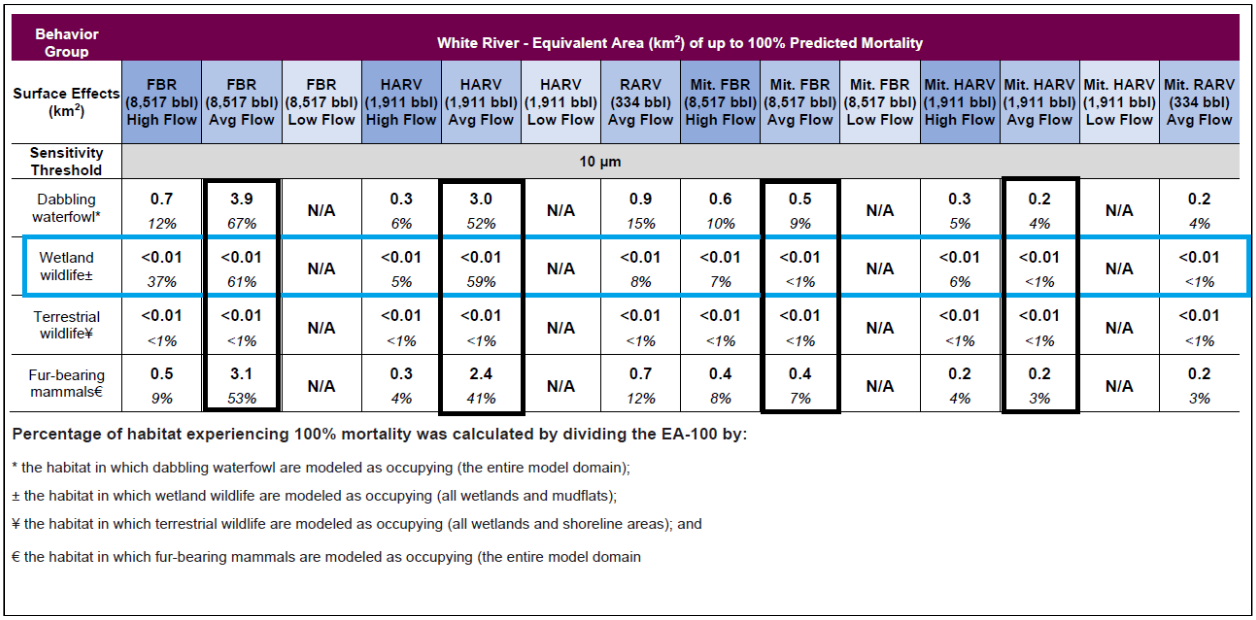
Table 6.4-6 River Area predicted to be affected by Acute ToxicityTable 6.4-7 River Area predicted to be affected by Acute Toxicity

Table 6.4-6 River Area predicted to be affected by Acute ToxicityTable 6.4-7 and Table 6.4-9 show the river area in (km^2) that are predicted to be affected by acute toxicity for the White River FBR, HARV, and RARV release scenarios, expressed as EA-100 (bold) and percentage of wildlife habitat experiencing 100% mortality (italics).



Behavior Group	**Bad River - Equivalent Area (km^2) of up to 100% Predicted Mortality**													
Surface Effects (km^2)	FBR (9,874 bbl) High Flow	FBR (9,874 bbl) Avg Flow	FBR (9,874 bbl) Low Flow	HARV (1,911 bbl) High Flow	HARV (1,911 bbl) Avg Flow	HARV (1,911 bbl) Low Flow	RARV (334 bbl) Avg Flow	Mit. FBR (9,874 bbl) High Flow	Mit. FBR (9,874 bbl) Avg Flow	Mit. FBR (9,874 bbl) Low Flow	Mit. HARV (1,911 bbl) High Flow	Mit. HARV (1,911 bbl) Avg Flow	Mit. HARV (1,911 bbl) Low Flow	Mit. RARV (334 bbl) Avg Flow
Sensitivity Threshold	**10 µm**													
Dabbling waterfowl*	**3.0** *21%*	**3.8** *27%*	**N/A**	**1.0** *7%*	**3.3** *23%*	**N/A**	**2.2** *16%*	**1.7** *12%*	**2.4** *17%*	**N/A**	**0.5** *4%*	**0.3** *2%*	**N/A**	**0.2** 1%
Wetland wildlife±	**<0.01** *15%*	**<0.01** *<1%*	**N/A**	**<0.01** *2%*	**<0.01** *<1%*	**N/A**	**<0.01** *<1%*	**<0.01** *<1%*	**<0.01** *<1%*	**N/A**	**<0.01** *<1%*	**<0.01** *<1%*	**N/A**	**<0.01** *<1%*
Terrestrial wildlife¥	**<0.01** *<1%*	**<0.01** *<1%*	**N/A**	**<0.01** *<1%*	**<0.01** *<1%*	**N/A**	**<0.01** *<1%*	**<0.01** *<1%*	**<0.01** *<1%*	**N/A**	**<0.01** *<1%*	**<0.01** *<1%*	**N/A**	**<0.01** *<1%*
Fur-bearing mammals€	**2.8** *19%*	**3.0** *21%*	**N/A**	**0.7** *5%*	**2.5** *18*	**N/A**	**1.7** *12%*	**1.3** *9%*	**1.8** *13%*	**N/A**	**0.4** *3%*	**0.2** *2%*	**N/A**	**0.1** *1%*

6.4-8 River Area Predicted to be affected by acute toxicity in water species.



Behavior Group	White River - Equivalent Area (km^2) of up to 100% Predicted Mortality													
Surface Effects (km^2)	FBR (8,517 bbl) High Flow	FBR (8,517 bbl) Avg Flow	FBR (8,517 bbl) Low Flow	HARV (1,911 bbl) High Flow	HARV (1,911 bbl) Avg Flow	HARV (1,911 bbl) Low Flow	RARV (334 bbl) Avg Flow	Mit. FBR (8,517 bbl) High Flow	Mit. FBR (8,517 bbl) Avg Flow	Mit. FBR (8,517 bbl) Low Flow	Mit. HARV (1,911 bbl) High Flow	Mit. HARV (1,911 bbl) Avg Flow	Mit. HARV (1,911 bbl) Low Flow	Mit. RARV (334 bbl) Avg Flow
Sensitivity Threshold	10 µm													
Dabbling waterfowl*	0.7 *12%*	3.9 *67%*	N/A	0.3 *6%*	3.0 *52%*	N/A	0.9 *15%*	0.6 *10%*	0.5 *9%*	N/A	0.3 *5%*	0.2 *4%*	N/A	0.2 *4%*
Wetland wildlife±	<0.01 *37%*	<0.01 *61%*	N/A	<0.01 *5%*	<0.01 *59%*	N/A	<0.01 *8%*	<0.01 *7%*	<0.01 *<1%*	N/A	<0.01 *6%*	<0.01 *<1%*	N/A	<0.01 *<1%*
Terrestrial wildlife¥	<0.01 *<1%*	<0.01 *<1%*	N/A	<0.01 *<1%*	<0.01 *<1%*	N/A	<0.01 *<1%*	<0.01 *<1%*	<0.01 *<1%*	N/A	<0.01 *<1%*	<0.01 *<1%*	N/A	<0.01 *<1%*
Fur-bearing mammals€	0.5 *9%*	3.1 *53%*	N/A	0.3 *4%*	2.4 *41%*	N/A	0.7 *12%*	0.4 *8%*	0.4 *7%*	N/A	0.2 *4%*	0.2 *3%*	N/A	0.2 *3%*

Percentage of habitat experiencing 100% mortality was calculated by dividing the EA-100 by:

* the habitat in which dabbling waterfowl are modeled as occupying (the entire model domain);

± the habitat in which wetland wildlife are modeled as occupying (all wetlands and mudflats);

¥ the habitat in which terrestrial wildlife are modeled as occupying (all wetlands and shoreline areas); and

€ the habitat in which fur-bearing mammals are modeled as occupying (the entire model domain

Table 6.4-9 River Area Predicted to be affected by acute toxicity in water species.

6.4.4.2 Surface Waters

Spills could affect surface water quality if spilled material reached waterbodies directly or from flow of the spilled material over land. Enbridge's proposed Line 5 relocation route would cross multiple rivers, many of which are trout streams. These rivers include, but are not limited to, Little Beartrap Creek, Bay City Creek, White River, Rock Creek, Deer Creek, Marengo River, Brunsweiler River, Trout Brook, Billy Creek, Silver Creek, Krause Creek, Taylor Creek, and the Bad River (Section 5.7.3). Many unnamed tributaries of those rivers, and other intermittent, ephemeral streams, or ditches are also crossed as part of the proposed route and route alternatives. The waters of the Bad River watershed support abundant outdoor recreation and tourism opportunities and are culturally significant to many of the Ojibwe people with connections to the area.

Table 6.4-10 lists the total miles of environmentally sensitive streams that could be affected by a FBR spill in high flow conditions along Enbridge's proposed relocation route and route alternatives. The 12-hour plume extent reflects a typical response time. This scenario corresponds with the spill scenario shown in Figure 6.4-5. Stream types that could be affected include Outstanding Resource Waters, Exceptional Resource Waters, ASNRI waters (Section 5.8.4.7), confirmed fish waters (e.g., Class 1 trout streams), and likely occurrence fish waters (Section 5.7.8.2), as well as flowing-water natural communities. Table 6.4-11 lists the total miles of environmentally sensitive streams that could be affected by a RARV spill scenario under average stream flow conditions. This scenario corresponds with the spill scenario shown in Figure 6.4-4.

Table 6.4-10 Miles of environmentally sensitive streams, by Enbridge's route alternatives, within 12-hour OILMAP plumes modeled by RPS for a FBR under high stream flow conditions.

	Proposed	RA-01	RA-02	RA-03
Hypothetical spills (all)	732	552	1,009	1,684
Length of Pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Estimated # of spills over 20 years	0.000082	0.000126	0.000116	0.000203
Extrapolated # of spills over 20 yrs	0.000690	0.000528	0.000974	0.001705
Special Designation Waters (miles)				
Outstanding Resource Waters	32.4 mi	18.4 mi	46.7 mi	78.3 mi
Exceptional Resource Waters	29.5 mi	16.4 mi	54.4 mi	32.3 mi
ASNRI Waters (all)	131.0 mi	89.2 mi	175.5 mi	198.9 mi
Confirmed Fish Waters (miles)				
Class 1 Trout Streams	6.9 mi	4.7 mi	27.5 mi	28.2 mi
Class 2 Trout Streams	57.2 mi	38.7 mi	89.7 mi	77.8 mi
Musky Waters (self-sustaining)	19.3 mi	17.6 mi	17.8 mi	30.4 mi
Sturgeon Waters	34.7 mi	33.3 mi	27.8 mi	60.1 mi
Likely Occurrence Fish Waters (miles)				
Brook Trout	32.5 mi	19.3 mi	69.5 mi	50.7 mi
Largemouth Bass	7.5 mi	7.5 mi	2.8 mi	13.1 mi
Smallmouth Bass	0 mi	0 mi	33.0 mi	33.1 mi
Walleye	17.8 mi	23.6 mi	18.6 mi	6.0 mi
Flowing-water natural communities (miles)				
Coldwater stream	98.6 mi	75.2 mi	105.0 mi	55.2 mi
Cool-cold headwater	13.4 mi	9.7 mi	50.2 mi	5.3 mi
Cool-cold mainstem	25.0 mi	22.6 mi	28.4 mi	7.9 mi
Cool-warm headwater	4.7 mi	3.9 mi	16.4 mi	113.7 mi
Cool-warm mainstem	29.0 mi	25.9 mi	59.4 mi	96.4 mi
Warm headwater	1.4 mi	0.75 mi	0.003 mi	0.2 mi
Large river	0 mi	0 mi	0 mi	0 mi
Macroinvertebrate	48.3	30.1	49.9 mi	4.6 mi

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Table 6.4-11 Miles of environmentally sensitive streams, by Enbridge route alternative, within 12-hour OILMAP plumes modeled by RPS for a RARV under average stream flow conditions.

	Proposed	RA-01	RA-02	RA-03
Hypothetical spills (all)	732	552	1,009	1,684
Length of Pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Estimated # of spills over 20 years	0.000222	0.000427	0.000696	0.000528
Extrapolated # of spills over 20 yrs	0.002055	0.00157	0.002900	0.005075
Special Designation Waters (miles)				
Outstanding Resource Waters	26.0 mi	16.5 mi	21.9 mi	12.8 mi
Exceptional Resource Waters	17.9 mi	11.9 mi	30.6 mi	12.0 mi
ASNRI Waters (all)	74.2 mi	47.4 mi	95.0 mi	60.0 mi
Confirmed Fish Waters (miles)				
Class 1 Trout Streams	5.6 mi	3.3 mi	24.8 mi	14.1 mi
Class 2 Trout Streams	37.8 mi	21.3 mi	37.6 mi	19.3 mi
Musky Waters (self-sustaining)	7.0 mi	5.6 mi	4.4 mi	1.6 mi
Sturgeon Waters	11.3 mi	9.9 mi	4.4 mi	5.0 mi
Likely Occurrence Fish Waters (miles)				
Brook Trout	24.8 mi	11.1 mi	54.6 mi	20.4 mi
Largemouth Bass	1.6 mi	0.2 mi	1.2 mi	7.7 mi
Smallmouth Bass	0 mi	0 mi	0 mi	0 mi
Walleye	4.5 mi	4.6 mi	4.2 mi	1.1 mi
Coldwater stream	63.3 mi	37.6 mi	73.2 mi	19.2 mi
Cool-cold headwater	11.5 mi	6.7 mi	48.0 mi	4.7 mi
Cool-cold mainstem	12.7 mi	14.9 mi	6.1 mi	0 mi
Cool-warm headwater	4.6 mi	3.8 mi	12.7 mi	46.9 mi
Cool-warm mainstem	16.2	12.8	20.9	13.9
Warm headwater	1.4	1.4	0.8	0
Large river	0	0	0	0
Macroinvertebrate	38.5	28.9	49.2	3.2

Figure 6.4-21 Outstanding and Exceptional Resource Waters
Source: Mashkiiziibii Natural Resources Department-Water Resources

Crude oil released to surface water could disperse, become suspended in the water column, or sink and adhere to bottom sediments. Since the spill into the Kalamazoo River in 2010, there has been an increase in need and interest in studying oil spills in freshwater environments. “Despite representing a small percentage of total water resources, the repercussions of oil spills on local surfaces and groundwater systems often have a more immediate and significant effect on human health than spills in the open oceans” (Yang et al., 2021). An oil spill in these areas would temporarily impair water quality downstream of the spill site. The duration of impairment would vary depending on the volume of spill and could last from several weeks to years.

The oil spill modeling reports from Enbridge document that in many spill scenarios, a thin surface sheen of oil would make it to Lake Superior but, it is unlikely that a large volume of oil would be able to reach the lake. Much of the higher concentrations of oil would become trapped in vegetation and sediments at the river bottom, wetlands, and riverbanks further upstream. Wetlands were identified as one of the most likely shorelines to retain oil.

The oil water identification chart used by NOAA (Figure 6.4-22) identifies the difference between an oil sheen and thicker oils as they display on surface water. In the RPS Report, employing mitigation tactics had significant effects on limiting surface oil, including oil sheen, from entering Lake Superior. On the Bad River, mitigation efforts were unable to prevent rainbow sheen from entering Lake Superior in all FBR and HARV release scenarios. One explanation for this is the location of Copper Falls State Park, which contains two waterfalls (Red Granite Falls and Copper Falls) that would cause the oil slick to break apart and temporarily submerge. The location of the first waterfall is approximately 1.6 miles downriver from where Enbridge's proposed pipeline relocation would cross the Bad River. Depending on the size of the release (FBR, RARV, HARV), the thickness of the surface oil as it enters the Copper Falls State Park would range from 0.35 to nine centimeters. These waterfalls create a lot of turbulence near the initial spill location, which would cause the oil plume to breakup into patchy discontinuous plumes, increasing the amount of entrained and dissolved hydrocarbons in the water column and the chance to form more OPA. Once the oil disperses to a thin sheen it is considered not recoverable and would be more likely to make it to Lake Superior. The non-recoverable oil is oil that is so thin that mechanical recovery is not productive.

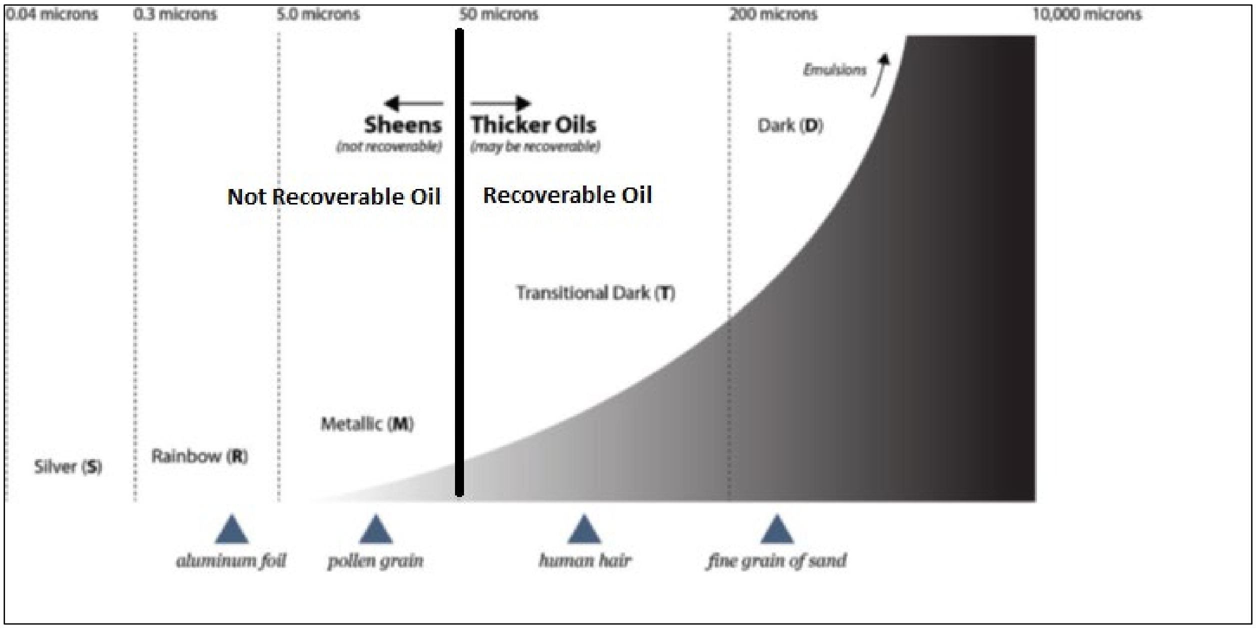


Figure 6.4-22 Open water oil identification.
Source: (National Oceanic and Atmospheric Administration (NOAA), 2016)

The RPS report highlights the short-term effects of an oil spill in the environment but is unable to predict long-term effects of a spill. The RPS report does not deny that long-term effects would be likely, instead they identify that many assumptions would need to be made to calculate long-term effects, making the results less accurate. Most studies report on the acute short-term effects oil spills have on organisms; however, there are lingering long-term effects specifically related to reproduction and deformities (Fingas, 2014).

6.4.4.3 Wetlands

Table 6.4-10 lists the acreage of wetland natural communities that could be affected by a FBR in high flow conditions along Enbridge's proposed Line 5 relocation route and route alternatives. These acreages are meant for relative comparison purposes only as they are based on polygon boundaries of the OILMAPLand plumes which are not related to wetland hydrology and do not account for the loss of oil as the plume moves downstream the way SIMAP outputs can. This scenario corresponds with the spill plumes shown in Figure 6.4-5.

Table 6.4-12 Acres of wetland natural communities, by Enbridge's route alternatives, within 12-hour OILMAP plumes modeled by RPS from all release points under a FBR high flow scenario.

	Proposed	RA-01	RA-02	RA-03
Hypothetical spills (all)	732	552	1,009	1,684
Length of Pipeline (miles)	41.1 mi	31.4 mi	58.0 mi	101.5 mi
Estimated # of spills over 20 years	0.000082	0.000126	0.000116	0.000203
Extrapolated # of spills over 20 yrs	0.000690	0.000528	0.000974	0.001705
Wetland natural communities (acres)				
Alter Thicket/ Shrub Carr	68.8 ac	22.9 ac	172.7 ac	1137.4 ac
Northern Hardwood swamp	715.4 ac	518.9 ac	1,261.6 ac	1348.9 ac
Northern Sedge Meadow	74.0 ac	25.6 ac	75.7 ac	416.0 ac
Northern wet forest / cedar swamp	190.6 ac	166.3 ac	354.4 ac	2096.1 ac
Other wetlands	49.8 ac	34.6 ac	63.6 ac	195.7 ac

There is no companion assessment for wetland impacts from the RARV scenario under average flow conditions. The SIMAP models assume wetland impacts only under high flow conditions when stream levels are high enough to reach adjacent wetlands. As described in the RPS spills report (Appendix AH, Part 2 page 48):

> *"In all scenarios other than low river flow wintertime conditions, effects were predominantly predicted within wetland areas. This was due to the prevalence of wetland areas within the model domain and the large oil holding capacity of wetland shorelines themselves, which resulted in acute effects to vegetation. Most effects were predicted to occur in upstream vegetated areas, closer to the release locations, where the potentials for shoreline exposure were greatest due to surface oil slicks being thickest and more continuous. Shoreline effects were predominantly influenced by river flow conditions and the resulting shore type in contact with the water at the time of the release. Under high river flow bank full conditions, more vegetation was exposed to surface floating oil. Secondarily, shoreline effects were influenced by the volume of oil released, with the largest release volumes (FBR) predicted to result in the largest potential for larger river flow rates generally resulted in greater transport and potential for shoreline effects with larger percentages of wetland shorelines (i.e., high river flow conditions) and longer lengths affected. The maximum length of vegetated shoreline from any scenario predicted to be affected was 15 km (9.3 mi., or approximately 18% of total vegetated shoreline) for the FBR release in the White River under high river flow conditions. However, in the White River, under average flow condition shoreline effects were relatively high (affecting 98-100% of vegetated shoreline) because nearly all habitats were in the upper portion of the river, where it was exposed to heavy black oil before wetland slicks thinned to sheens. Finally, response mitigation had a notable influence on the potential for shoreline effects, especially for scenarios where containment and collection efforts removed oil prior to reaching downstream wetlands. No shoreline effects were predicted for releases during low river/iceflow conditions because vegetated shorelines were assumed to be covered by a layer of ice.*

6.4.4.4 Volatile Portions of Crude Oil

“The monoaromatic and polycyclic aromatic hydrocarbons (MAHs and PAHs) are the most toxic portion of the oil by virtue of their relative solubility in water, making them available to aquatic biota for uptake” (Horn, 2023a). The most volatile being the MAHs, which includes BTEX, which directly after a spill, pose air pollution and fire concerns to the immediate spill area. Because of this, at the discovery and notification of a spill, Enbridge indicated that the nearby area would be immediately evacuated for human safety. Air pollution risks associated with a plume would likely dissipate quickly after the release but requires rigorous air monitoring to end the evacuation, and it is still a major concern in the initial cleanup phase. Depending on the spill type, recoverable oil may only be available for up to four to eight hours after the spill (NOAA, 2014).

Another concern related to BTEX is its solubility in water, as identified in the pipeline spill outside Bemidji, Minnesota, in 1979 that is still being monitored today. “Benzene, toluene, ethylbenzene, and the xylenes (BTEX) are of particular interest because they are the most soluble components of oil and are toxic” (Baedecker et al., 2011). The pipeline spill near Bemidji resulted in a pipeline leaking 10,700 barrels of crude oil into a neighboring wetland, and much of the oil seeped into the unsaturated zone and eventually resulted in a plume in the shallow aquifer that moved toward a nearby lake. This Bemidji spill site has turned into one the best studied subsurface contaminant sites in the world due to the research that was done on the site in the 1980s documenting how crude-oil contamination at a site can dissipate due to natural attenuation (USGS, 1998). The spill site has been used to understand the physical, chemical, and biological processes controlling the migration and fate of hydrocarbon contaminants in the subsurface and to identify the potential for, and long-term performance of, natural and enhanced bioremediation of hydrocarbon contamination (USGS, 1998). Results of research conducted on processes affecting the migration and fate of crude oil in the environment have provided fundamental knowledge that has been used to remediate similar sites worldwide. Based on this research, natural recovery is a remediation approach identified in NOAA’s shoreline assessment manual as the best strategy to prevent further damage in some environments. That being said, oil contamination remains in the subsurface today despite 30 years of natural attenuation and five years of pump-and-skim remediation (Essaid et al., 2011). Groundwater monitoring wells are still active at the site and while sample collections of BTEX concentrations are decreasing, BTEX is still present at the site. Concentrations of BTEX in the Bemidji oils decreased from an average of 12.3 ± 1.5 mg/g oil in 1987 to 7.2 ± 1.7 mg/g oil in 2008 (Baedecker et al., 2011) As highlighted in these collected samples, 20 years after the spill, BTEX concentrations were still present in the water. Given that the BTEX components are so volatile, the presence of BTEX in these monitoring wells suggests that there is a source of trapped oil that continues to seep from the unsaturated soil layer into the groundwater 45 years after the original spill. This site is one of the most studied oil spills; influential in that it identified that natural attenuation (the break down oil by the surrounding environment) occurs, but it also is an example of how persistent crude oil can remain in the environment.

6.4.4.5 Effects of Removing Oil on Shorelines

The impacts of removing oil stranded on the shoreline include cutting oiled vegetation, excavating the oil contaminated soil along the riverbank, and, when possible, using absorbent pads and vacuum trucks to remove any oil contaminated water or pockets of oil. If approved by local and governmental officials, dewatering of a section of the river may be completed to aid in excavation of contaminated banks and streambeds. The physical damage impacts of shoreline clean up extend well beyond the oil toxicity impacts. As shown on Mill Creek after the 2022 oil spill from the Keystone pipeline in Figure 6.4-23, the impacts to the shoreline are substantial.

Figure 6.4-23 Dewatered section of Mill Creek
Source: EPA OSC Response

Nearly all types of active cleanup would cause habitat damage or disturbance due to the equipment used, the way it is used, or the mere presence of the cleanup workers in the wetland. Aggressive and intrusive cleanup methods tend to mix oil into the water column and into sediments and form additional OPAs (which are often anoxic below the surface layer), which in turn affects oil degradation rates. Passive cleanup methods, including natural attenuation and biodegradation processes, generally result in much lower impact to wetland resources, particularly if the impact area is small, the spill is of a light oil that would rapidly evaporate and weather, or the oil is mostly on vegetation (NOAA and API, 1994).

The removal of the vegetation in the area for many days or months disturbs animal habitat at the water's edge and causes lasting effects. Such physical disturbances may alter local trophic structures, which could subsequently cause individuals to spend more time foraging, change their diet, or leave the area entirely (Otten, Williams, and Refsnider, 2023b). The Mill Creek remediation was successful in removing the oil from the environment, but it required a prolonged and intense human footprint on the land for months to achieve that goal. As with any extended human footprint within a pristine area, the risk of introducing nonnative species to the ecosystem is much greater. Some areas of the Bad River reservation are likely too remote or unstable to sustain the type of cleanup that was able to be completed on Mill Creek.

6.4.4.6 Bad River & Tributaries

For spills entering tributary streams and rivers to the Bad River, such as White River, Marengo River, and Tyler Forks, the water quality would be impacted on a short-term or long-term basis depending on the location of the spill, the type and volume of crude oil released, and the length of time that crude oil remains in the environment.

The most immediate impact on water quality from crude oil spills is increased concentration of toxic chemicals in the water column. The water-soluble fraction of crude oil and petroleum derivatives contains a toxic mixture of PAHs and other compounds. Crude oil released to surface waters could disperse, become suspended in the water column, or sink and adhere to bottom sediments. An oil spill that reached a freshwater body could cause reduced dissolved oxygen concentrations and increased toxicity to aquatic organisms, particularly from dissolved phase hydrocarbons.

Because oil slicks are less permeable to oxygen than water, spilled material that reached wetlands, ponds, or small lakes could lower dissolved oxygen concentrations due to a decreased influx of atmospheric oxygen and the relatively high rate of natural sediment respiration in many shallow waterbodies. In small, shallow waterbodies with limited water movement and high organic loading (e.g., small lakes, farm reservoirs, and stock ponds), increased biodegradation resulting from the addition of oil to the water column could further reduce oxygen levels. However, biodegradation rates are temperature-dependent: in cooler waters, such as Lake Superior and the rivers of Wisconsin, rates would be slower than in warmer waters, such as the Gulf of Mexico (Atlas, 1975). In smaller flowing streams, an oil spill could create direct aquatic toxicity in the water column because of the lower relative volume and rate of water flow, and thus with less dilution, there would be a higher likelihood of direct contact between the biota and the dispersed oil.

Decreases in dissolved oxygen levels could occur if the oil covered much of the water surface for a day or more. Direct toxicity would likely be short-term because of the high dilution volume in the lake and the rapid evaporation of most of the potentially toxic lighter hydrocarbons. Spreading of a spill over a lake surface could result in minor to major impacts to wildlife on the surface, beneath the surface, and water aesthetics and recreational use. The duration of impairment would vary based on the size of the spill, location of residual and sunken crude oil mixtures, the characteristics of the impacted waterbody, and the timing and effectiveness of response and clean up.

Some toxicity might persist in these streams for a few weeks to months, until toxic compounds trapped in the sediment were washed out or until oiled sediment was covered by cleaner sediment. Some of the crude oil could sink, become incorporated into the sediments, and remain there for years, depending on response actions and the amount of biodegradation and chemical or physical weathering that takes place.

Petroleum spills to any Bad River tributary above the confluence of the Bad River and Tyler Forks have the potential to reach the Copper Falls Gorge. Similarly, petroleum spills to the Potato River sub-watershed upstream of the confluence with Barr Creek, have the potential to reach the Potato River Falls.

6.4.4.7 Kakagon & Bad River Sloughs

The Kakagon Slough is a wetland complex of international importance, as identified by the Ramsar Convention, and is highly valued for the variety of habitats and diverse assemblage of native fish species. The slough is on Bad River Band lands. It is likely that this area (including tributaries to these rivers) would be a high priority for protection, and response actions would focus on preventing oil from entering such habitats. Similarly, the proposed route crosses 17 different streams designated as Areas of Special Natural Resource Interest (ASNRI). This important habitat area would also be high priority for protection in the event of an oil spill along Enbridge's proposed pipeline relocation route. It is notable that high flow mitigated and unmitigated spills from an FBR at the proposed Bad River crossing indicate oil will make it to the sloughs.

In addition to the Kakagon Slough complex, there is potential impacts of spills to wetlands such as the Bad River Slough. Like the Kakagon Slough, the Bad River Slough is home to a diverse ecosystem of fish and wetland habitats. In the event of a spill, these sloughs are influenced primarily by the type of oil spilled, the amount and proportion of water surface area covered, the type of vegetation present in the wetland, the duration of oil wetland cover, and cleanup response actions.

The extent of impacts to the Kakagon and Bad River Sloughs is dependent on many factors, including the location of the spill, the flow rate, the lake levels of Lake Superior at the time of the spill, the amount of spilled oil, precipitation following the spill, and the time of year. As described in Section 6.4.4.10, about complications during flood conditions, it was explained that during flood conditions or at varying points throughout the year, Lake Superior and the Kakagon and Bad River Sloughs can become interconnected. For this reason, the possible impacts to Lake Superior can also be considered impacts to the Kakagon and Bad River sloughs.

The Technical Appendix to the Rebuttal Report of Dr. Matthew Horn provides detailed modeling of a hypothetical oil spill from the existing Line 5 pipeline and the impacts it might have. In the Rebuttal report, Horn identifies that up to 60 percent of the spilled oil from the existing Line 5 could reach Lake Superior during flood conditions. Many variables are different when comparing the existing pipeline to the proposed pipeline routes, but, mainly, the distance to the Kakagon Sloughs and Lake Superior is much shorter with the existing line then it would be with Enbridge's proposed line. Also, the quantity of oil that could be spilled is much different between the existing and the proposed line. The existing line does not have as many valve sites along the pipeline as the proposed line would have which results in a greater possible volume of oil that could be released if a rupture occurred on the existing line. On the existing line, up to 21,974 barrels is the maximum volume of oil that could be release based on the location of the valve sites. The maximum release volume on the proposed route would be 9,874 barrels.

We do not have a specific flood model for a spill originating along Enbridge's proposed route, however we can look at the existing route and compare the volume of the worst-case reaching Lake Superior on the existing route to the worst case reaching Lake Superior on the proposed route. Based the models completed in the Rebuttal Report, not more than 60 percent of the release volume from the existing pipeline would ever be able to reach Lake Superior because a large amount is expected to evaporate. "Light crude oil contains a greater amount of volatile organic compounds and would lose up to 20 to 40 percent of its mass immediately" (John Mitchell, 2015). Additionally, during flood conditions more oil has the potential to strand along the shoreline resulting in a lower volume of oil reaching as far downstream. Figure 6.4-24 and Figure 6.4-25 compare oil mass balance for a full-bore rupture between flood and average conditions on the Bad River along the existing alignment.

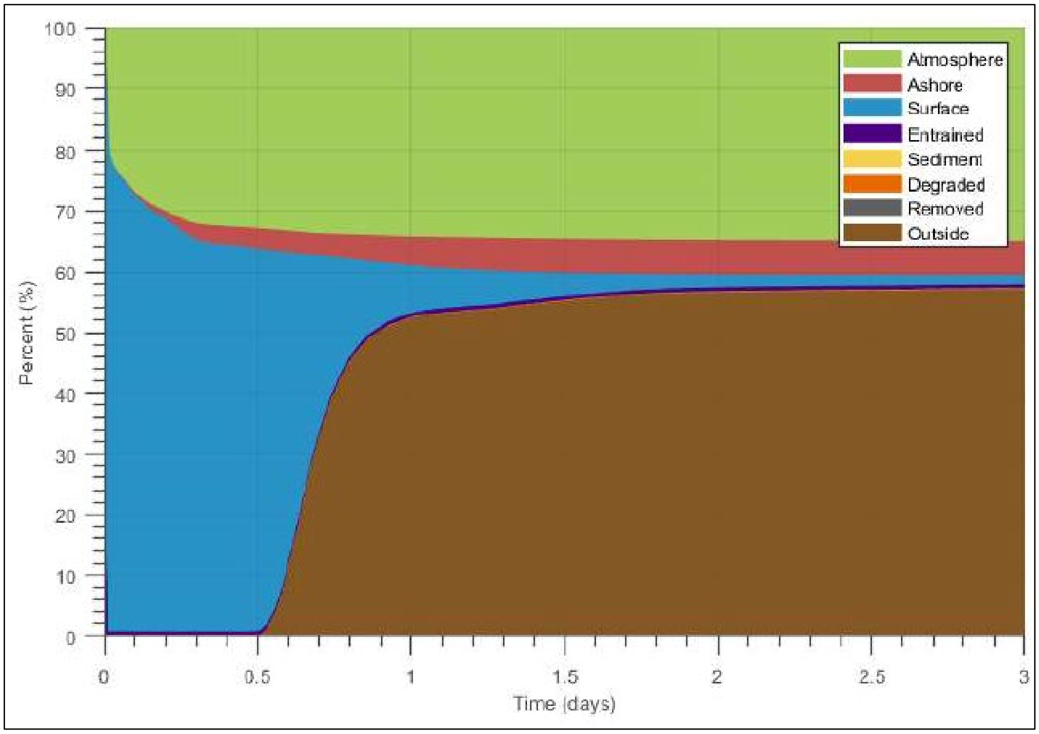


Figure 6.4-24 Oil mass balance for FBR in flood conditions on the Bad River channel, from existing line 5 alignment.
Source: Matt Horn Rebuttal Report

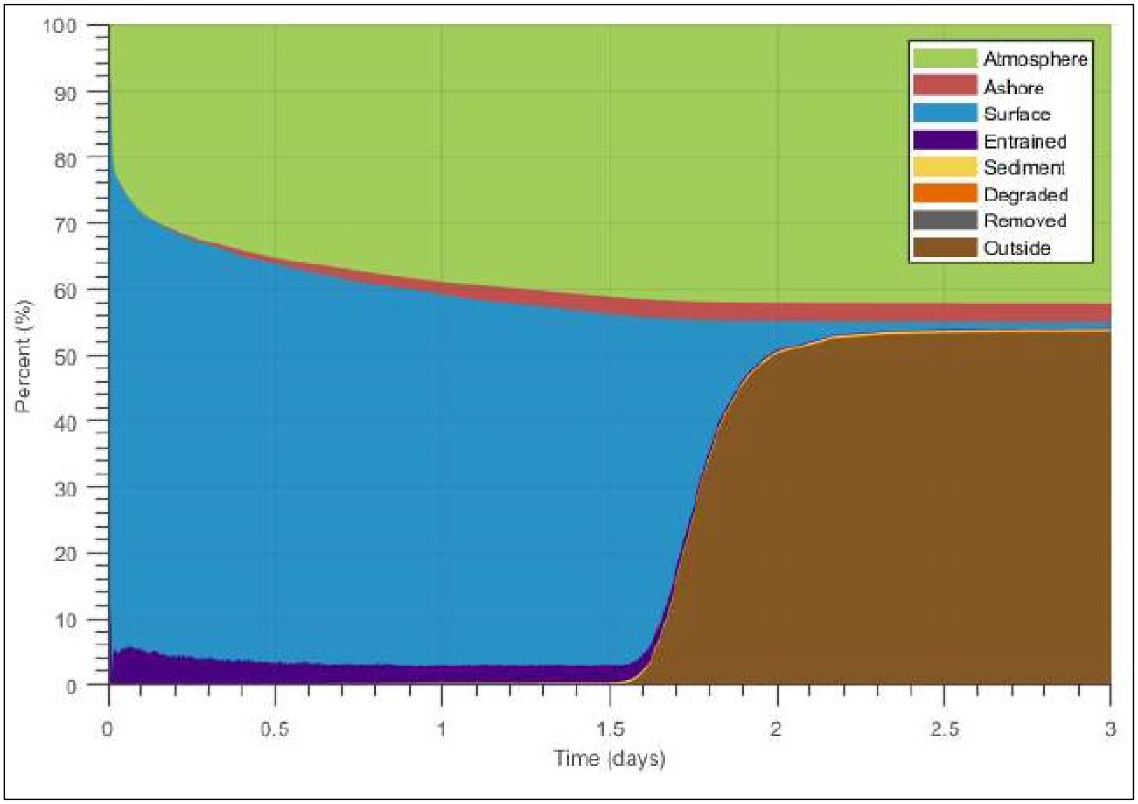


Figure 6.4-25 Oil mass balance for full bore release in average June flow conditions, existing line 5 alignment.
Source: Matt Horn Rebuttal Report

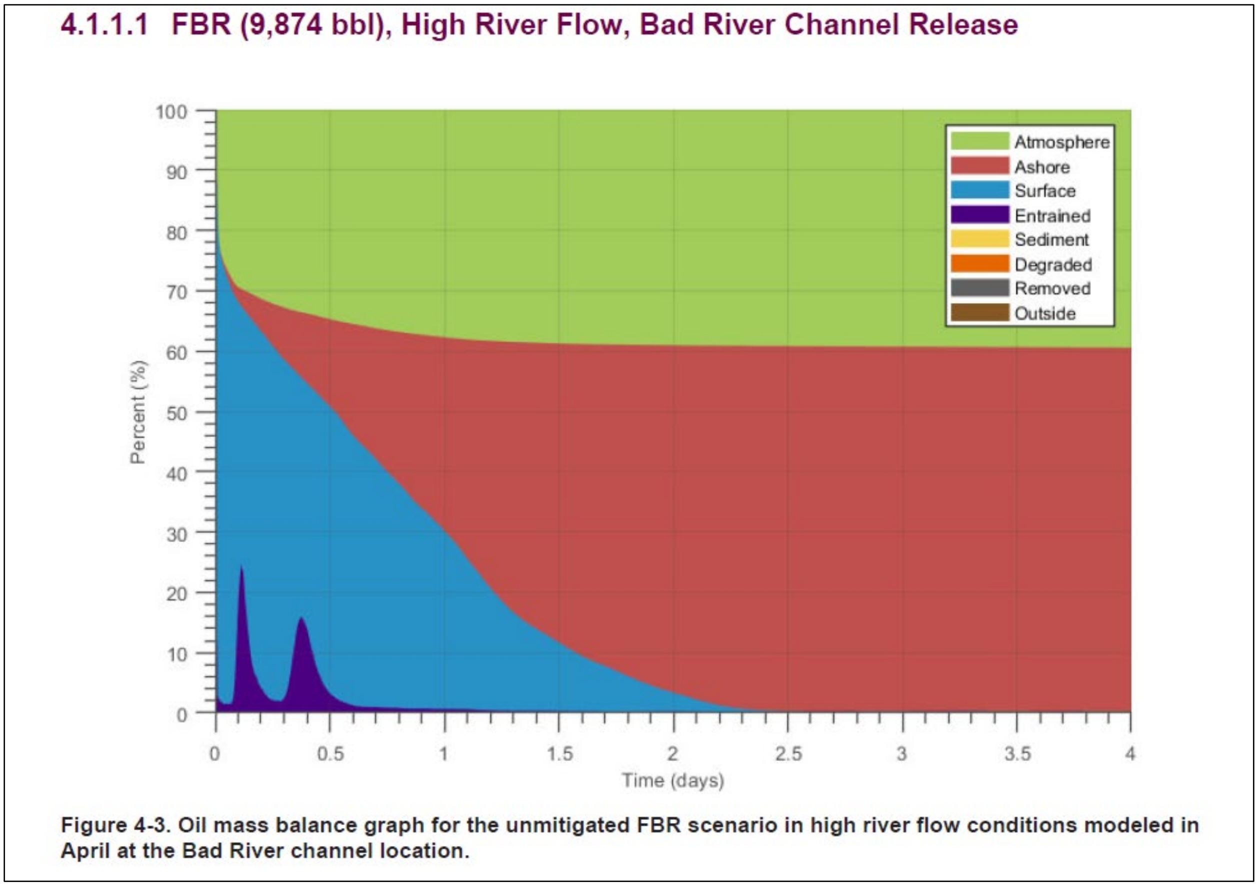
Since Enbridge's proposed line would cross the Bad River approximately 35 miles farther upstream from the location where the existing Line 5 crosses the Bad River, the oil would have more time to evaporate, be contained and removed, and more chances to strand on the shoreline with a spill from the proposed line. This suggests that less than 60 percent of the oil from the proposed line would reach Lake Superior. To try to determine how much less than 60 percent could reach Lake Superior during flood conditions (given that we do not have a model during flood conditions for the proposed route), we can look at the models during high and average flow to predict the quantity of oil that realistically could impact the Kakagon Sloughs or Lake Superior.

The high flow model during an unmitigated spill has [minimal: approx. 0.1 percent] of the oil reaching Lake Superior due to the absorbent wetland banks causing the spilled oil to strand onshore upstream of the Kakagon Slough (Figure 6.4-26Figure 6.4-26).

From RPS Report Appendix B page 215.

> *"In the unmitigated FBR releases under average river flow conditions (for both rivers), which are unlikely and extreme worst-case scenarios, the majority of oil was predicted to form surface slicks that would move downstream, stranding on shorelines and evaporating, with the potential for 35-39% of the release to remain on the surface or enter Lake Superior at the end of the 4-day simulation. This was not the case for the unmitigated high and low river flow scenarios or any of the mitigated scenarios, where less than 0.1% surface oil was predicted to reach Lake Superior due to stranding on upstream vegetation (high river flow), remaining trapped under the*

> *ice surface closer to the release location (low river flow, ice-covered conditions), and the containment and collection of oil by successful emergency response mitigation measures that would be employed."*

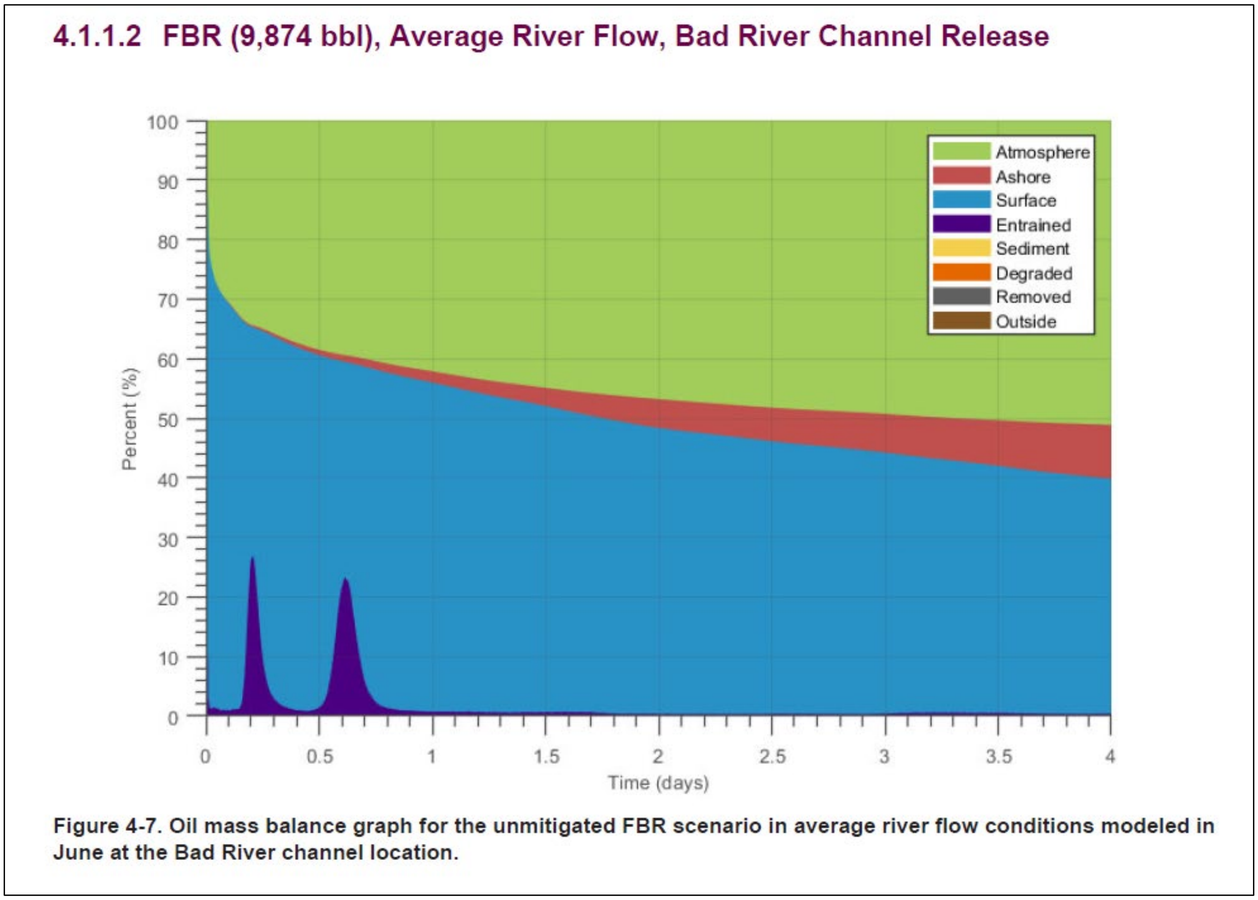


4.1.1.1 FBR (9,874 bbl), High River Flow, Bad River Channel Release

Figure 4-3. Oil mass balance graph for the unmitigated FBR scenario in high river flow conditions modeled in April at the Bad River channel location.

Figure 6.4-26 Oil mass balance for unmitigated FNR in April flow conditions.

If we then look at the average flow (Figure 6.4-27), unmitigated model on the Bad River, it showed up to 39 percent of the oil reaching Lake Superior which is 3,840 barrels in a FBR and 745 in HARV spills.



4.1.1.2 FBR (9,874 bbl), Average River Flow, Bad River Channel Release

Figure 4-7. Oil mass balance graph for the unmitigated FBR scenario in average river flow conditions modeled in June at the Bad River channel location.

Figure 6.4-27 Oil mass balance for unmitigated FBR under average flow conditions.

This would be the worst-case outcome when emergency response has not been included in the modeling. The extent of fast and successful containment of oil upriver would significantly reduce the chance of oil reaching the Kakagon Slough. As mentioned in section 6.4.4.6, mitigation was more successful at limiting the downstream transport of surface oil on the White River than on the Bad River.

From RPS Report Appendix B p. 219

> *"Notably, for the mitigated HARV and RARV scenarios, as well as the mitigated FBR scenarios in the White River, mitigation prevented surface slicks from reaching the most downstream portions of the Bad River (north of Highway 2), including the wild rice areas and Bad River Slough " However, for the FBR scenarios in the Bad River, a sufficient oil volume was released that a small amount of surface oil (<1 bbl in total) was predicted to reach the area adjacent to the Bad River Slough and Lake Superior, at levels that were never greater than patchy and discontinuous dull brown or rainbow sheens (<10µm)."*

Based on this analysis, between less than 0.1 percent and 39 percent of the oil realistically could reach the Kakagon Sloughs in flood conditions. Which for a FBR release is between 9.8 and 3,840 barrels and for a HARV spill is between two and 745 barrels.

FBR
9,847 barrels x 0.39 (39%) = 3,840 barrels
9,847 barrels x 0.001 (0.1%) = 9.8 barrels

HARV
1911 barrels x 0.39 (39%) = 745 barrels
1911 barrels x 0.001 (0.1%) = 1.9 barrels

6.4.4.8 Wild Rice

Wild rice is an important ecological, cultural, sustenance, socioeconomic, and recreational plant that continues to suffer from long-term decline throughout the state. Wild rice is highly susceptible to pollutants and poor water quality. It relies on specific pH and nutrients, substrate/sediment characteristics and water level interactions, low copper and sulfate levels, and high-water clarity—many of which can be significantly altered by an oil spill (DNR, 2021a).

Spilled oil would cover the water surface, coat plants and animals, and restrict oxygen exchange between air and water, thus impeding germination, killing living plant tissue or inhibiting the fruiting of the seed. Dense stands of emergent vegetation, such as wild rice, tend to act as oil booms and collect oil at the edges of the stand as oil adheres to vegetation; however, this would only be the case during the months of July, August, and September when the plant is erect. Wild rice is an annual plant that reseeds ever year. Early on in the reseeding process wild rice goes through a “floating leaf” stage in June and July, where the wild rice floats horizontally on the water surface, capturing more sunlight and creating mats on top of the water (Tillison, 2020). By mid-July wild rice begins developing more secure roots and grows vertically again (Tillison, 2020). During that early stage of growing, wild rice is more susceptible to oil contamination as the whole leaf lays on the surface of the water and may become coated in a thin film of oil. Those plants directly affected by the spill would likely die and the entire crop within the body of water would not be harvestable. If a spill occurred in winter, wild rice seed banks could be covered under ice or snow, which could contain the oil above the beds and potentially allow much of it to be recovered before it directly affected the wetland habitat and associated beds or animals. For spills occurring during the rest of the year or when ice or snow is not present, most of the oil spilled would float on the water or wet soil surface—although some of the volatile fraction could dissolve or disperse in the water. An oil spill could create permanent, negative changes to wild rice beds even after clean-up; water chemistry could change, suspended solids could increase, and water clarity could decline.

While thick oil may not reach the wild rice beds, which are between 18 and 50 river miles downstream of the proposed pipeline route, oil in the form of a rainbow sheen and dissolved hydrocarbons could reach the wild rice beds within the Kakagon Sloughs. When it comes to contaminating food or a place, the amount of oil is not as relevant. A thin sheen of oil floating within the wild rice would have a devastating and lasting effect on the community that is brought together by this food source and tradition. During the court case with Husky Energy after the oil spill into the north Saskatchewan River, a representative from the Little Pine First Nation, which is located downstream of the spill site testified three years after the spill that “people no longer farm, fish or collect medicinal plants near the river for fear of being poisoned (Quenneville, 2019).” Even a small amount of oil within the estuary would damage this otherwise pristine, internationally recognized, environment and cast doubt on the quality and safety of harvesting wild rice, berries, and fish from the area in the short-term, long-term, and possibly permanently. As is mentioned in section 6.4.5.11 about human health, the impacts of oil (even in a thin layer) reaching the wild rice beds is likely to cause mental health concerns to the community. While oil spills have been documented to cause mental health concerns to any community in the wake of an oil spill, those communities that rely heavily on natural resources for sustenance and tradition, are affected to a greater extent (Eykelbosh, 2014). Furthermore, members of the community have a connection to the land, separate from harvesting food and resources, as explained in Chapter 4.

With regard to potential oil spills on land affecting Lake Superior, the proposed project terminates approximately two and four miles inland from the shore of Lake Superior and none of the pipeline routes parallel the lakeshore. Spills on land can be contained using berms and trenches (Oil Spill Prevention and

Response, 2016) to prevent spills from entering waterways. A crude oil spill that reached the lake would likely result from a release that entered a river or estuary upstream from the location where the river or estuary enters Lake Superior, or possibly through groundwater movement. Impacts to Lake Superior would likely be localized and could include surface sheens or slicks and some localized water contamination. Given the volume of Lake Superior, it is unlikely that a release into a river or estuary would result in significant long-term impacts to its water quality and its aquatic resources. For spills in water colder than the oil's pour point, the oil quickly becomes viscous or tar-like (NOAA and API, 1994). Even lighter, refined products can lose the ability to disperse and become non-coalescing, semi-solid, smooth, spherical particles that are difficult to recover. Weathering and loss by evaporation are slowed by low temperature and thickness of the slick (NOAA and API, 1994). Depending upon the time of year and the water's temperature a spill into Lake Superior could either disperse across the water or become more tar like and not spread as easily.

During cleanup activities, the use of dispersants (unlikely to be permitted) would transfer oil and its associated toxic hydrocarbons into the water column, which would temporarily degrade water quality until toxins were diluted to sufficiently low concentrations to reduce their accumulation in fish tissue. In commenting on the Draft EIS, the EPA noted that "the Region 5 Regional Response Team does not allow for use of dispersants in the Great Lakes." Other cleanup methods that could be used, including booming, skimming, and mechanical removal, would not affect water quality. In-situ burning (if permitted) could result in sinking of heavier pyrogenic products as a consequence of the high temperatures. These heavier components are left behind after the lighter components are consumed by the fire and can linger in sediments, occasionally re-suspending in the water column. For some portion of the winter months each year, spill responders could remove spilled material from frozen ground or ice-covered waterbodies prior to snowmelt.

6.4.4.9 Groundwater

The risk of groundwater contamination varies from location to location, depending on the nature of the soils; underlying sediments; depth to groundwater; groundwater flow direction; local groundwater – surface water interactions; magnitude of the spill; nature of the spilled material such as solubility in water, tendency to stick to soils, sediments or rock, evaporation rate, density compared to water (specific gravity), tendency to be changed or metabolized by soil and aquifer microorganisms, or the tendency to change through natural chemical processes; the toxicity of the spilled material; the length of time the material is in the environment; and other factors.

Clayey soils and sediments tend to provide a measure of protection to groundwater from contaminant spills or releases. The movement of liquid materials through clayey soils and sediments tends to be slow. In contrast, the movement of liquids through sandy soils or sediments is much faster.

A significant depth to groundwater, on the order of tens of feet or a hundred feet versus less than ten feet, tends to provide a measure of protection to groundwater from contaminant spills or releases. The depth to groundwater, in part, impacts the time required for a spill or release to reach groundwater, a greater depth requires a greater travel time for materials to reach groundwater, and allows for a greater opportunity for natural processes to function on the spilled or released material prior to it impacting water.

Groundwater flow in unconfined conditions is generally from areas of higher elevation to areas of lower elevation. Under artesian, or confined conditions, flow is from areas of higher pressure to areas of lower pressure. In general, the water table is a subdued parallel of local topography and groundwater flow direction is generally from topographic high areas to topographic lows areas, often toward surface waters in the local topographic lows. Deeper groundwater systems generally flow from regional recharge areas to regional discharge areas, such as Lake Superior. Regional flow patterns often start at regional surface water divides and flow toward regional low points, regardless of local topography. The specific local direction of shallow groundwater flow is rarely known with certainty without performing local field investigations.

Groundwater flow direction could, at times, provide a measure of protection for a receptor, such as a municipal or private supply well, a wetland or a waterway from a spill or release. The general risk to a specific receptor would be a function of the location of the receptor in the groundwater flow field relative to the spill (up flow or down flow) and the magnitude of the spill.

Groundwater – surface water interactions can be thought of as four general types: (1) isolated systems wherein groundwater and surface water do not interact; (2) flow-through conditions where groundwater flows through surface water without a significant change in vertical or lateral flow directions; (3) recharge boundaries wherein surface water flows into and recharges groundwater; and (4) discharge boundaries wherein groundwater discharges into the surface water system. The third and fourth types of interactions often result in flow system divides through which groundwater flow does not cross, and as such, provide a measure of isolation between groundwater regimes. Groundwater – surface water interactions can vary throughout a year. For example, in spring or following significant rain events, elevated surface water conditions could induce recharge to groundwater. During summer or during comparatively dryer times, the same system could have groundwater discharge to surface water. Many boundaries are variable over the course of a given year. Spills or releases to surface waters that recharge groundwater could result in impacts to a groundwater system. Conversely, contaminated groundwater that discharges to the surface water of wetlands results in impacts to these waters.

The chemical properties of a spilled or released liquid impact on the relative ease with which the material could be transported to groundwater and the relative ease with which the material could be transported by groundwater. Crude oils are generally considered hydrophobic substances, or substances that tend not to dissolve in water. Crude oils are composed of a wide array of hydrocarbon compounds that each have unique suites of chemical characteristics, such as solubility, evaporation rate, and density, and interact with soils and groundwater differently as characterized by these properties. For example, hydrocarbons having a relatively higher water solubility are more easily transported to groundwater through the soils and transported by groundwater than hydrocarbons having a relatively lower water solubility. Hydrocarbons having a relatively higher water solubility are generally more easily metabolized and removed from the environment by soil microbes than hydrocarbons having a relatively lower water solubility. The specific impact to the environment would depend on the nature of the material spilled and the quantity released. If the quantity of the material released would be less than the capacity of the soil and groundwater to naturally retain and decompose the release, there would be minimal impact. If the quantity of the material released would be greater than the capacity of the soils and groundwater to naturally retain and decompose the release, there could be more significant impacts.

As described in Section 5.8.2 the recharge to the groundwater in the Bad River Watershed was evaluated as part of the process of formulating the groundwater model of the Bad River Watershed (USGS, 2015). The lowest levels were found to be within the area of the Lake Superior Lowlands mantled by the Miller Creek Formation. The recharge rates through clays were on the order of inches per year or less. The highest estimated levels occurred in upland areas underlain by sandy sediments and in the areas of bedrock hills. The recharge rates were calculated using the Soil Water Balance code (SWB) model (Westenbroek and others, 2010). A tabulated summary of the recharge rates along the existing section of Line 5 that would be replaced and the proposed route are presented in Table 6.4-13.Table 6.4-13.

Table 6.4-13 Modeled recharge rates in the Bad River watershed.

	Existing Line 5		Proposed	
Average annual recharge [a]	5.08 in/year		6.21 in/year	
Recharge categories with 1,200 ft. [b]				
> 16 inches per year	16 acres	0.2%	10 acres	0.1%
14-16 inches per year	557 acres	8.2%	220 acres	1.6%
12-14 inches per year	717 acres	10.6%	1555 acres	11.5%
10-12 inches per year	73 acres	1.1%	2022 acres	14.9%
8-10 inches per year	46 acres	0.7%	752 acres	5.6%
6-8 inches per year	314 acres	4.6%	1805 acres	13.3%
4-6 inches per year	584 acres	8.6%	2264 acres	16.7%
2-4 inches per year	3115 acres	46.0%	2580 acres	19.1%
< 2 inches per year	1346 acres	19.9%	2322 acres	17.2%

The recharge rates along the proposed route are skewed to the higher end of the range in comparison to the rates along the existing section of Line 5 that would be replaced (Figure 6.4-28). Approximately 66 percent of the area along the existing section of Line 5 is within the lowest two recharge rate categories. In comparison, approximately 36 percent of the area along the proposed route is within the lowest two recharge rate categories.

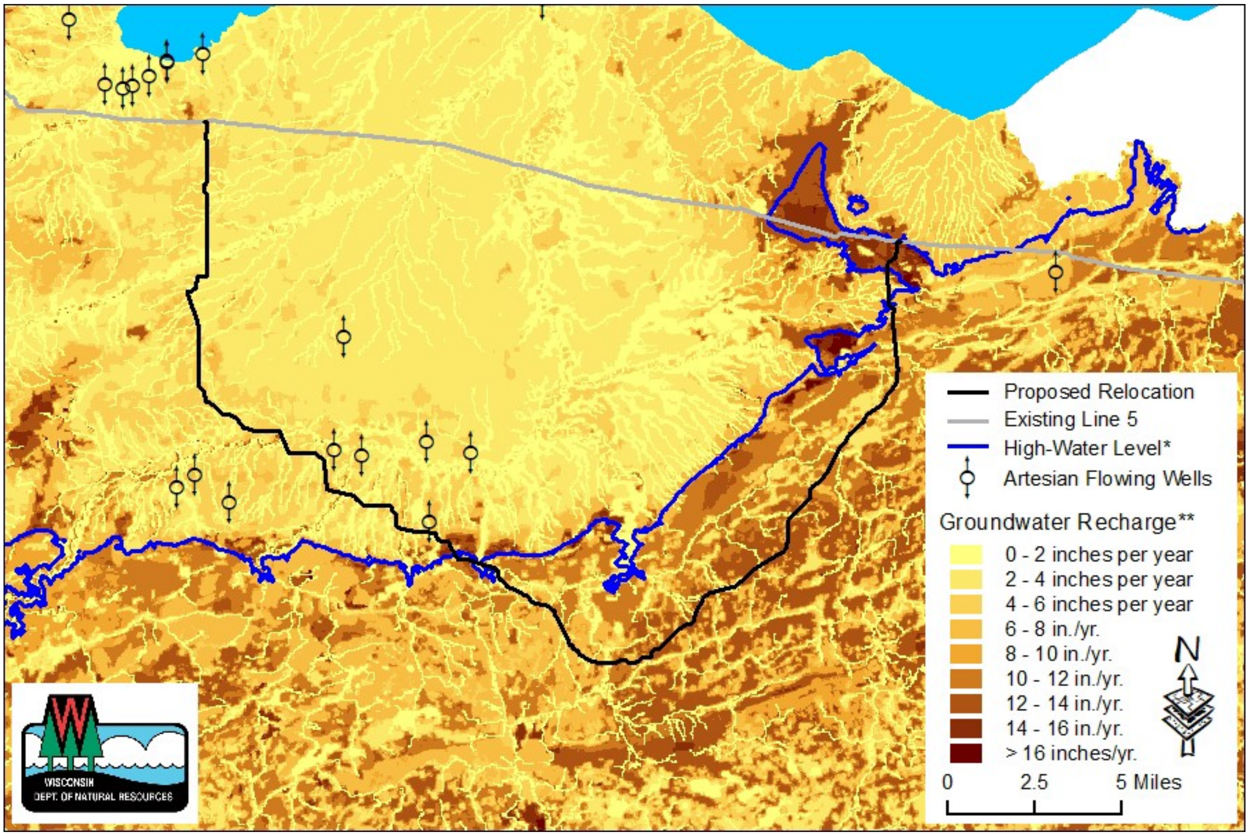


Figure 6.4-28 Modeled Groundwater Recharge Rates in the Bad River Watershed

A map of the recharge rates that were implemented in the groundwater model is shown in Figure 7.8.2- 1 below. The lowest recharge rates correspond to the lighter colors and the higher recharge rates correspond to the darker colors on the map. In general, higher recharge rates correspond to areas of comparatively more pervious soils, which are soils through which water can move more easily in comparison to other soils, such as sandy or gravelly soils. Similarly, petroleum spills could move more easily through comparatively more pervious soils than through less pervious soils. Other things being equal, the risk to groundwater from petroleum spills in areas of sandy soils is greater than in areas of clayey soils.

*High-water level elevations approximately correspond to the glacial Lake Superior Duluth beach level referenced in (WGNHS, 1984)

**Recharge zones and rates were modified from the USGS (2015) Bad River Watershed modeling study.

Areas having comparatively higher recharge rates are generally south of blue line on the map in Figure 7.8.2-1, which corresponds to southern extent of the elevation of the Duluth beach during a Lake Super high-water level during waning glaciation of the basin (WGNHS, 1984). Other things being equal, releases of petroleum to soils south of the blue line in Figure 7.8.2-1 would be anticipated to reach groundwater more quickly than in other areas, and more petroleum would be anticipated to reach groundwater in areas south of the blue line than in other areas.

6.4.4.10 Copper Falls Aquifer Recharge Area

A recharge area is a geographic area that supplies water from precipitation or surface water to a specific groundwater system. Recharge to an aquifer is possible even through a relatively thick layer of earth materials, on the order of many tens of feet, yet generally requires a longer time frame for the water to reach the aquifer compared to a relatively less thick layer of earth materials. Artesian aquifers are not recharged in the area of artesian conditions. Restrictive layers that cap artesian aquifers prevent downward migration of water to those aquifer areas. Similarly, the upward water pressure in the aquifer beneath the cap and within the cap also prevent downward water flow from above the artesian aquifer. Recharge to artesian aquifers occurs in areas where the aquifers are under water table conditions and where caps are missing.

Neither the extent of the Copper Falls Aquifer nor the extent of the aquifer recharge area have been formally defined in published documents that are readily available. However, the general extent of the recharge area could be surmised from groundwater first principals, and would include, at a minimum, the area where the aquifer extends to or close to the ground surface under a thin cover of other earth materials.

The Copper Falls Aquifer could be directly recharged in sections of the mapped areas. In some of these areas, recharge to the Copper Falls Formation possibly recharges shallow groundwater within the aquifer that flows to local surface waterbodies, including wetlands, streams, ponds, and lakes. Some percent of the recharge probably flows deeper into the aquifer. Some percent of that recharge flows even deeper and recharges the underlying Superior Sandstone Aquifer. In general, the Copper Falls Aquifer would be comparatively more vulnerable to direct releases of petroleum to the Copper Falls Formation, to releases in areas where the cover over the Copper Falls is thin, in areas where the covering material is relatively pervious, such as where the formation is mantled by Duluth beach lake level shoreline deposits, or in areas where surface waters discharge into the aquifer.

6.4.4.11 Supply Wells

Since the revisions to federal and state regulations on aboveground and underground tanks used to store petroleum implemented in the 1980s and 1990s, a wealth of information has been accumulated on the average extents of petroleum contamination in groundwater associated with releases from leaking tanks. Evaluation of 275 sites in California found that 90 percent of the evaluated sites contamination extended less than 255 feet from the source, the median distance was 101 feet and the maximum extent was 1,713 feet (API, 1998). Evaluation of 217 sites in Texas found that at 90 percent of the evaluated sites contamination extended less than 382 feet from the source, the median length was 181 feet from the source and the maximum was 1,619 feet. In Florida, at 90 percent of evaluated sites contamination extended less than 211 feet from the source, the median length was 90 feet from the source, and the maximum was 600 feet. The 1,200-feet distance for inventory of wells used in Section 5.5.2 is based on a general “rule of thumb” that the vast majority of petroleum groundwater impacts travel less than the 1,200-feet distance.

The number of supply wells within 1,200 feet of the existing route and the proposed route were inventoried (Table 6.4-14). As would be anticipated, a greater number of wells were inventoried for the proposed route at a length of 41 miles that for the 20 miles of the of the existing Line 5 replacement section.

Table 6.4-14 Wells within 1,200 of existing Line 5 and Proposed Route

	Existing Line 5		**Proposed**	
Well Construction Date	Number	Percent	Number	Percent
1988 to Present	26	63%	88	53%
Prior to 1988 *	15	37%	79	47%
Total Number of Wells with 1200 feet **	41		167	
Well Use †				
MUNICIPAL COMMUNITY	0	0%	0	0%
OTHER-THAN-MUNICIPAL COMMUNITY	0	0%	0	0%
NONTRANSIENT NONCOMMUNITY	0	0%	0	0%
TRANSIENT NONCOMMUNITY	2	5%	1	1%
NONCOMMUNITY	0	0%	0	0%
PRIVATE POTABLE	22	54%	88	53%
PRIVATE NON-POTABLE	0	0%	0	0%
Not Listed ‡	17	41%	78	47%
Static Water Level				
< 50 ft.	1	2%	50	30%
50-100 ft.	9	22%	23	14%
100-150 ft.	4	10%	12	7%
150-200 ft.	3	7%	4	2%
200-250 ft.	1	2%	0	0%
> 250 ft.	5	12%	0	0%
Not Listed ‡	18	44%	78	47%
Well Depth				
< 50 ft.	3	7%	4	2%
50-100 ft.	0	0%	26	16%
100-150 ft.	8	20%	20	12%
150-200 ft.	8	20%	17	10%
200-250 ft.	1	2%	13	8%
> 250 ft.	6	15%	9	5%
Not Listed ‡	15	37%	78	47%
Casing Depth				
< 50 ft.	3	7%	21	13%
50-100 ft.	0	0%	34	20%
100-150 ft.	10	24%	15	9%
150-200 ft.	6	15%	14	8%
200-250 ft.	1	2%	4	2%
> 250 ft.	6	15%	1	1%
Not Listed ‡	15	37%	78	47%

* Pre-1988 wells are not available in electronic format and detailed information may not be available.

** Total of the pre-1988 wells and wells in the current DNR database.

† Well use categories are based on definitions in the Wis. Adm. Code.

‡ Generally pre-1988 wells, the documentation for which were collected under different regulations or wells that do not have the referenced parameter detailed in records.

Based on available records, 41 wells are located within 1,200 feet of the existing section of Enbridge's Line 5 to be replaced by the proposed route and 167 wells are located within 1,200 feet of the proposed Line 5 relocation route section. Of those wells, none are known municipal community wells or other-than- municipal community wells. There are two transient noncommunity wells within 1,200 feet of the existing line and one within 1,200 feet of the proposed route (these are wells that serve locations such as taverns, motels, restaurants, churches, campgrounds, or parks). Based on these statistics, the risk of groundwater contamination from a petroleum release would be primarily to private residences.

As described in Section 5.5.2, well static water levels are the depths to the water in a newly drilled well at the time the well was constructed. The depth to the static water level is not a definitive indication of the comparative risk to a well from contamination spills. A water table well having the same static water level has a greater risk from contamination spills than an artesian well that taps into an aquifer many tens of feet deeper in the earth than the water table well. The wells within 1,200 feet of the proposed route have a higher percentage of comparatively shallow static water levels, 30 percent of the wells within 1,200 feet of the proposed route had a static water level of less than 50 feet below grade compared to only two percent of the existing line.

Well depths are the total depth of the wells as reported by the individual that constructed the well. There is considerable variation among the wells in terms of total depth. In general, deeper wells withdraw water from deeper in the earth, and as such may offer incrementally greater protection from surface or near surface releases of petroleum. In general, wells having deeper casing depths have a greater level of protection from surface contamination spills than wells with shallower casing depths. Wells within 1,200 feet of the proposed route generally have shallower casing depths (33 percent were cased less than 100 feet) than wells within 1,200 feet of the existing section of Line 5 (seven percent were cased less than 100 feet).

6.4.4.12 Human Health

Humans may be impacted directly or indirectly by oil spills. One example of direct exposure is breathing contaminated air. Oil products contain many volatile compounds which are released as gas vapors from spilled oil. The surrounding air becomes contaminated with these vapors, which humans are at risk of inhaling or ingesting. The highly toxic portions of crude oil that are toxic to humas and animals are those that are volatile and include BTEX, which are usually dangerous to the public or emergency response personnel within the first 4 to 8 hours after the spill. As identified in Enbridge's Field Emergency Response Plan, "chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of cancer in humans and animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity". The proper PPE is necessary for emergency workers who are cleaning up a fresh oil spill or a recently exposed spill or a spill that is in an area with poor ventilation. Benzene monitors can be placed within the contaminated area or carried on the response workers to ensure safe working conditions. A review of literature from 2014 identified short-term impacts for residents living in the spill impact zone, and longer duration and extended range of impacts for emergency response workers (Eykelbosh, 2014). Examples of physical effects that have been documented in emergency response workers included persistent respiratory, endocrine, immunological, and genotoxic effects (Eykelbosh, 2014). These short- and long-term effects on humans can be mitigated with the proper use of personal protective equipment and decontamination strategies.

Drinking oil-contaminated water is another way humans can be directly impacted by an oil spill. As identified in the historical spills section, portions of these volatile hydrocarbons can dissolve in water. Careful monitoring of drinking water wells and sources in the vicinity of a spill is necessary as they can be temporarily impacted by oil spills. Since volatile components like benzene have a strong odor, water contaminated with soluble portions of oil are likely to have a noticeable chemical odor. The historical spill that occurred near Glendive, Montana into the Yellowstone River that impacted the downstream water treatment plant had "odor complaints from residential water consumers" that caused the treatment plant to shut down for a few days (Peronard, 2015).

A second type of direct exposure is direct contact of oil with the skin. This direct contact typically causes an immediate irritation. Additionally, some contaminants may enter the body by being absorbed through the skin. Cleanup crews are at the greatest risk for direct exposure.

Humans may also have indirect exposure to oil spills. This indirect exposure may occur by bathing in contaminated water. Swimmers may inadvertently have contact with the spilled oil contaminants in a lake or stream located downstream of an oil spill, even if no visible plume or oil sheen can be seen. Residents of the City of Ashland may be at risk as the City's water comes from a collection point about ½-mile offshore in Lake Superior's Chequamegon Bay. An oil spill near or into Bay City Creek, which is the creek that runs directly through the City of Ashland and into Chequamegon Bay, is the most likely way that drinking water in Ashland could get contaminated. Th public works building that houses the town's water treatment plant is approximately 0.8-miles east of Bay City Creek.

There is also the risk of drinking wells that could be contaminated within an impact area. Another method of indirect exposure by humans is eating contaminated food, such as wild rice obtained from affected waters. Oil contaminants may bioaccumulate in smaller organisms and become more concentrated along the food chain. Humans living far away from an oil spill could have indirect exposure if the food they are consuming comes from a spill affected area.

Mental health concerns have also been documented related to oil spills. "Oil spills have been found to produce significant impacts to the psychological health and social well-being of residents living in affected communities"(Palinkas, 2012) "Mental health impacts were most often related to income loss or financial uncertainty and were exhibited by increased anxiety, depression, and posttraumatic stress disorder"(Eykelbosh, 2014). Mental health concerns were also at the community level "especially in individuals and communities dependent on natural resources affected by an oil spill" (Eykelbosh, 2014) who may no long come together as a community to hunt or gather. "Mental health impacts often showed broader geographic extent than physical impacts, impacted the family as well as the individual, and were found to persist or worsen over years" (Eykelbosh, 2014).

6.4.4.13 Effects on Sensitive & Rare Species

Oil spills affect plants and animals and their habitats in many ways. The severity of impact depends on the type and quantity of the oil spilled, the season and weather during this spill, and type of habitat impacted. Plants exposed to hydrocarbons are affected by direct toxicity. Oil coating plants limits their access to light, and the oil limits the movement of nutrients in the soil, preventing plants from acquiring the necessary nutrients (Ming, 2011). Oil harms fish and wildlife through physical contact, absorption, inhalation, and by eating contaminated food supplies. Floating oil within waterbodies contaminates algae, fish eggs, small invertebrates, wetland birds and mammals, and foraging wildlife. Terrestrial and wetland edible plants would be impacted resulting in loss of forage for wildlife, creating unnatural wildlife movements for clean food and water. Soil contamination could cause long-term impacts to many different terrestrial and aquatic species.

In a study that analyzed 1,702 oil spills (80 percent of which were in in US) from 1970 to 2018 it was identified that wildlife impacts are not proportional to the size of oil spills (Chilvers, Morgan, and White, 2021). "Significant numbers of wildlife are affected from just about any size spill" (Chilvers, Morgan, and White, 2021). Instead, it is important to the density of the wildlife in the area rather than the quantity of oil spilled. Most spills that were reported during that timeframe did not report the presence of wildlife either impacted or not impacted, making it difficult to have a baseline set of data. However, since wildlife often get scared away by human presence establishing that baseline is difficult, but the point stands that reporting should include both impacted and nonimpacted wildlife. Wildlife effects were highest on spills from truck/train related spills at 37 percent, followed by 30 percent of all tanker spills, 29 percent of all pipeline spills. The predominant species reported affected by oils spills were 45 percent birds, 45 percent air-breathing wildlife including birds and marine mammals and/or reptile species, and 10 percent non-air-breathing wildlife only, i.e. fish (Chilvers, Morgan, and White, 2021).

The RPS report does not assess long term effects on the environment primarily because it is difficult to accurately monitor long term effects, not because they do not occur. It has been well documented that long term effects of oil contamination on fish, waterfowl, and mammals occur. A study after an oil spill off the tip of Argentina was one of the first of many studies to identify that seabirds with low levels (20 percent body coverage) of oil coverage on their body “suppress circulating levels of reproductive hormones and interfere with breeding (Fowler, 1995) .”

Fish eating these organisms become contaminated through ingestion. Larger animals in the food chain can consume these contaminated fish and other wildlife, passing the contamination on up the food chain. Scavengers like the bald eagle are also exposed by consuming the contaminated carcasses of animals directly killed by the oil spill. Following the immediate impacts of an oil spill the long-term impacts to the habitat can persist in the environment many years to decades after a spill. This long-term impact would continue to affect fish and wildlife in the area (USFWS, 2010).

The federally listed threatened and endangered species and state listed threatened and endangered species that may occur within or near to the limits of construction of the proposed project and the potential impacts from construction are provided in Sections 5.9.4, 5.10.8, and 5.10.9. It is possible that these species could be affected by spills if they are located down gradient or downstream from a spill and if the spill were to travel to the extent necessary to reach these species or their habitats.

Table 6.4-15 presents the number and types of documented occurrences of rare species and natural communities located in between Enbridge’s proposed Line 5 pipeline relocation route, the existing Line 5 segment that would be replaced, and the number of documented occurrences of rare species and natural communities in between the existing Line 5 segment and Lake Superior. This is not intended to suggest that all these could or would be impacted by a spill. Rather, it is intended to communicate what has been documented down gradient or downstream from the pipeline within the Ecological Landscapes in the region.

Table 6.4-15 Known rare species and natural communities between Enbridge's proposed route and the existing Line 5 segment and north of the existing Line 5 segment to Lake Superior.

	Existing Line 5 pipeline area[1]	**Proposed pipeline area[2]**
Area encompassed	120 square miles	204 square miles
Number of rare species or natural communities	37	42
Conservation status:		
State		
Endangered species	8	1
Threatened species	8	6
Species of special concern	21	35
Other[3]	8	7
Federal		
Endangered species	1	0
Species of concern	3	3
Critical habitat	1	0
Type:		
Animal		
Aquatic animals	3	7
Wetland animals	8	7
Terrestrial animals	5	7
Plant		
Aquatic plants	1	1
Wetland plants	8	3
Terrestrial plants	2	8
Natural community		
Aquatic communities	1	2
Wetland communities	4	0
Terrestrial communities	3	4
Animal concentration site		
Other - aquatic	0	1
Other - terrestrial	1	0
Other - wetland	1	2

[1] Area located between the existing Line 5 segment that would be rerouted and Lake Superior.

[2] Area located between Enbridge's proposed Line 5 relocation route and the existing Line 5 segment.

[3] Natural communities

6.4.4.14 Effects on Fish

Fisheries, including lake sturgeon and muskellunge, for example, could be affected. Lake sturgeon and muskellunge are known to spawn in the Bad River. Sturgeon's preferred spawning sites are rocky areas along riverbanks and on the Bad River those sites are likely to be 15 to 20 miles upstream in the river. Muskellunge spawn in the shallow vegetation of the sloughs and near the river mouth. There are many important fisheries in and near Lake Superior that could be affected by an unanticipated spill. Effects of Enbridge's proposed project on fish in the Bad River watershed are highlighted in Section 5.9 and in 6.4.4.25.

6.4.4.15 Effects on Macroinvertebrates

Aquatic macroinvertebrates live in the water and substrates of rivers and streams. While not immediately noticed in the environment, small invertebrates play an important role in maintaining healthy terrestrial and aquatic ecosystems. "The species richness and functional importance of freshwater benthic invertebrates generally go unnoticed until unexpected changes occur in ecosystems" (Covich, 1999). An oil spill that reaches a river would be an example of an unexpected change that would likely cause macroinvertebrates to die, which would result in a change in water quality and stream health. "Hydrocarbons trapped in sediments may decrease microbial and meiofauna density, biomass and diversity of benthic fauna, suppress photosynthesis of phytoplankton, as well as alter macrofauna community and feeding activity" (de Santiago-Martín et al., 2015). Bottom dwelling macroinvertebrate species are important in that they help convert live plant and dead organic material into food for larger consumers and accelerate nutrient cycling (Covich, 1999). While the consequences of each macroinvertebrate loss cannot be predicted, if one species after another were lost from an ecosystem, then at some point the ecosystem would likely change drastically (Covich, 1999).

6.4.4.16 Effects on Mussels

Freshwater mussels are highly sensitive to oil spills. Although adult mussels have the ability to "clam up" for a limited time to avoid toxins such as gasoline and oil, young mussels are often killed immediately. Multiple spills or the long-term, chronic leaching of toxins can accumulate in the tissues of mussels as they continually filter water for food and can be passed through the food chain. Eventually the entire mussel population can be killed; directly from a toxin or by killing the fish hosts on which they depend for successful reproduction, ultimately eliminating the mussels (Upper Mississippi River Basin Association, n.d.). Mussels exposed to non-dispersed oil also experienced immune suppression, reduced transcription and higher levels of mortality. After 21 days, mussels in all treatments exhibited evidence of genetic damage, tissue loss and a continued stress response (Counihan, 2018). Elevated polycyclic aromatic hydrocarbon (PAH) levels reflected bioaccumulation in mussels from all the oiled mesocosms. This correlated with reduction in growth rate (Le Floch et al., 2003).

From Exxon Valdez Oil Spill Trustee Council: Long-term mussel contamination occurred where substantial amounts of oil was trapped in sediment; primarily within coarse-textured habitats, including heavily oiled beaches exposed to considerable wave and storm energy (e.g., Sleepy Bay). In 1991, high concentrations of relatively unweathered oil were found in the mussels and in underlying byssal mats and sediments in certain dense mussel beds. No differences in abundance or biomass were documented in sheltered rocky and estuarine habitats. However, in coarse-textured habitats along the Kenai Peninsula, mussel populations were still affected.

A study detected greater concentrations of total PAC in mussels ($\sum PAC_{44}$) exposed to dilbit-contaminated water (25.92–27.79 $\mu g\ g^{-1}$ lipid, $n = 9$, at day 25 of the uptake phase) compared to mussels from a control with no exposure to dilbit (average of $2.62 \pm 1.95\ \mu g\ g^{-1}$ lipid; ±SD, $n = 17$). However, metal accumulation in dilbit-exposed mussels did not exceed the unexposed controls, suggesting no excess metal accumulation by mussels from a 25-day dilbit exposure. This study provides the largest, most comprehensive set of toxicokinetic and bioaccumulation parameters for PACs and their alkylated counterparts (44 analytes) in freshwater mussels obtained to date (Séguin et al., 2022).

6.4.4.17 Effects on Amphibians & Reptiles

As mentioned in 5.10.5, due to their unique physiology, amphibians are able to absorb water through their skin and rely upon moist environments to complete their life cycle, maintain proper water balance, and regulate temperature. This unique trait also means they are excellent indicators of environmental conditions and are, therefore, very sensitive to changes in water parameters or introduction of pollutants and other chemicals. There is ample evidence to suggest that petroleum products and other hydrocarbons can cause acute toxicity including death, developmental issues, inhibition of egg hatching and growth, and other issues (Lefcort et al., 1997; Bommarito, Sparling, and Halbrook, 2010). Downstream effects of oil and petroleum product contamination can be related to die-off of plants, arthropods, and other animals required as food sources by amphibians and reptiles. Further, persistent large hydrocarbon molecules and related contamination can remain in the soil for a period and can have detrimental effects to the survivability of reptile eggs, in addition to increasing the likelihood of malformations. Though literature is relatively scarce concerning direct mortality and physiological effects of oiling on terrestrial or freshwater reptiles, it is known from other spills that sea snakes, sea turtles, and freshwater turtles can die from ingestion of oil and petroleum products, among other fatal pathways (Mitchelmore et al 2017; Short 2011).

Research into the freshwater northern map turtle after the Enbridge pipeline spill into the Kalamazoo River identified a 30 percent reduction of population, a shift in overall size of turtles (smaller) and change in the population sex ratio over a 10-year period post spill (Otten, Williams, and Refsnider, 2023b). Short-term mortality calculations after a spill often miss die-off related to reproduction. About nine months after the Kalamazoo River spill, another notable die-off occurred when northern map turtles emerged from hibernation (Otten, Williams, and Refsnider, 2023b).

6.4.4.18 Effects on Birds

An oil spill that results in physical contact to wildlife could result in decreased movement of wildlife. Direct oil exposure to waterfowl can have adverse effects including physical fouling of the feathers, damage to exposed skin and eyes, and the toxic effects of ingested or inhaled petroleum hydrocarbons (Fingas, 2014). Birds with oil stuck to their wings would be inhibited from flying or unable to fly long distances, reducing them to only being able to swim. Waterfowl and wetland birds such as loons would not be able to maintain their feathers and waterproof layer, making them more susceptible to hypothermia and reducing their buoyancy. Even slightly oiled birds coming into contact with between three to five ml of oil thickness can suffer physical effects limiting flight or putting them at risk of hypothermia (Fingas, 2014).

Thin, low viscosity, and highly volatile oils (including benzene, toluene, xylene and naphthalene) are able to penetrate to the animals skin, resulting in injury to bare skin and eyes (Fingas, 2014) Light crude oil has a higher concentration of highly volatile oils, but volatile portions are not likely to last in the surface oil slick beyond eight hours due to evaporation. Effects from other less volatile portions of the oil would still be a concern to wildlife but the most toxic portions of oil (volatiles) only pose a concern to animals for a short period of time.

The SIMAP model used 350 mL of oil as a lethal dose for all wildlife, which was obtained from a study that identified lethal does to wildlife to be between 200 and 500 mL of oil. Assuming that a swimming bird has a width of 15 cm, it would need to swim through 230 m of oil of 10 µm thickness, 23 m of oil of 100 µm, or 2.3 m of oil of 1000 µm to obtain a dose of 350 mL. A slick thickness of 10 µm is assumed as a threshold thickness for oiling mortality, given the sizes of the waterbodies involved and likely exposure times of animals within them (French-McCay, 2009). Table 6.4-16 identifies the extent in miles on the Bad River and and White River, where modeling results showed a maximum oil thickness of 10 µm or higher. The unmitigated scenarios are highlighted in gray and the table identifies the oil slick extent during average and high flow and during a FBR and HARV scenarios.

Table 6.4-16 Miles of surface oil on Bad River and White River.

Spill	Flow	Miles to Reach Lake Superior from Spill site	Miles of oil slick	Miles above 10 um threshold for oiling mortality*	Average maximum thickness (cm)
Bad River					
Mitigated Spill					
FBR (9,874 bbl)	Avg	50	50	**43**	0.3
	High		50	**25**	0.3
HARV (1,911 bbl)	Avg		19	**17**	0.4
	High		25	**12**	0.2
Unmitigated Spill					
FBR (9,874 bbl)	Avg	50	50	**43**	0.7
	High		50	**43**	0.4
HARV (1,911 bbl)	Avg		49	**37**	0.1
	High		43	**17**	0.1
White River					
Mitigated Spill					
FBR (8,517 bbl)	Avg	25	11	**11**	2.8
	High		9	**9**	3.0
HARV (1,911 bbl)	Avg		6	**6**	1.0
	High		6	**6**	0.7
Unmitigated Spill					
FBR (8,517 bbl)	Avg	25	25	**25**	0.9
	High		12	**12**	2.5
HARV (1,911 bbl)	Avg		25	**25**	0.2
	High		6	**6**	0.6

Two additional studies outlined in the Handbook of Spill Science and Technology by Fingas identified that oil applied to mallard eggs or the breast of wedge-tailed shearwaters, decreased embryo survival rates and increased malformations of hatchlings. Decreased body weight, decreased reproduction rates, and an increase in deformities are all possible long-term effects on waterflow after an oil spill.

There are many important bird areas within the three counties included in the project area but four of these important bird areas could be impacted by a large oil spill in the area. These areas have been designated because the one or more bird species that uses the site is endangered, threatened, or vulnerable. A vulnerable bird species is one that is not widely distributed, has concentrated populations to one general habitat type or because they congregate for breeding, feeding, or migration. The important bird areas have been designated by the Wisconsin Bird Conservation Partnership are not associated with any legal status or regulatory requirements, they only serve as a guide to help bird populations in Wisconsin ("Wisconsin Important Bird Areas," n.d.).

The four important bird areas within the project area are:

- **Lower Chequamegan Bay** – Includes Whittlesay Creek National Wildlife Refuge and the South Shore State Fish and Wildlife Area both of which are in Bayfield County. Lower Chequamegen Bay host the oldest of Wisconsin's four active common tern colonies and is an important migratory staging and stopover.
- **Kakagon and Bad River Wetlands –** Includes the most extensive and least disturbed coastal wetlands communities in the Great Lakes Region along with the forest corridors of the Bad, White, Potato, and Marengo Rivers. This is popular migratory bird concentration area and includes species yellow rail, Virginia rail, northern harrier, sedge wren, Le Conte's sparrow, northern waterthrush, Blackburnian warbler, and golden-winged warbler.
- **Penokee Range –** Two large rivers, the Potato and the Montreal River carve through the steep terrain of the Penokee-Gogebic Iron Range. This range provides core habitat for the black-throated blue warbler. Other prominent birds use this area for breeding including veery, wood thrush, Canada warbler, golden-winged warbler along Alder Creek, and Nashville warbler and Lincoln's sparrow. The American pine marten which is the only endangered species in Wisconsin has been reintroduced to the Penokee Range and also has habitat within the Apostle Islands.
- **Apostle Island National Lakeshore –** The Apostle Island which are designated by the National Park Service as a National Lakeshore are in Lake Superior a few miles north of the mouth of the Kakagon and Bad Rivers. The Apostle islands national Lakeshore is in Bayfield County and includes 21 of the 22 islands that make up the Apostle islands and it also includes Long Island. Long Island which is part of the Apostle Islands is off the Chequamegon Spit. According to the National Park Service, Long Island is made of sand and fluctuates from being an island and reconnecting with Chequamegon Spit and the island is significant in that it provides nesting grounds for the endangered bird called the Piping Plover.

6.4.4.19 Effects on Mammals

Mammals that rely on their coat for thermal regulation in the winter such as fox, if affected by oil, would also be susceptible to hypothermia in the winter. While trying to clean themselves off, they could suffer from poisoning. Oil spills in the spring, summer, and fall are more likely to have adverse effects on wildlife. The RPS Report indicates that during the January model runs there would be no acute surface or shoreline effects that would impact wildlife due to the ice and snow cover predicted at the time of the spill. While it is unlikely that there would be no effects on wildlife and waterfowl during a January spill, the effects would be likely to be more limited. Many animals are less active in the winter and the ice acts as a natural barrier to many animals that are still active in the winter. Beavers, water shrews, muskrat, and otters are examples of mammals that are less active in the winter, but still move about both above and below the ice during the winter. Beaver lodges (Figure 6.4-29) which often end up providing shelter for numerous other species have their lodge above the water and store a food cache underwater near their lodge that they access daily. The beaver lodges are warm enough that they keep a portion of the river under the lodge unfrozen and accessible. These mammals are examples of animals that use the river environment in the winter and would be affected by an oil spill that was trapped under the ice. Beavers are known to be a keystone species meaning that their dams and lodges, which often alter wetland areas, provide benefits to many other species in the area. A more in-depth description of beavers in in section 5.10.3.6.

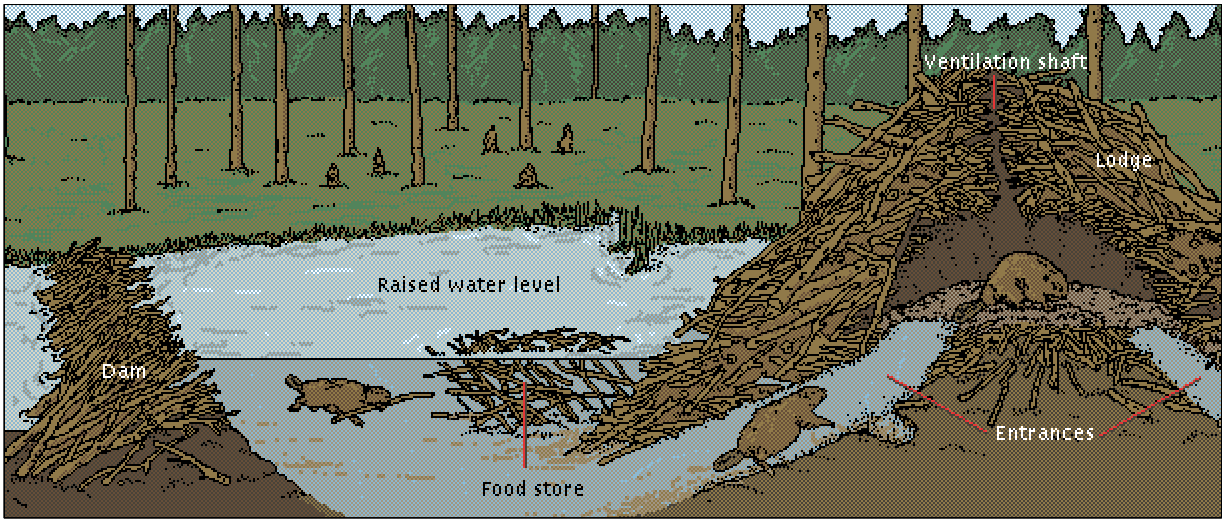


Figure 6.4-29 Winter beaver activity.

6.4.4.20 Effects on Plants

Effects of contamination from oil and other petroleum-based hydrocarbons can have direct, indirect, developmental, and sustained environmental effects on plants and plant communities. The first and most acute cause of stress and death to plants from oiling is related to a decrease in the ability to absorb water and conduct respiration. A layer of oil on plant tissues would prevent gas and water exchange, and severely limit the ability of the plant to photosynthesize, obtain carbon dioxide, and release oxygen. Resulting in cellular death or decreased ability to uptake water and other nutrients. Further, contamination of soils from petroleum products can severely limit or entirely restrict germination of new seeds in the soil, and inhibit their dispersal by covering seeds, especially those dispersed by wind and water (da Silva Correa et al. 2022).

6.4.4.21 Copper Falls State Park

Enbridge's proposed Line 5 relocation route would cross the Bad River and Tyler Forks approximately one mile upstream of Copper Falls State Park. A spill located in this area would contaminate two waterways, Bad River and Tyler Forks River. While the park allows for relatively easy road access to the Bad River, which would allow for containment of the spill to occur, the proximity of Red Granite Falls and Copper Falls (1.6 and 5 river miles downstream from the proposed pipeline crossing) is concerning if any size of spill reaches the Bad River. The park itself may not suffer great losses from a small spill and small spills are unlikely to have significant long-term impacts. A short-term closure of the park would likely occur. A very large spill in the vicinity of Copper Falls State Park could have a devastating effect on the park. A large spill would quickly be carried into the park by the two rivers and damage habitat, wildlife, and the recreational amenities the park offers. There are two 100-foot gorges within the park that are inaccessible by machinery and very inaccessible by foot. These gorges could be contaminated by a very large spill and cleaning of that contamination could take years resulting in a long-term closure of the park until the spill is remediated.

6.4.4.22 Wisconsin Public Access Lands

In addition to state parks, Wisconsin has many other protected lands that are available for the public to use for recreation and provide protection for rare plants, animals, and landscapes. Within the project area there are designated State Fishery Areas, State Natural Areas, and State Wildlife Areas (Section 5.12). A spill from the proposed route is likely to impact the following public lands (Figure 6.4-30).

- White River Fishery Area
- White River Breaks State Natural Area
- Lake Two Pines State Natural Area
- Sajdak Spring State Natural Area
- White River Wildlife Area
- White River Boreal Forest State Natural Area
- Copper Falls State Natural Area

A more detailed description of these areas is outlined in Section 5.9.3. and 5.12.The majority of these public access lands are concentrated to a specific area along the White River, between 1 and 3 miles downstream of the proposed pipeline crossing. The proposed crossing of the White River would be an HDD site and the pipeline is planned to be 108 feet below the riverbed at the crossing site, however, a spill south of the HDD crossing where the HDD terminates is within the Deer Creek/White River watershed and is expected to reach the White River. The modeling done by RPS identified multiple spill scenarios particularly during high water flow conditions, where the oil was expected to strand on the shoreline within the vicinity of the White River Fisher Area and the White River Wildlife Area.

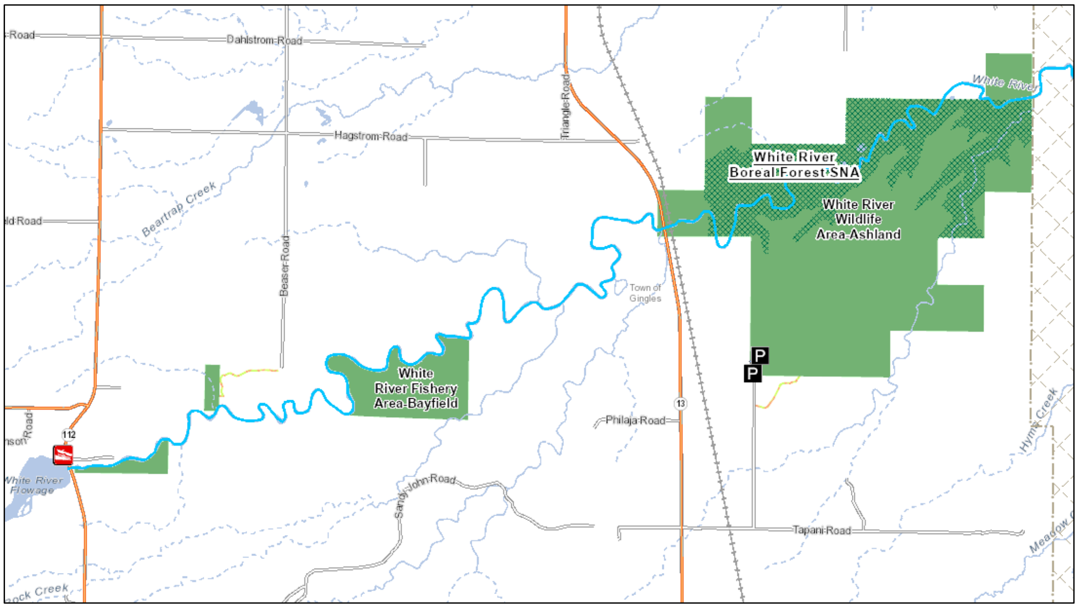


Figure 6.4-30 State Natural Areas and State Fishery Areas along the White River.
Source: DNR Public Access Lands mapping application

6.4.4.23 Environmental Justice

The full range of environmental justice effects of the proposed project is described in Chapter 4 .Chapter 4 includes input and insights on the anticipated environmental justice consequences of a Line 5 spill, as shared by tribal members and staff from the Bad River, Red Cliff, and Lac du Flambeau Bands of Lake Superior Chippewa, the Forest County Potawatomi Community, and the Great Lakes Indian Fish and

Wildlife Commission. The current section describes mostly different effects, although there is some overlap.

The proposed relocation route is located outside of the Bad River Reservation. A spill, however, would have the potential to impact both the reservation and portions of the Ceded Territories to which the Bad River members and other indigenous communities have rights. Anticipated impacts to surface water from a pipeline spill are described in Section 6.4.4.2. Negative impacts from a spill affecting surface water would include loss or degradation of fishing, with toxicity persisting in streams and tributaries for weeks to months. Loss of access or degradation of natural resources would have the potential to impact Native American and low-income populations in the vicinity of the spill. These populations may depend on subsistence fishing and hunting or may have cultural practices associated with fishing, hunting, and gathering. While recreational anglers and hunters would be able to shift to unaffected locations in the event of a spill, low-income populations may have limited access to transportation to reach unpolluted areas.

Depending on the location and size of a spill, the Native American population would be at risk for more significant impacts. Tribal members use subsistence and commercial fishing treaty rights within the Ceded Territories. Much of the subsistence fishing for walleye occurs on the Bad River, Kakagon River, and White River with additional subsistence fishing in Lake Superior and on Madeline Island. Spear fishing is focused on the spring spawning run on inland waters. Additionally, the Bad River Band has operated a fish hatchery since 1968. The hatchery has concentrated its efforts on raising walleye fry and fingerlings to supplement existing walleye populations within reservation waters (Lorrie Salawater, 2017). Impacts to surface waters are discussed in Section 6.4.4.2. Impacts to fish are discussed in Section 6.4.4.14. Depending on tribal fishing patterns, tribal members may experience some disruption to traditional cultural fishing practices in specific areas during the Project's construction.

Wild rice beds are harvested annually and are an important tribal resource. While the beds are separated from the pipeline by distance, a spill that is large enough to reach the beds would cause impacts to the Bad River Tribe. According to the Bad River Band Tribal Court Code 303, wild rice (manoomin) has been a nutritional staple for members of the tribe for generations and continues to provide a substantial portion of nutritional needs of the tribe's members. Additionally, the annual harvest of wild rice is a traditional event of long-standing cultural importance. Wild rice also provides a predictable source of income for the tribe's members through the sale to non-residents of the reservation (Section 4.2.1.10). Section 6.4.4.8 discusses anticipated impacts to wild rice beds in the event of a spill.

6.4.4.24 Regional Economy

In addition to the costs associated with tangible clean up items, there is the potential for impacts to the local economy's tourism industry. The region's recreation-based tourism industry is at a higher level of risk in the event of a very large spill. The tourism and recreation industry in the region would likely experience impacts if a very large spill was to occur. Very small to large spills are unlikely to pose a risk to the tourism industry or regional economy. Of the 61 spills in Wisconsin mentioned above, two were large enough to be classified as substantive spills. The remaining 59 spills were small or very small spills. Since 2000 there have not been any pipeline oil spills in Wisconsin that were of large enough category to adversely affect a regional economy.

6.4.4.25 Tourism

The tourism industry generates jobs, income, and state and local tax revenues in Ashland, Bayfield, and Iron counties (Section 5.14.1.2). In 2019, an estimated 1,476 jobs were in the tourism industry, with $32.5 million in personal income generated. Tax revenues from the industry were estimated to total approximately $13.8 million (Wisconsin Department of Tourism, 2021). These impacts are generally dispersed throughout the three-county region, with Bayfield County having 43 percent of the total jobs. Leaks or small spills would be expected to have a negative impact on the immediate area of the event, may impede access to adjacent property, and may impact waterways. A very large spill would have a more widespread impact and could also negatively affect perceptions of the pristine nature of the three-county area and, thus, discourage tourism in areas elsewhere in the counties. It is unlikely, however, that tourism associated with Lake Superior, Chequamegon Bay, and the Apostle Island National Lakeshore, which drive much of the tourism in the area, would be impacted by a pipeline spill along Enbridge's proposed route or route alternatives unless the spill was large enough to reach Lake Superior.

The counties in which Enbridge's proposed relocation route and route alternatives are located each offer hundreds of miles of snowmobile trails, with some trails also available for ATV/UTV and fat biking use. Cross-country skiing, snowshoeing, fishing, and hunting are also available in the three-county area. The impacts of a spill would potentially include degradation and impeded access to recreation trails, fishing sites, and hunting areas. Impacts to game and fish may occur as well. The Bad River would be the recreational resource most likely to experience significant impacts from a spill. A spill of any size could result in a decline in local recreation-based tourism during remediation efforts. However, the potential for impact is limited by the large variety of outdoor recreation resources in Ashland, Bayfield, and Iron counties. A small or minor spill would likely shift recreation-based tourism within the region rather than displace recreation demand altogether. A very large spill, however, would not only impact a large number of recreational resources and acreage, could also pose a greater risk to the tourism industry of the three-county area.

The three-county socioeconomic study area has nine Wisconsin DNR-recognized fisheries and numerous additional lakes. Each of the counties also borders Lake Superior. In 2020, an estimated 94,000 U.S. anglers fished Lake Superior, of which 28,988 (31%) were from Wisconsin. Anglers spent about an average of 18 days fishing on Lake Superior equating to about 1.7 million total fishing days. Anglers spent a total of $300 million for recreational fishing on Lake Superior in the U.S. including $41 million on trip expenditures and $177 million on equipment. The direct spending of $319 million by anglers on Lake Superior in 2020 generated $76.7 million in household income to 1,600 full- and part-time employees and proprietors who worked for and owned Lake Superior businesses. This spending contributed $34.9 million in tax revenues, $106.6 million to GDP and $205.3 million to direct economic output (Cornicelli et al., 2022). The state-licensed commercial fishermen reported annual landings of 424,097 pounds of lake whitefish, 34,545 pounds of lake trout, 90,866 pounds of siscowet, 532,375 pounds of cisco, 9,276 pounds of cisco eggs, 49,080 pounds of chubs, 1,135 pounds of rainbow smelt, and 1,285 pounds of burbot harvested from all gears in Wisconsin waters of Lake Superior in 2020 (Sapper and Carl, 2021). A spill reaching these areas would result in the loss or degradation of fish available for subsistence, recreational, and commercial fishing in future years (Sapper and Carl, 2021). Spill impacts to surface waters are discussed in Section 6.4.4.2.

Fisheries impact the regional economy through recreation-based activity and through commercial fishing. The American Sportfishing Association found that Wisconsin's 7th Congressional District, in which the socioeconomic study area is located, has 213,700 anglers. These anglers are estimated to spend $141.9 million annually on fishing-related purchases in Wisconsin. Economic activity by the 7th Congressional District's anglers supports 1,480 jobs and generates $206.3 million in economic output (American Sportfishing Association, 2021). Leaks or small spills would be expected to have a negative impact on the fisheries in the immediate area of the event and may impede access waters. A very large spill would likely affect multiple fisheries. Such a spill could discourage sportfishing in the counties if the perception is that the pristine nature of the area has been spoiled. It is unlikely, however, that sportfishing associated with Lake Superior, Chequamegon Bay, and the Apostle Island National Lakeshore would be impacted by a pipeline spill along Enbridge's proposed relocation route or route alternatives unless the spill was large enough to reach Lake Superior.

Wisconsin issues 10 commercial fishing licenses annually for Lake Superior. Additionally, members of the Red Cliff and Bad River Bands of Lake Superior Chippewa Indians in Wisconsin fish commercially in Lake Superior. The tribes license large and small boat fishers who must adhere to tribally adopted codes regulating the fishery. Commercially caught local fish are popular in Wisconsin's restaurants and supermarkets. While it could be possible for spilled oil to reach Lake Superior, it is unlikely that a large volume of oil would reach this area since much would become trapped in sediments and vegetation at the river bottom, along stream and riverbanks and in wetlands before reaching this far downstream. However, if an oil spill reached Lake Superior, lighter crude oil would likely readily disperse in the large volume of water within the lake, and heavier crude oils would not spread extensively, particularly in cold-water conditions, and would be more likely to coat rather than penetrate shorelines (NOAA and API, 1994).

6.4.4.26 Property Values

Property values have the potential to be impacted by both an actual spill and by the perception of risk of a spill. Should a spill event occur, Enbridge would be responsible for mitigation at any properties impacted. The mitigation would include environmental cleanup activities with the intent to restore effected lands to their previous state to the extent practicable. Property owners would also be compensated monetarily for any lost revenue they may experience due to the spill and for any loss of value associated with the property. Residential properties located along the pipeline ROW corridor, but not impacted by the spill, may experience minor declines in value over the short term (four years), according to a study of 1993 Colonial Pipeline spill in Fairfax County, Virginia. (Simons, 1999) The study, which was published in *The Appraisal Journal*, found that residential properties located within two miles of a major, well-publicized spill may experience losses of up to 4 percent to 5 percent. Residential properties located farther away from the spill site, but on the pipeline corridor within the same market area would be expected to have a one percent to two percent discount. The author asserts that the expected losses can be attributed to the market's valuing the possibility of a future occurrence, based on a well-publicized and substandard-operating record with respect to pipeline ruptures.

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7 GREENHOUSE GAS EMISSIONS & CLIMATE

This chapter overviews recent trends and future projections for greenhouse gas (GHG) emissions and Wisconsin's climate. It also discusses impacts resulting from Wisconsin's changing climate. Treatment of these topics responds to public comments and provides context, using global, national, state, and regional data, for the discussions of cumulative effects in Chapters 4 and 5 and the emissions analysis estimates for the material carried by Enbridge's Line 5 pipeline that are presented in Chapter 8.

7.1 Background

Climate change refers to the significant shift in average climatic conditions observed globally since the mid-20th Century. Changes in local weather patterns have been caused by the observed dramatic increase in GHGs in our atmosphere such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), with CO_2 being the most significant. The increase in GHGs is predominantly attributed to human activities and specifically to the burning of fossil fuels. Each year, human activities release more GHGs into the atmosphere than natural processes can remove. GHGs trap energy in the atmosphere resulting in rising global temperatures, an effect often referred to as global warming. GHGs are well-mixing, meaning they warm the planet regardless of where they are emitted. The cumulative effects of increased GHG emissions and the associated absorbed energy have led to shifts in historic temperature patterns, altered precipitation regimes, and changes in weather extremes over time—also known as climate change impacts. The GHG emissions associated with the materials and products transported by the current Line 5 contribute to climate change. Enbridge's proposed Line 5 pipeline relocation and the relocation alternatives would also contribute to GHG emissions and climate change.

The Paris Agreement, a legally binding international treaty on climate change, was adopted by 196 nations at the UN Climate Change Conference (COP21) in Paris, France in 2015. The treaty's overarching goal is to hold "the increase in the global average temperature to well below 2° C (3.6° F) above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5° C (2.7° F) above pre-industrial levels." In recent years, world leaders have stressed the need to limit global warming to 1.5° C by the end of this century as crossing the 1.5° C threshold risks unleashing severe climate change impacts, including more frequent and severe droughts, heatwaves, and rainfall. To limit global warming to 1.5° C, GHG emissions must peak before 2025 at the latest and decline 43 percent by 2030. As discussed in Section 1.4.3.5, Wisconsin's state energy policy aims to meet the Paris Agreement's GHG emissions reduction targets.

7.2 Greenhouse Gas Emissions Trends & Projections

Atmospheric concentrations of GHGs are typically reported in parts per million (ppm). For GHG inventories, emissions are often reported and understood in units known as carbon dioxide equivalents (CO_2e). CO_2e is created by multiplying the emissions of a non-CO_2 GHG by the gas's global warming potential, a measure of how effective the gas is at warming the earth relative to CO_2. CO_2 is used as a reference gas with a global warming potential of 1. The following sections most often report GHG numbers in billion metric tons of CO2e or million metric tons of CO_2e (BMT CO_2e or MMT CO_2e, respectively). Many GHG emissions inventories subtract certain emissions from the gross emissions totals using calculated carbon sinks and pools. The change in these carbon pools is usually accounted for in Land-Use and Land-Use Change and Forestry (LULUCF).

7.2.1 Global GHG Trends & Projections

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change, including GHG emissions. The IPCC's 2023 Synthesis Report (IPCC, 2023) synthesizes and integrates materials prepared as part of its Sixth Assessment and provides the most comprehensive assessment of GHG emissions and climate change undertaken thus far. This section briefly overviews key findings from the IPCC's Sixth Assessment report (IPCC, 2023) and related efforts.

According to the IPCC (2023), "observed increases in well-mixed GHG concentrations since around 1750 are unequivocally caused by GHG emissions from human activities over this period." In addition, the IPCC (2023) reported with "high confidence" that historical cumulative net CO_2 emissions from 1850 to 2019 totaled 2,400 ± 240 Gt CO_2 of which more than half (58%) occurred between 1850 and 1989, and about 42 percent occurred between 1990 and 2019. In 2019, atmospheric CO_2 concentrations were higher than at any time in at least 2 million years. The IPCC (2023) further reported with "very high confidence" that concentrations of CH_4 and N_2O were higher than at any time in at least 800,000 years.

The National Oceanic and Atmospheric Administration's (NOAA's) Global Monitoring Lab collected and analyzed more than 15,000 air samples from monitoring stations around the world in 2023. The NOAA lab reported global average atmospheric CO_2 was 419.3 ppm in 2023, setting a record high with a peak of 424 ppm in May of that year (NOAA, 2024b). The increase between 2022 and 2023 was 2.8 ppm—the 12th year in a row where the amount of CO_2 in the atmosphere increased by more than 2 ppm (Figure 7.2-1). At Mauna Loa Observatory in Hawaii, where the modern CO_2 record began in 1958, the annual average in 2023 was 421.08. The last time concentrations were as high as 400 ppm was more than 4.3 million years ago, when global surface temperatures were 4.5–7.2° F (2.5–4° C) warmer than pre-industrial temperatures. During this time, sea level was about 75 feet higher than today (NOAA, 2024b).

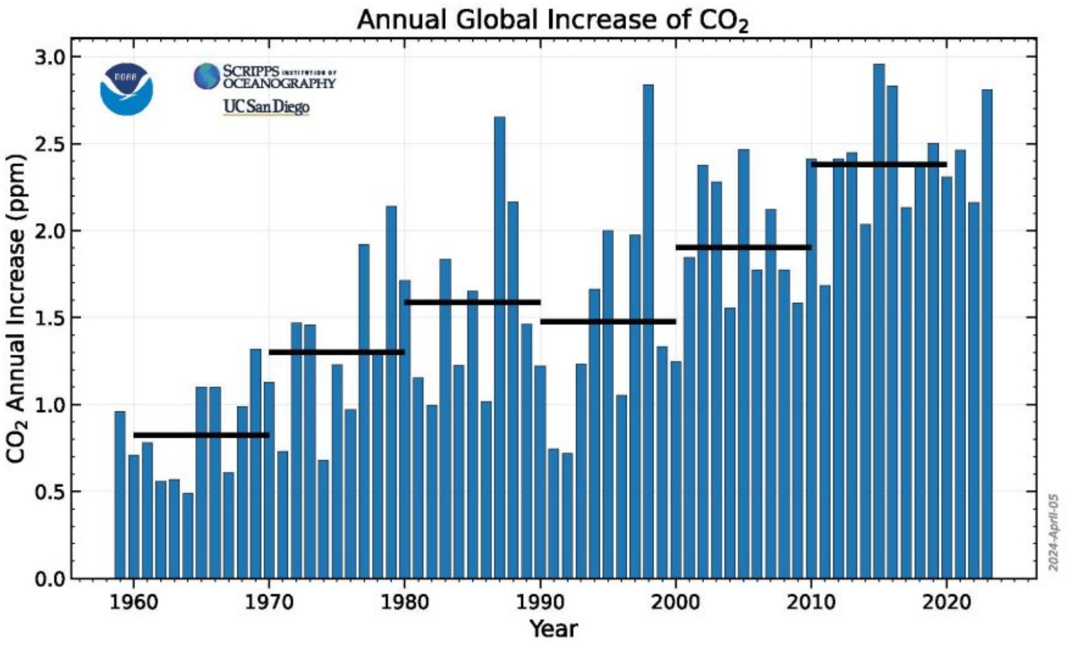
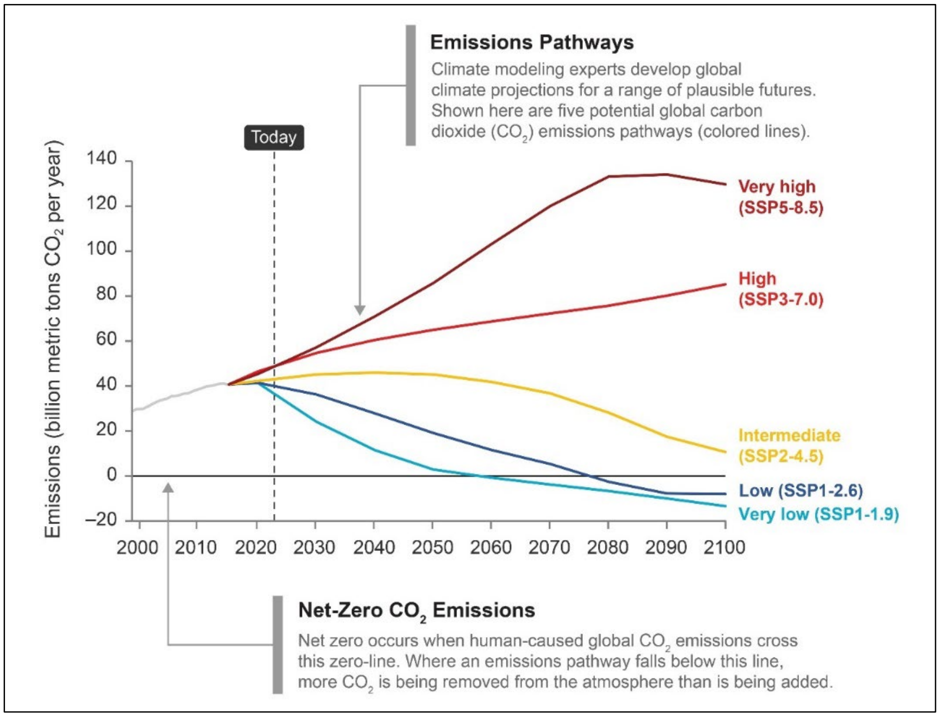


Figure 7.2-1 Annual global increase in CO2, 1958-2023
Source: NOAA (2024b)

The IPCC (2023) estimates the global net anthropogenic GHG emissions were approximately 59 BMT CO_2e in 2019, 12 percent higher than emissions levels in 2010 and 54 percent higher than in 1990. By this estimate, more than half of anthropogenic GHG emissions have occurred in the last 30 years. Net GHG emissions have also increased across all major categories since 2010. Most of the world's GHG emissions come from a relatively small number of countries. China, the United States, India, the nations that make up the European Union, and Russia are the five largest emitters of GHGs on an absolute basis (Climate Watch, 2024), with per capita GHG emissions highest in the United States (17.69 t CO2e;(Vigna and Friedrich, 2023).

NOAA (2024b) estimates that about half of the CO_2 emissions from fossil fuels to date have been absorbed at the Earth's surface, divided roughly equally between oceans and land ecosystems, including grasslands and forests. CO_2 absorbed by the world's oceans contributes to ocean acidification, which is causing a fundamental change in the chemistry of the ocean, with impacts to marine life and the people who depend on them. The oceans have also absorbed an estimated 90 percent of the excess heat trapped in the atmosphere by GHGs.

Climate scientists rely on models that simulate the physics, chemistry, and biology of the atmosphere, land, and oceans in detail to generate global projections for a range of realistic futures. These models are constantly being updated to incorporate higher spatial resolutions, new physical processes, and biogeochemical cycles. Modelling groups around the world coordinate their updates as part of the Coupled Model Intercomparison Projects (CMIP). The state-of-the-art CMIP6 models consist of the "runs" from around 100 distinct climate models from 49 different modelling groups. The IPCC (2023) used CMIP6 projections to illustrate potential GHG emissions pathways. CMIP6 incorporates shared socioeconomic pathways (SSPs), five scenarios that represent alternative plausible trajectories of socioeconomic and technological progress. The IPCC Sixth Assessment (IPCC, 2023) provides additional details regarding these pathways. Figure 7.2-2 shows potential global GHG emissions pathways/projections based on CMIP6 modeling.


Emissions Pathways

Climate modeling experts develop global climate projections for a range of plausible futures. Shown here are five potential global carbon dioxide (CO_2) emissions pathways (colored lines).

Net-Zero CO_2 Emissions

Net zero occurs when human-caused global CO_2 emissions cross this zero-line. Where an emissions pathway falls below this line, more CO_2 is being removed from the atmosphere than is being added.

Figure 7.2-2 Future global carbon dioxide emissions pathways.

Source: Fifth National Climate Assessment (U.S. GCRP, 2023a)

The five GHG emissions scenarios depicted in Figure 7.2-2 (colored lines) demonstrate potential global CO_2 emissions pathways modeled from 2015 through 2100, with the solid light gray line showing observed global CO_2 emissions from 2000 to 2015. The vertical dashed line, labeled “Today,” marks the year 2023; the solid horizontal black line marks net-zero CO_2 emissions. Many of the projected effects described in scholarly reports are based on potential climate futures defined by one or more of these scenarios.

7.2.2 National GHG Trends & Projections

The EPA develops an annual report called the *Inventory of U.S. Greenhouse Gas Emissions and Sinks* (EPA, 2024a) that tracks U.S. GHG emissions and sinks by source, economic sector, and GHG going back to 1990. This annual report provides a comprehensive accounting of total GHG emissions for all man-made sources in the United States, including carbon dioxide removal from the atmosphere by sinks (e.g., through the uptake and storage of carbon in forests, vegetation, and soils) from management of lands in their current use or as lands are converted to other uses. The GHGs covered by the EPA inventory include CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride.

According to the EPA (2024a), gross U.S. GHG emissions totaled 6,343.2 MMT of CO_2e in 2022 (Table 7.2-1). Total gross U.S. emissions decreased by three percent from 1990 to 2022, down from a high of 15.2 percent above 1990 levels in 2007 (Table 7.2-1; Figure 7.2-3). Gross GHG emissions increased from 2021 to 2022 by 0.2 percent (14.4 MMT CO_2e). Net emissions, including sinks, were 5,489.0 MMT CO_2e in 2022. Overall, net emissions increased by 1.3 percent from 2021 to 2022 and decreased by 16.7 percent from 2005 levels (Table 7.2-1).

Between 2021 and 2022, the increase in total GHG emissions was driven largely by an increase in CO_2 emissions from fossil fuel combustion across most end-use sectors due in part to increased energy use from the continued rebound of economic activity after the height of the COVID-19 pandemic. In 2022, CO_2 emissions from fossil fuel combustion increased by 1.0 percent relative to the previous year and were 1.1 percent below emissions in 1990. CO_2 emissions from natural gas use increased by 5.2 percent (84.8 MMT CO_2e) from 2021 to 2022. The increase in natural gas consumption and associated emissions in 2022 was observed across all sectors except U.S. Territories. Emissions from petroleum use also increased by 0.9 percent (19.0 MMT CO_2e) from 2021 to 2022. Nationally, carbon sequestration from the LULUCF sector offset 14.5 percent of total emissions in 2022 (Table 7.2-1).

Table 7.2-1 Recent trends in U.S. GHG emissions and sinks (MMT CO2e).

Gas/source [1]	1990	2005	2021	2022	% change since 1990
CO_2	5,131.6	6,126.9	5,017.2	5,053.0	-1.5
CH_4 (excludes LULUCF sources) *	871.7	795.4	720.5	702.4	-19.4
N_2O (excludes LULUCF sources) *	408.2	419.2	398.2	389.7	-4.5
HFCs	47.7	121.7	177.0	182.8	282.9
PFCs	39.5	10.2	6.3	6.7	-83.1
SF	37.9	20.2	8.5	7.6	-80.0
NF	0.3	1.0	1.1	1.1	238.3
Total gross emissions (sources)	**6,536.9**	**7,494.6**	**6,328.8**	**6,343.2**	**-3.0**
LULUCF emissions	58.0	62.8	72.9	67.6	16.5
CH_4	53.1	58.5	62.1	58.4	10.0
N_2O	4.8	10.3	10.7	9.1	88.3
LULUCF carbon stock change	(1,034.7)	(976.6)	(983.4)	(921.8)	-10.9
LULUCF net total	(976.7)	(907.7)	(910.6)	(854.2)	-12.5
Net emissions (sources & sinks)	**5,560.2**	**6,586.9**	**5,418.2**	**5,489.0**	**-1.3**

[1] CO_2 = carbon dioxide, CH_4 = methane, N_2O = nitrous oxide. HFCs = hydrofluorocarbons, PFCs = perfluorocarbons, SF = sulfur hexafluoride, NF = nitrogen trifluoride.

* Gross emissions totals do not include CH4 and N2O emissions from LULUCF. LULUCF CH4 and N2O emissions are included in net emission totals.

Source: Adapted from EPA (2024a)

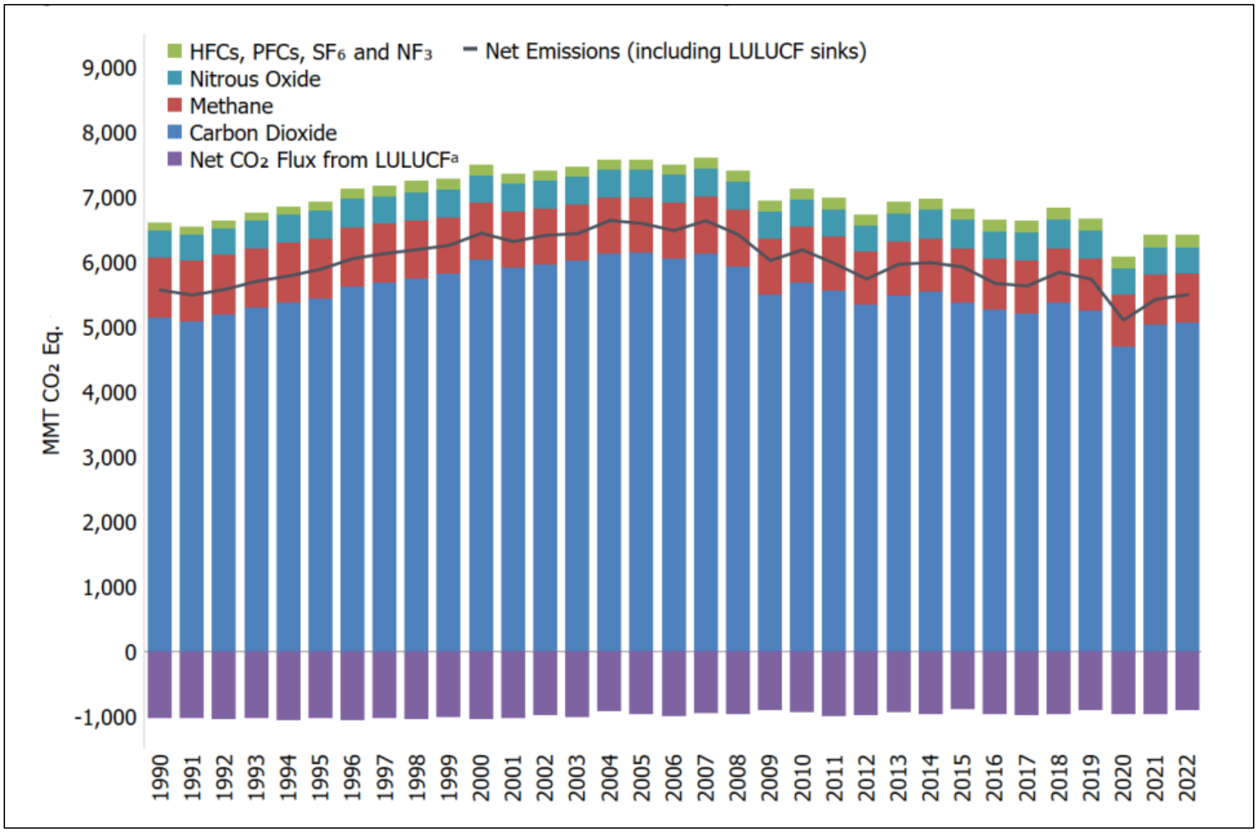


Figure 7.2-3 U.S. GHG emissions and sinks by gas.

[a] The term “flux” is used to describe the exchange of CO2 to and from the atmosphere, with net flux being either positive or negative depending on the overall balance. Removal and long-term storage of CO2 from the atmosphere is also referred to as “carbon sequestration.”

Source: EPA (2024a)

Energy-related activities in the United States, primarily fossil fuel combustion, accounted for most CO_2 emissions for the period of 1990 through 2022. Energy-related activities were also responsible for methane and nitrous oxide emissions (40.2 percent and 10.8 percent of total U.S. emissions of each gas, respectively). Overall, emission sources from energy accounted for a combined 82.0 percent of total gross U.S. GHG emissions in 2022. Emissions from energy-related activities increased by 0.5 percent (26.5 MMT CO_2e) since 2021, but they have decreased by 3.4 percent (181.2 MMT CO_2e) since 1990. In 2022, 83.0 percent of the energy used in the United States (on a Btu basis) was produced through the combustion of fossil fuels (Figure 7.2-4). As discussed in Section 1.3.2, U.S. consumption of natural gas increased between 2010 and 2022 by 36 percent. During the same period U.S. consumption of liquid petroleum, including crude oil, natural gas liquids, and refined petroleum products (e.g., motor gasoline, diesel, and jet fuel) increased by only 1.5 percent (U.S. EIA, 2023a).

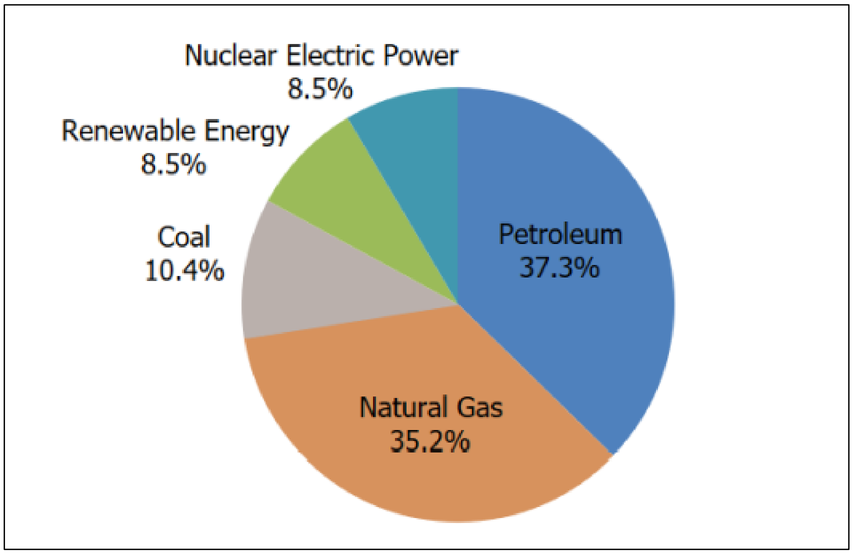


Figure 7.2-4 U.S. energy consumption by energy source (percent), 2022.
Source: EPA (2024a)

7.2.3 Wisconsin GHG Trends & Projections

The DNR's most recent GHG emissions inventory for the state covers the years 2005-2018 (Wisconsin DNR, 2021d). In 2018, the gross GHG emissions in Wisconsin were estimated to be 145.4 MMT of CO_2e, a 9.5 percent net decrease from peak levels in 2005 (Figure 7.2-5). As in the rest of the United States, the electricity sector emitted the most GHGs in 2018 (32.3 percent of gross emissions); the largest decrease in emissions from 2005 to 2018 (11.8 MMT CO_2e) also came from this sector (Table 7.2-2). Coal remained the largest source of CO_2 emissions from the electricity generation sector, 81.6 percent. The transportation, industrial, natural gas and oil, and waste sectors also showed modest emission decreases from 2005 to 2018 (Table 7.2-2).

Wisconsin's forests hold about 1.162 BMT of carbon with more than half of forest carbon stored in soil (Wisconsin DNR, 2021e). Live tree carbon pools make up approximately 34 percent of the Wisconsin's forest carbon storage and are an import resource to manage for CO_2 sequestration efforts. The techniques forest managers use can greatly influence Wisconsin's overall carbon sequestration and storage (Wisconsin DNR, 2021e). LULUCF accounting is done by tracking over time the forest land that remains forest land, land that is converted to forest land, and forest land that is converted to other land uses. Wisconsin's net forest carbon flux was -21.1 MMT CO_2e in 2018, the negative number meaning the sector acted as a net sink of GHGs in Wisconsin.

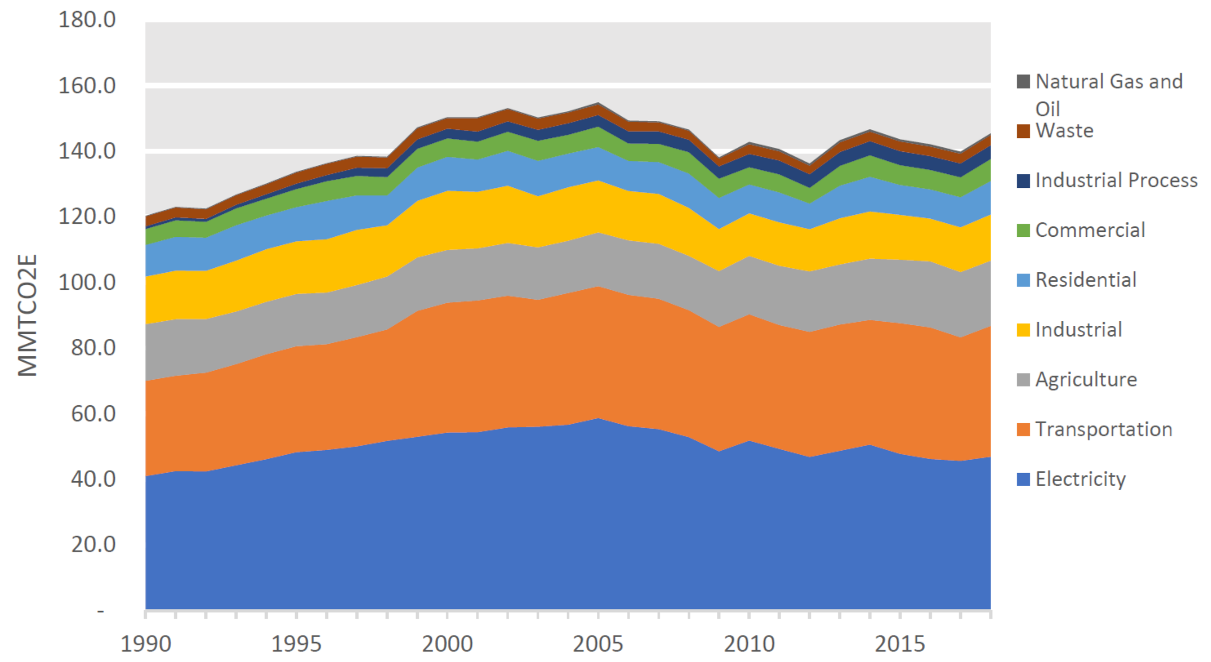


Figure 7.2-5 Wisconsin GHG emission trends, 1990-2018 (MMT CO2e).
Source: Wisconsin DNR (2021d)

Table 7.2-2 Wisconsin GHG emissions by economic sector, 2018 (MMT CO2e).

	2018 emissions	**Change (2005 to 2018)**
	MMT CO_2e	
Electricity	46.9	-20.1%
Generation	39.2	-18.8%
Import	7.7	-26.0%
Residential	10.2	+0.0%*
Commercial	6.7	+8.1%
Industrial	14.1	-10.8%
Transportation	39.9	-0.7%
Industrial process	4.2	20.0%
Natural gas and oil	0.5	-16.7%
Agriculture	19.9	21.3%
Waste	3.1	-3.1%
Solid waste	2.2	+4.3%
Wastewater	0.9	+0.0%*
Gross emissions	**145.4**	**-6.1%**
LULUCF	-19.1	20.1%
Total net emissions	**126.3**	**-9.1%**

Note: Totals may not sum due to independent rounding.
* Does not exceed 0.05 MMT CO_2e or 0.05%
Source: Adapted from Wisconsin DNR (2021d)

The DNR's most recent GHG emissions inventory (Wisconsin DNR, 2021d) can be used to gauge the state's progress toward reducing emissions consistent with the targets established in Executive Order #38, issued by Governor Tony Evers in 2019 (Section 1.4.3.5); that is, a 26 to 28 percent reduction in GHG emissions from 2005 values by 2025. While GHG emissions in the state have decreased since 2005, the state would need to do more to meet the specified emission reduction targets. Total net GHG emissions for Wisconsin, which incorporated the LULUCF sector, in 2018 were 126.3 MMT CO_2e, a 9.1 percent decrease from 2005 levels (Table 7.2-2). This accounts for less of a decrease than what would be needed to meet the 2025 goal (Figure 7.2-6;(Wisconsin DNR, 2021d)).

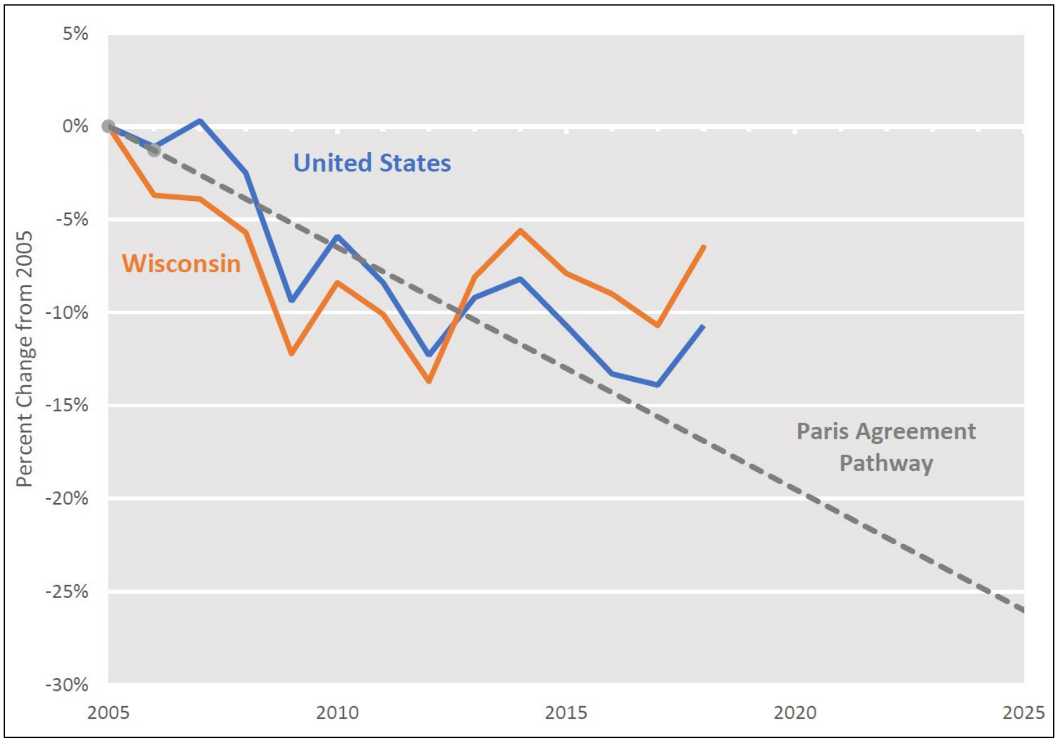


Figure 7.2-6 Paris Agreement goal and percent change in gross GHG emissions in Wisconsin and nationally, 2005-2018.
Source: Wisconsin DNR (2021d)

7.2.4 GHG Emissions from the Oil & Natural Gas Industry

The oil and natural gas industry includes a wide range of operations and equipment, including wells, natural gas gathering lines, processing facilities, storage tanks, and transmission and distribution pipelines that contribute to GHG emissions. The EPA's GHG reporting program (www.epa.gov/ghgreporting) covers emissions from different aspects of the oil and gas industry (Figure 7.2-7). The oil and gas industry is the largest industrial source of methane emissions in the United States (EPA, 2024b). According to the EPA (2024b), methane is "a potent GHG with a global warming potential more than 25 times that of CO_2 and is responsible for approximately one-third of current warming from human activities." With respect to Enbridge's Line 5 pipeline, both direct and indirect GHG emissions occur. Direct emissions occur at mainline valves, pumps, and connectors. The upstream emissions from production and downstream emissions from combustion contribute indirect emissions causally linked to the direct emissions from the crude oil and NGL transport (Figure 7.2-7).

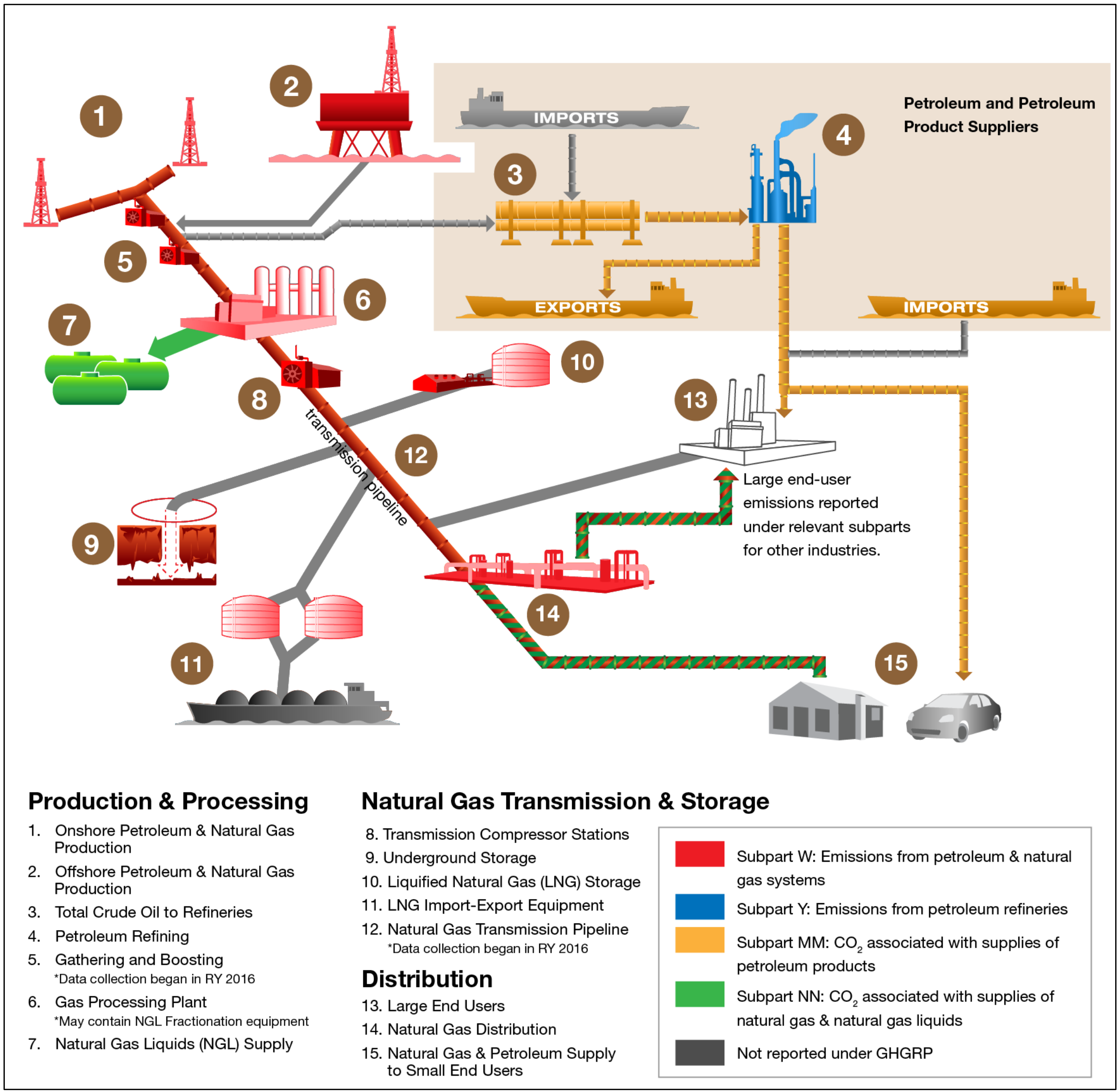


Figure 7.2-7 Overview of GHG emissions sources from oil and gas industry infrastructure.
Source: EPA (2024a)

As noted in Section 1.3.2, U.S. consumption of oil and gas products increased between 2010 and 2022. Consumption of natural gas increased by 36 percent and consumption of liquid petroleum, including crude oil, natural gas liquids, and refined petroleum products increased by 1.5 percent (U.S. EIA 2023a). The natural gas and oil sector, however, is the smallest sector represented in the Wisconsin GHG emissions inventory (Wisconsin DNR, 2021d). In 2018, the sector accounted for 0.5 MMT CO_2e (Table 7.2-3). Natural gas emissions include estimated emissions from transportation and distribution. Emissions from the oil sector represent emissions from oil processing plants in the state.

Table 7.2-3 Natural gas and oil emissions (MMT CO2e).

	2005	2018	% emissions (2018)
Natural gas	0.3	0.4	80
Oil	0.4	0.1	20
Total	**0.6**	**0.5**	**100**

Note: Totals may not sum due to independent rounding.
Source: Wisconsin DNR (2021d)

As discussed in Section 1.3.2, U.S. energy demand shrank in 2020 due to the COVID-19 pandemic but rebounded in 2021. As demand fluctuates, so would GHG emissions. International demand for U.S. oil and gas products is forecasted to increase, while domestic consumption is projected to stay stable through 2050 (Figure 1.3-2). Similarly, Canadian crude oil production is projected to stay stable (Figure 1.3-3). Domestic natural gas consumption for electricity generation is predicted to decrease by 2050 relative to 2022 as electricity generation shifts to using more renewable and battery sources.

Enbridge has indicated that the company is committed to achieving net-zero GHG emissions from its operations by 2050 and suggested its “existing energy transmission and distribution assets will be a critical platform to achieve societal climate ambitions,” noting that “existing assets are also critical to allow Enbridge to fund renewable projects” (Enbridge, 2020d).

7.3 Climate Trends & Projections

7.3.1 Global Climate Trends & Projections

This section briefly overviews key findings from the IPCC’s Synthesis Report (IPCC, 2023) and related efforts by the NOAA and others.

The year 2023 was the warmest year in recorded human history with a global mean temperature of 2.43° F above the pre-industrial (1850-1900) average reported by NOAA. The last 10 years have been the 10 warmest years since 1850 (NOAA, 2024c). Combined global land and ocean temperatures have increased at an average rate or 0.11° F per decade since 1850 but have been more than three times as fast since 1982 at 0.36° F per decade (Figure 7.3-1) (NOAA, 2024d). Global surface temperature has increased faster since 1970 than in any other 50-year period over at least the last 2,000 years. The likely range of total human-caused global surface temperature increase from 1850-1900 to 2010-2020 is 33.4° F to 34.34° F, with a best estimate of 1.96° F.

The year 2023 was also the first year the global annual average temperature was near or exceeded the key 1.5° C (2.7° F) threshold identified in the Paris Agreement, as recorded in Table 7.3-1 (Berkeley Earth, 2024; Copernicus, 2024). On reporting this number, Berkely Earth (2024) said a “single year exceeding 1.5° C is a stark warning sign of how close the overall climate system has come to exceeding this Paris Agreement goal.”

Table 7.3-1 2023 warming above 1850-1900 average.

Data Source	2023 warming
NOAA (2024d)	2.43 °F (1.35 °C)
Berkeley Earth (2024)	2.77 °F (1.54 °C)
Copernicus (2024)	2.66 °F (1.48 °C)

7.3.2 National Climate Trends & Projections

The U.S. Global Change Research Program (GCRP) prepares a National Climate Assessment to summarize the impacts of climate change on the United States, now and in the future. A team of hundreds of experts guided by a Federal Advisory Committee produced the most recent National Climate Assessment, which was extensively reviewed by the public and experts, including federal agencies and a panel of the National Academy of Sciences. This section summarizes key findings from the most recent National Climate Assessment (U.S. GCRP, 2023b).

Temperatures in the contiguous United States have risen 2.5° F since 1970 compared to a global temperature rise of around 1.7° F over the same period (Figure 7.3-1), reflecting a global pattern of higher latitudes warming faster than lower latitudes. The temperature trend in Figure 7.3-1 changes color as additional data became available for more regions of the United States, with Alaska data added to the average temperature for the contiguous United States beginning in 1926 (medium blue line) and Hawaii, Puerto Rico, and U.S.-affiliated Pacific Islands data added beginning in 1951 (dark blue line). Global average surface temperature is shown by the black line.

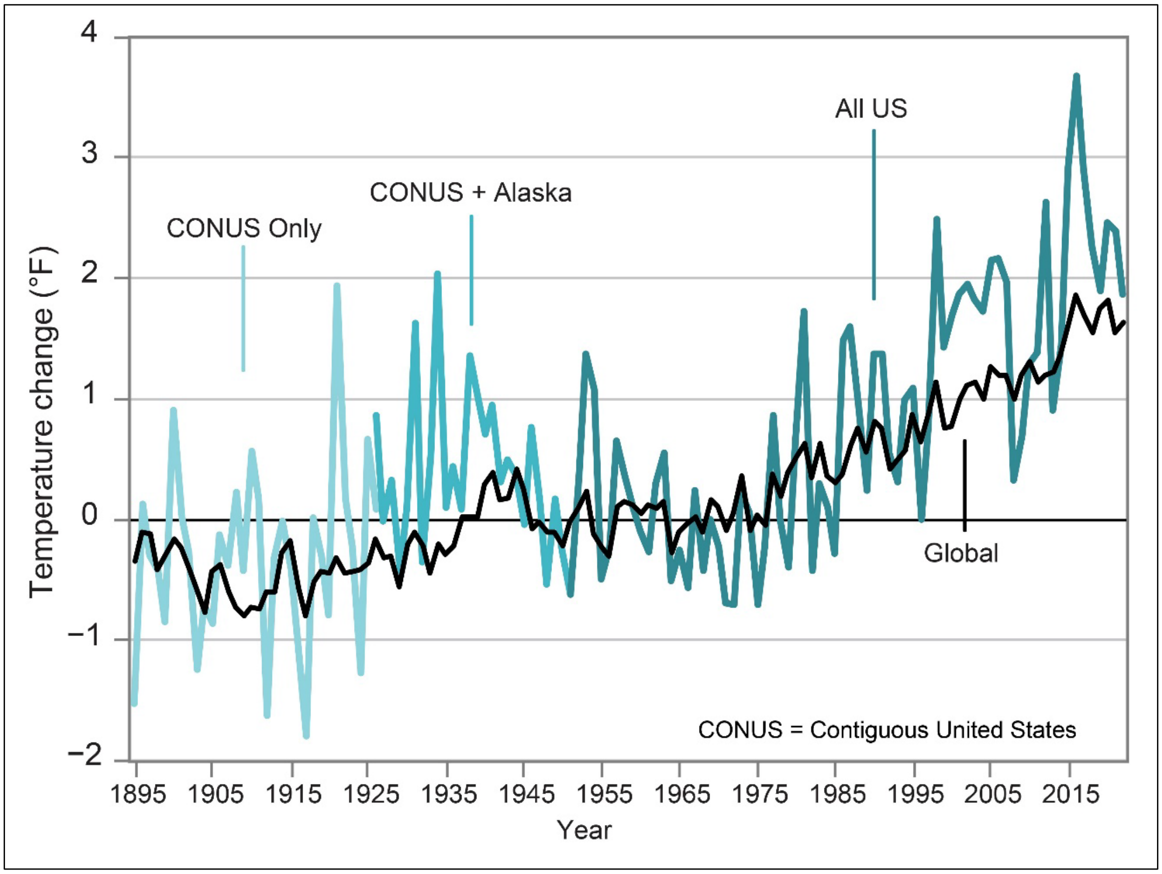


Figure 7.3-1 Changes in average surface temperature, globally and within the U.S., 1895-2022.
Source: (U.S. GCRP, 2023a)

These trends are projected to continue based on different GHG emissions scenarios (Figure 7.3-2 and Figure 7.3-3). For every 1.8° F of global warming, the average U.S. temperature is projected to increase around 2.5° F. While the average temperature across the United States is increasing, temperature trends vary widely between regions and seasons. Annual average temperatures in some areas are more than 2° F warmer than they were in the first half of the 20th Century. Additionally, in many northern states, winter is warming almost twice as fast as summer. The 5th National Climate Assessment reports that “the northern and western parts of the country are likely to experience proportionally greater warming.” (Figure 7.3-3) (U.S. GCRP, 2023c).

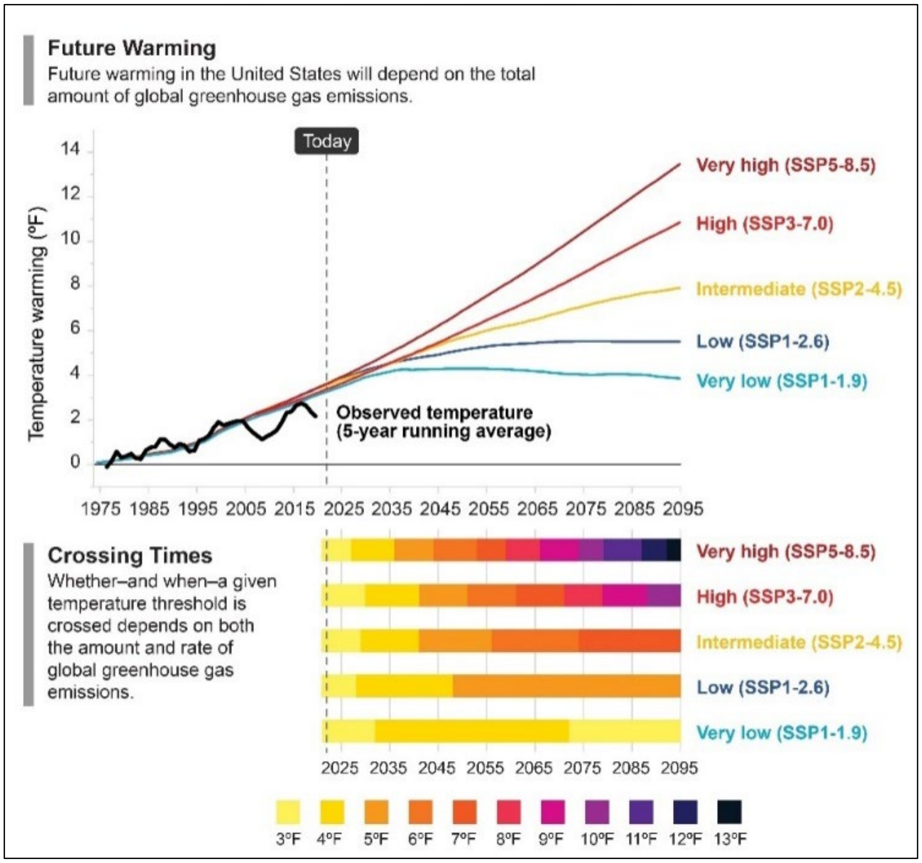


Figure 7.3-2 Potential warming pathways in the United States.
Source: Fifth National Climate Assessment (U.S. GCRP, 2023a)

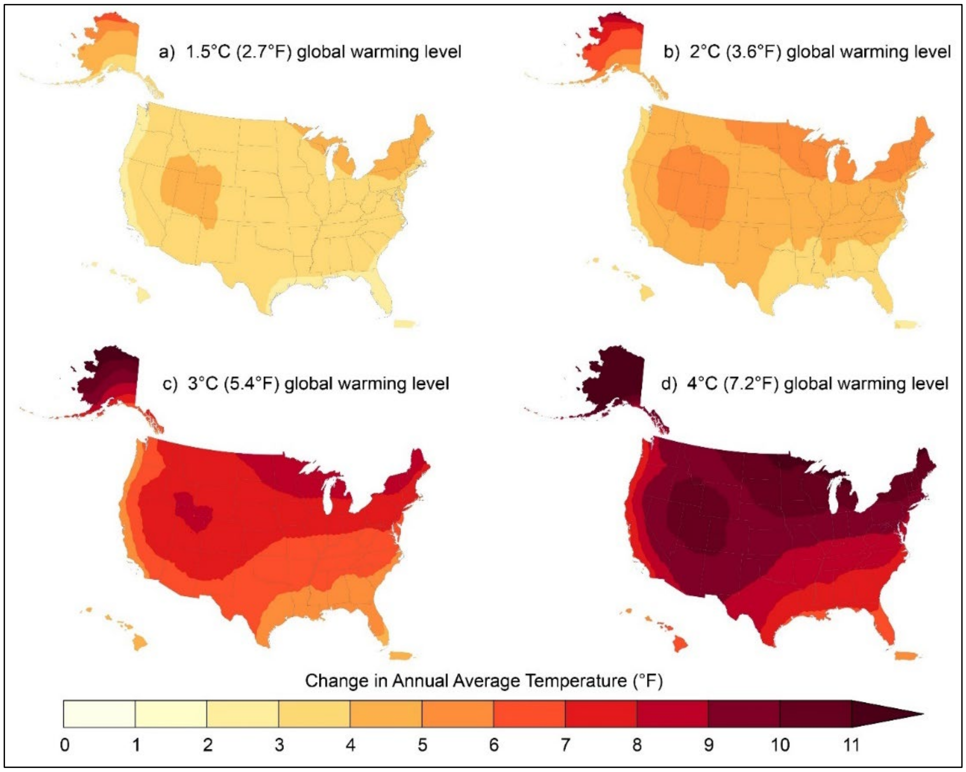


Figure 7.3-3 Projected U.S. temperature changes at 1.5°C, 2°C, 3°C, and 4°C of global warming.
Source: (U.S. GCRP, 2023c)

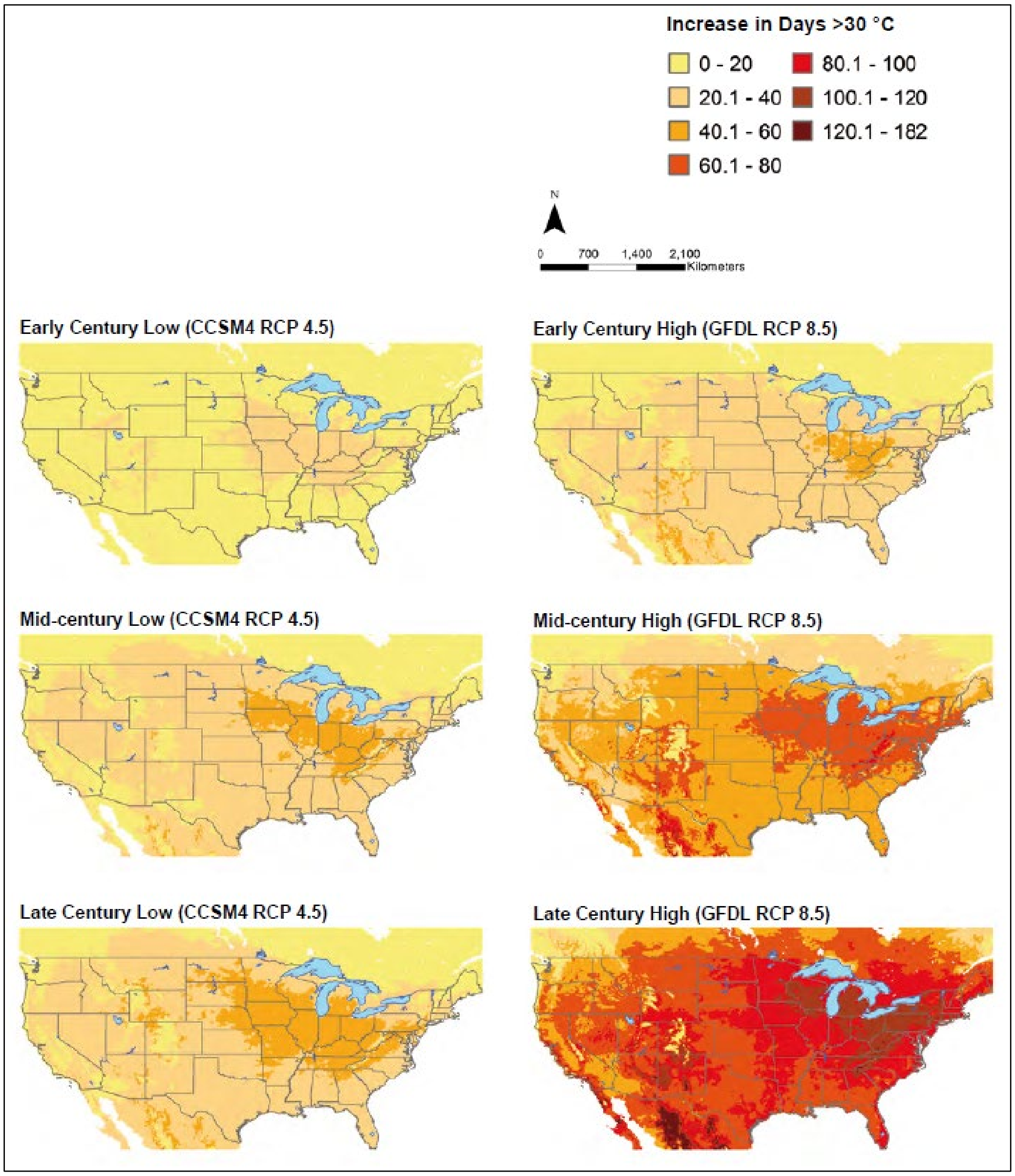


Figure 7.3-4 Mapped projections of changes in number of days per year with temperature above 30 °C by 30-year time period and climate scenario; left = low emissions scenario; right = high emissions scenario.

Source: Matthews et al. (2018)

Changes have also been observed in average annual precipitation across the United States from 2002 to 2021 relative to the historical levels observed from 1901 to 1960. Central and eastern U.S. precipitation increased by 5 to 15 percent. The Midwest now sees wetter conditions in all seasons (U.S. GCRP, 2023c). This increase is driven largely by more frequent precipitation extremes. Extreme precipitation intensity is projected to increase 10 to 15 percent, and perhaps more than 20 percent in some areas (Figure 7.3-5) (U.S. GCRP, 2023c).

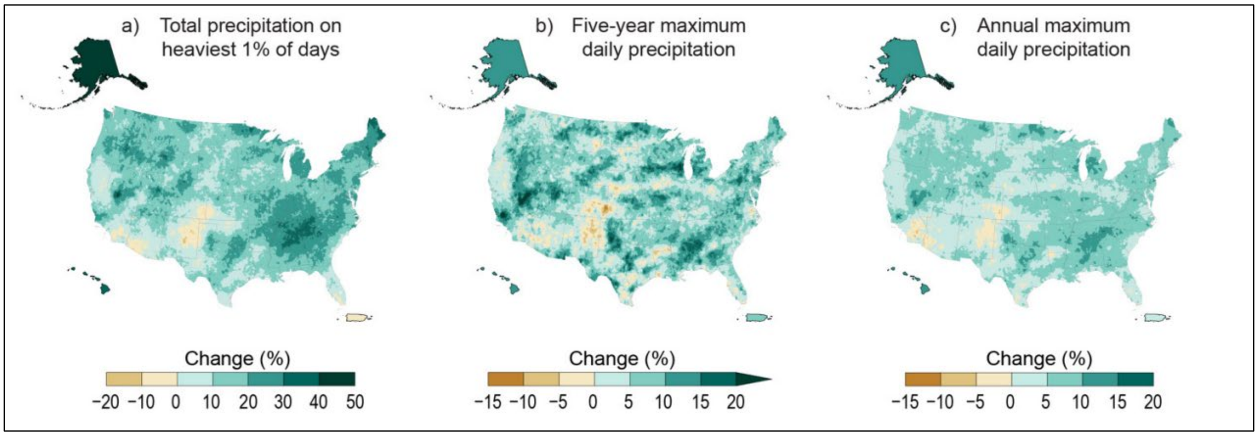


Figure 7.3-5 Projected increases in U.S. precipitation relative to 1991–2020; a) total precipitation falling on the heaviest 1% of days, b) daily maximum precipitation in a 5-year period, and c) annual heaviest daily precipitation amount.

Source: (U.S. GCRP, 2023c)

In addition to changes in average precipitation, climate change has caused increased variability and elevated likelihood of extreme rainfall events. Research has yielded insights into the connections between global warming and the factors that cause severe thunderstorms and tornadoes (such as atmospheric instability and increases in wind speed with altitude) (Trapp et al., 2007), with studies suggesting a projected increase in the frequency of conditions favorable for severe thunderstorms (Diffenbaugh, Scherer, and Trapp, 2013). In addition, analyses show substantial increases in storm frequency and intensity (Janssen et al., 2014; Myhre et al., 2019; Papalexiou and Montanari, 2019).

Changes in the frequency and intensity of storms have not been limited to summer months. For the entire Northern Hemisphere, there is evidence of an increase in both storm frequency and intensity during the cold season since 1950 (Vose, Applequist, Bourassa, et al., 2014). Extremely heavy snowstorms increased in number during the last century in northern and eastern parts of the United States but have been less frequent since 2000 (Kunkel et al., 2013). Very snowy winters have generally been decreasing in frequency in most regions over the last 10 to 20 years, although the Northeast has been seeing a normal number of such winters (Kunkel et al., 2009). Heavier-than-normal snowfalls recently observed in the Midwest and Northeast in some years, with little snow in other years, are consistent with indications of large-scale wintertime circulation in the Northern Hemisphere (Francis and Vavrus, 2012). Overall snow cover has decreased in the Northern Hemisphere, due in part to higher temperatures that shorten the time snow remains on the ground.

7.3.3 Wisconsin Climate Trends & Projections

Trends in Wisconsin's weather and climate have been well studied and documented by the Wisconsin Initiative on Climate Change Impacts (WICCI) (WICCI, 2011; 2021). Wisconsin is becoming warmer and wetter and is having more extreme weather events, including extreme heat and cold, drought, storms, and flooding. WICCI's climate scientists have used downscaled national climate models to create statewide projections for temperature and precipitation changes by 2050. This section overviews key findings from WICCI's work.

Since the 1950s, Wisconsin's average daily temperature has become 3° F (1.67° C) warmer, with the last two decades being the warmest on record. January 2024 to June 2024 was the warmest January-through-June stretch in state history, with the average of 45.1° F far exceeding the 1991-2020 average of 41.9° F (Vavrus and Mason, 2024). Winters have warmed more rapidly than summers, and nighttime low temperatures are warming faster than daytime high temperatures. These trends are consistent with climate projections from a decade ago (WICCI, 2020).

Under a range of future GHG emissions scenarios, statewide average temperatures are projected to warm 2° F to 8° F above 1950-2000 temperatures. WICCI reports that by mid-21st Century, Wisconsin's average temperature will be similar to the current warmest years in Wisconsin's history. Days over 90° F in Wisconsin will likely triple and nights when the temperature does not drop below 70° F will likely quadruple (Figure 7.3-6) (WICCI, 2021).

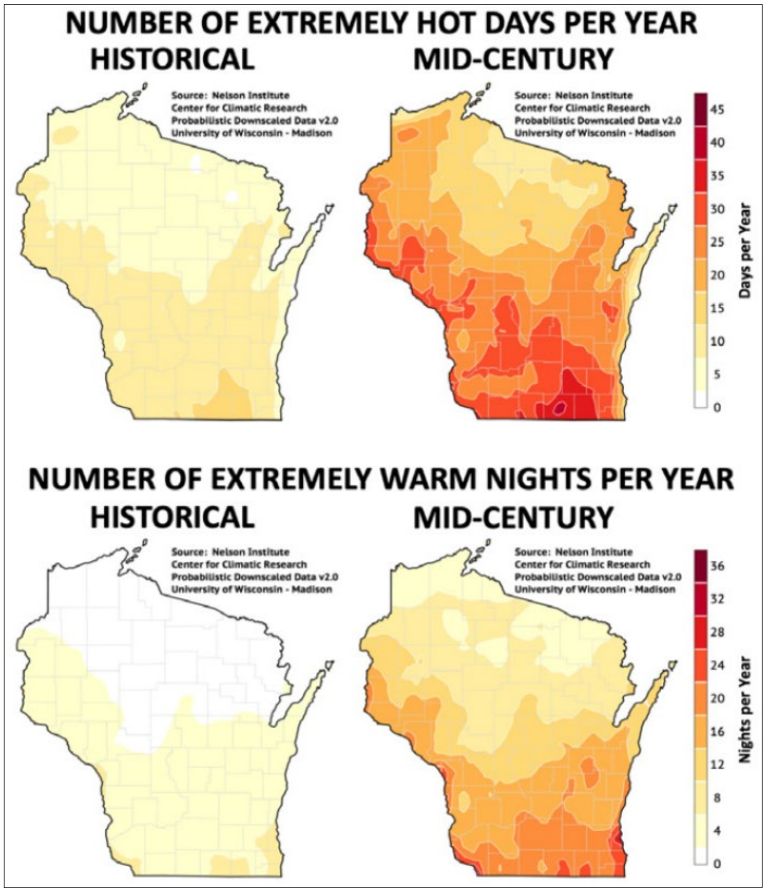


Figure 7.3-6 Number of days (top) and nights (bottom) above 90°F, historical and projected.
Source: (WICCI, 2021)

Average precipitation levels in Wisconsin have increased 17 percent (about 5 inches) since 1950, with southern Wisconsin experiencing the highest increase in precipitation. Statewide, May and June 2024 had more precipitation than any other May and June period on record. By the end of June, Madison had already documented almost as much precipitation in 2024 as it typically gets all year (32.09 in compared to 37.13 in) (Pollack, 2024). The unrelenting rain erased the last traces of drought from Wisconsin which, one year earlier, was experiencing the fifth-driest June on record. Wisconsin's state climatologist pointed out how this swing from one extreme to another was atypical: “The biggest one-year flip-flop that we’ve had in Wisconsin for June. We’ve never gone from so dry a June to, the following year, so wet a June” (Pollack, 2024).

While Wisconsin’s average precipitation is increasing, it is not distributed evenly. Wisconsin is getting more rain, but in less consistent and more concentrated bursts. Figure 7.3-7 shows the twenty-one 100-year rainfall events that occurred from 2010-2019, that is, twenty-one events over a decade that are statistically expected to happen only once in a hundred years. These precipitation trends mean extreme events are becoming more common and more damaging (WICCI, 2021).

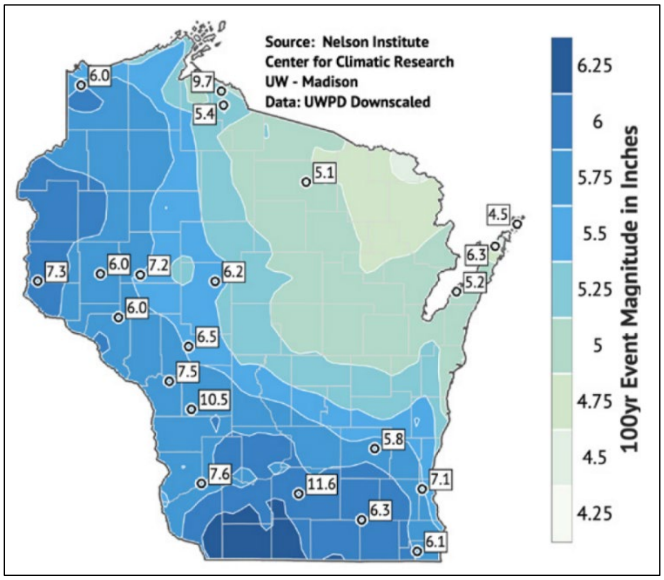


Figure 7.3-7 100-year rainfall event magnitude and actual extreme events, 2010-2019.
Source: (WICCI, 2021)

The trend in increased precipitation and extreme events is projected to continue (Figure 7.3-8). Winter and spring are expected to have the most increases, then fall and summer. As noted elsewhere, summer droughts are expected to worsen.

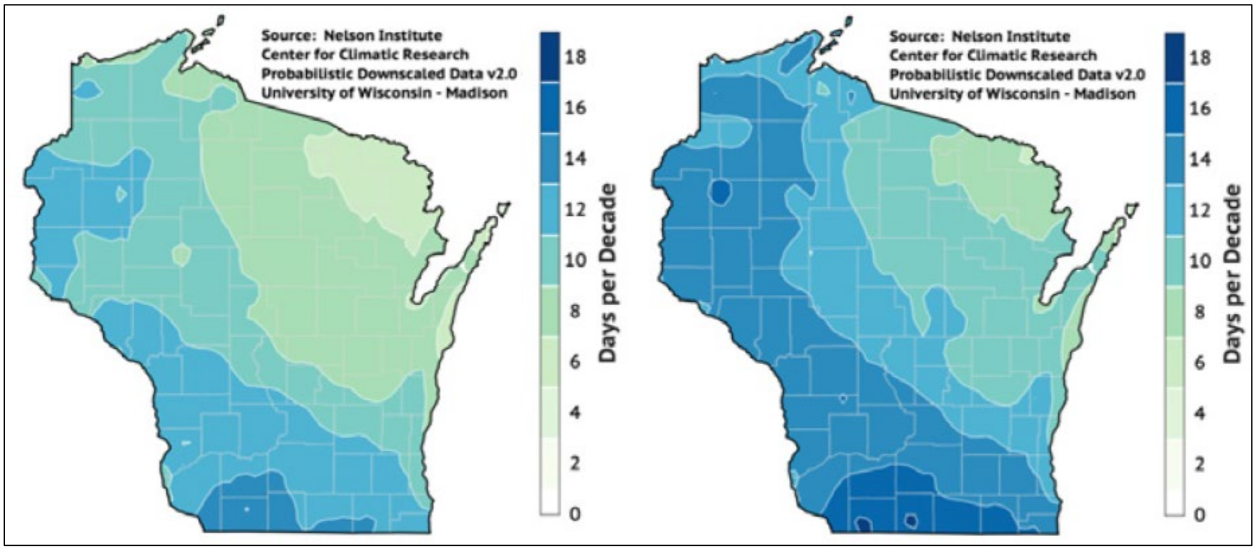
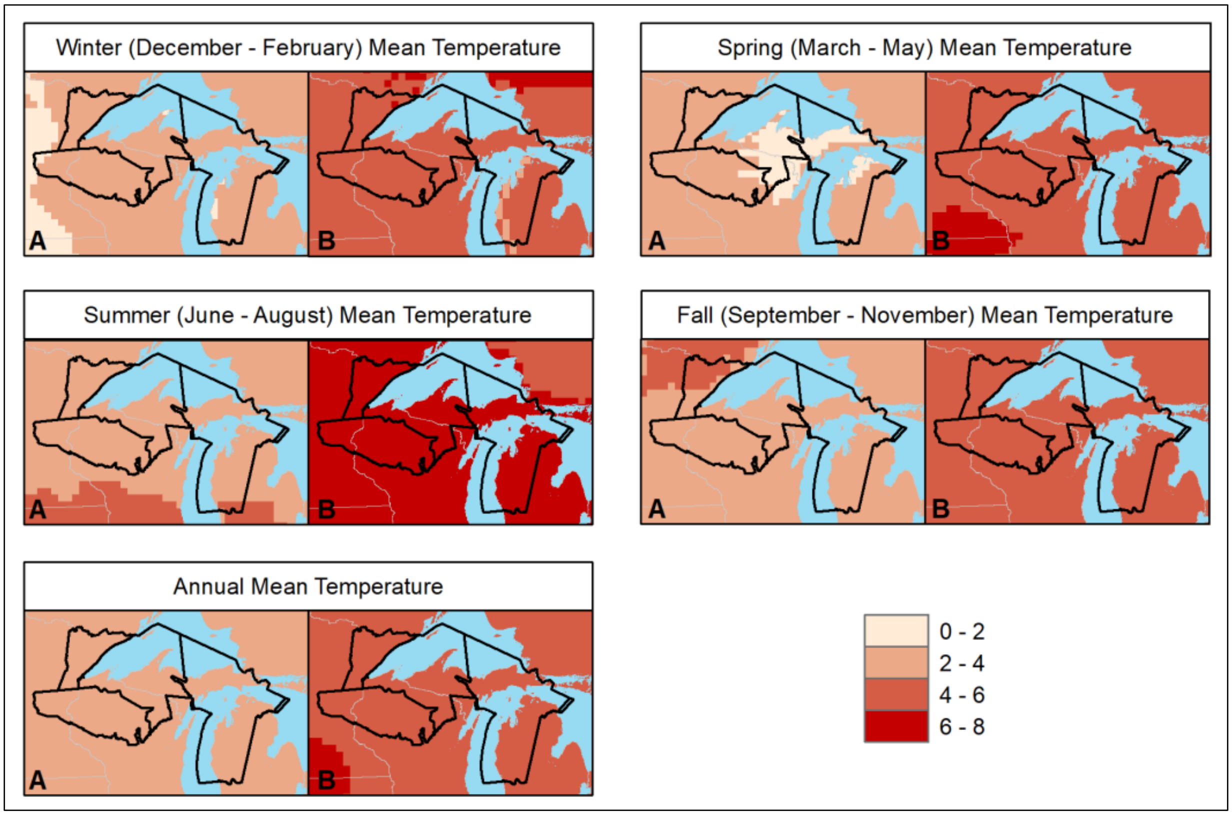


Figure 7.3-8 Frequency of days with two inches or more of precipitation in a 24-hr period; left: 1981-2010 (historical), right: 2043-2060 (projected).
Source: (WICCI, 2021)

7.3.4 Climate Trends & Projections in the Ceded Territories

Climate Change is currently affecting northern Wisconsin and the Ceded Territories. Air temperature has increased in the Great Lakes region over the 20th Century. Annual mean temperature increases in the Great Lakes region (1.6° F) have been larger than increases across the rest of the United States (Vose, Applequist, Squires, et al., 2014). Average daytime high temperatures in the upper Midwest have increased 1.4° F and average nighttime low temperatures have increased 3.1° F from 1900 to 2019 (NOAA National Centers for Environmental Information, 2019). The northern two-thirds of the state, including Ashland, Bayfield, Douglas, and Iron counties, have warmed by an annual average of 3° F from 1950 to 2019 (WICCI, 2020).

The average annual temperature across the Ceded Territories is projected to rise by 2.9° F to 5.5° F by the mid-21st Century relative to the 1980-1999 average (Figure 7.3-9) (GLIFWC Climate Change Team, 2023). The smallest increase in average temperature (2.1° F to 5.4° F) is projected to occur in spring and the largest increase in average temperature (3.5° F to 6.6° F) is projected to occur in summer. Both the average and the average minimum temperatures for this region are projected to increase. The biggest increases in minimum temperatures are likely to be in the winter months (December-February) (The average annual temperature across the Ceded Territories are projected to rise by 2.9° F to 5.5° F by the mid-21st Century relative to the 1980-1999 average (Figure 7.3-9) (GLIFWC Climate Change Team, 2023). The smallest increase in average temperature (2.1° F to 5.4° F) is projected to occur in spring and the largest increase in average temperature (3.5° F to 6.6° F) is projected to occur in summer. Both the average and the average minimum temperatures for this region are projected to increase. The biggest increases in minimum temperatures are likely to be in the winter months (December-February) (Figure 7.3-9) (GLIFWC Climate Change Team, 2023).



Note: A = least projected change, B= most projected change.

Figure 7.3-9 Increase in average temperature (° F) across the Ceded Territories by the mid-21st Century relative to the 1980-1999 average.

Source: GLIFWC Climate Change Team (2023)

The number of nights with low temperatures below 0° F in the Ceded Territories are projected to decrease by 1 to 24 nights per winter by the mid-21st Century, and the number of days with a high temperature above 90° F is projected to increase by 1 to 28 days per year relative to the 1980-1999 average (GLIFWC Climate Change Team, 2023).

As with Wisconsin as a whole, heavy precipitation events have increased in the Ceded Territories. For example, in 2012, a 500-year rain event (a flood of a magnitude with a 1 in 500 chance of occurring in a given year) dropped 9-11 inches of rain over western Lake Superior. In July 2016, the Bad River area received another 500-year rain event that dropped 8-10 inches of rain in an 8-hour period (Figure 7.4-3) (GLIFWC Climate Change Team, 2023).

Changes in future regional precipitation patterns are more difficult to project than changes in future temperatures, because of the number of local and regional variables involved in producing precipitation. Because of this variability, climate models do not all agree whether average precipitation will increase or decrease in the Ceded Territories in the future (Figure 7.3-10). What scientists are confident of is that precipitation will become more variable. As with Wisconsin as a whole, more total precipitation is projected to fall in bigger events, with drier periods between storms, although the number of days per year with precipitation is uncertain and could either increase or decrease (Figure 7.3-10).

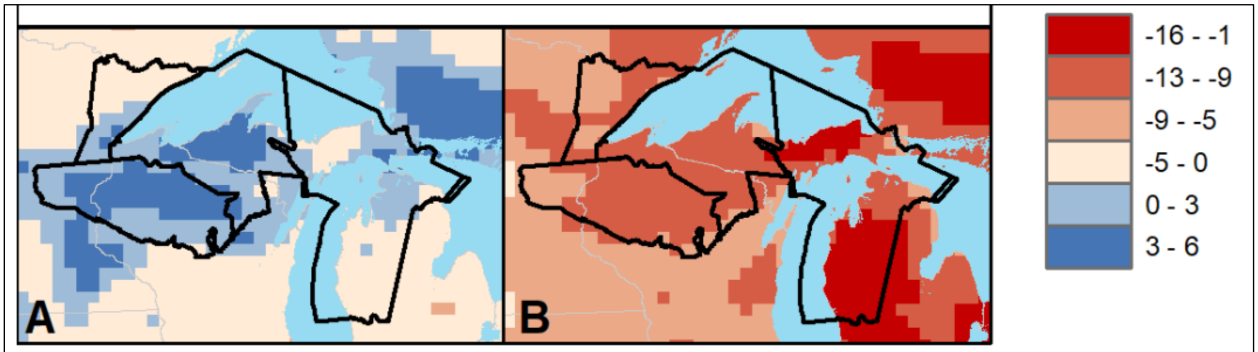


Figure 7.3-10 Projected change in days per year with precipitation.
A = least projected change, B= most projected change.
Source: GLIFWC Climate Change Team (2023)

The Ceded Territories have received snow later in the year and are experiencing less snow overall (GLIFWC Climate Change Team, 2023). Snow depth is projected to decline due to increased winter temperatures, with more precipitation falling as rain instead of snow and decreased winter precipitation in general. January's snow depth is projected be 0.5 to 10 inches below its current levels by the mid-21st Century relative to the 1980-1999 average, and the number of days in a year with snow could stay fairly constant or could decrease up to 18 days per year (Chiriboga, 2022).

In winter, when cold, dry air moves across big bodies of comparatively warmer water such as the Great Lakes, it absorbs moisture. When this air reaches a landmass, it drops the moisture in the form of precipitation (usually snow). This phenomenon, known as lake-effect precipitation, results in 'snow belts.' In general, "lake-effect snow is projected to decline in frequency throughout the 21st Century, with some lake-effect precipitation falling as rain instead" (Chiriboga, 2022). Lake-effect precipitation around Lake Superior could increase due to the warming lake and decreased ice cover (Notaro, Bennington, and Vavrus, 2015).

7.4 Climate Change Impacts

According to the IPCC (2023), widespread and rapid changes in the atmosphere, ocean, cryosphere, and biosphere have occurred resulting in widespread adverse effects and related losses and damages to nature and people. Climate change is a global phenomenon that has local effects and is cumulative in nature. More specifically, climate change is warming our planet, altering precipitation patterns, increasing the intensity and frequency of extreme climate events such as storms, droughts, floods, fires, and heatwaves. Not only is our climate changing, but the pace at which it is changing is increasing (United Nations, 2023; National Aeronautics and Space Administration (NASA), 2023; DNR, 2023b; U.S. EPA, 2023b).

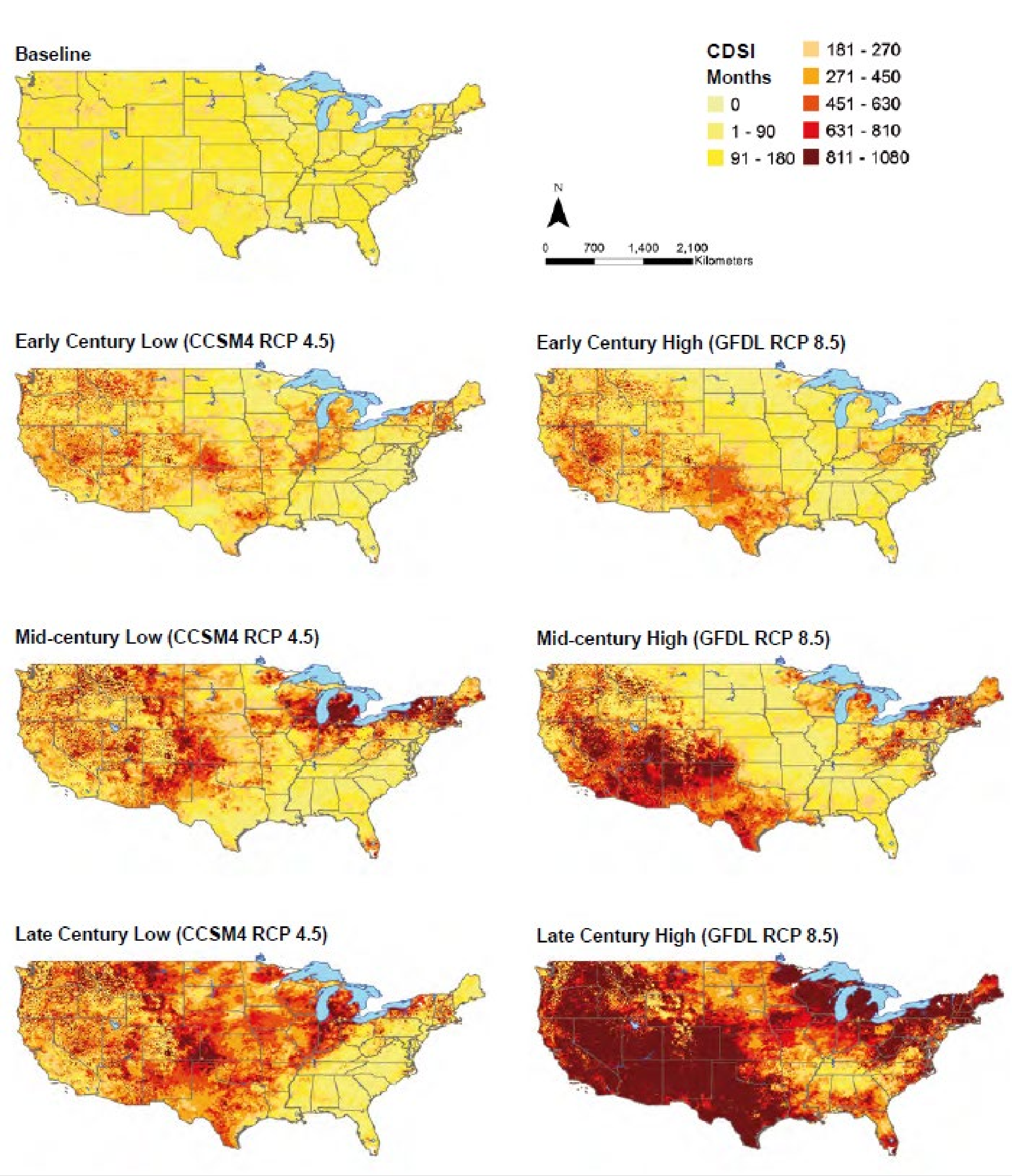
Climate change impacts happen at varying scales, including globally, regionally, and locally. Regions and states within the United States will experience climate impacts differently based on location. For example, while a region could experience drier conditions overall, some localities within that region could experience wetter conditions. Climate change impacts are felt across sectors such as agriculture, energy, and water and will result in serious health effects for many Americans. Secondary climate impacts include how changes in our climate will affect wildlife and biodiversity, agriculture and forestry, water quality, and storm and flooding events. Many of the effects of climate change are associated with increased risk and severity of the environmental conditions and risks described in Chapters 4 and 5. Recognizing the scope and scale of these impacts helps us better understand the ways climate change affects people where they live.

7.4.1 Impacts Related to Changing Temperatures

Projected increases in extreme heat events across the Midwest amplify the risk of heat-related and respiratory illnesses. For example, a July 2012 extreme heat event in Wisconsin was associated with approximately $290.3 million (in 2022 dollars) in damages due to loss of life, hospitalizations, lost wages, and other health-related costs (Limaye et al., 2019). Rising temperatures can increase the production of ground-level ozone and particulate matter, and lead to rising pollen counts. Exposure to these air pollutants can cause or worsen allergies, asthma, and other cardiovascular and respiratory illnesses and lead to premature death. Future warming is projected to increase exposure to ground-level ozone by mid-century, with higher ozone-attributable death rates in counties in the Midwest and Great Plains than in the rest of the United States (U.S. GCRP, 2023d).

Flash droughts, characterized by sudden onset and rapid intensification, have increased in frequency since 1980—although it is unclear whether current frequencies reflect a departure from the longer-term past (i.e., before the instrumental record began). Flash droughts affect crops and can induce significant water stress in thin-soiled forests, inciting pathogen infections that increase tree mortality. Additionally, climate change combined with river management for navigation can strain the health of floodplain forests that are important hotspots of ecological activity.

It can be challenging to account for the long-term influence of droughts within a region due to variations in the intensities over different spatial and temporal scales. To assess the severity of droughts experienced by different ecosystems, the U.S. Forest Service created the Cumulative Drought Severity Index for the United States (Peters, Iverson, and Matthews, 2014). More recently, the Forest Service used a baseline calibration period (1981–2010) and various GHG emissions scenarios to compile maps to show projected changes in the Cumulative Drought Severity Index (Figure 7.4-1) (Matthews et al., 2018). The yearly Cumulative Drought Severity Index values were accumulated over 30-year periods, with the Cumulative Drought Severity Index values for each period ranging from 0 (no months with any drought) to 1080 (every month has an extreme drought). Each future 30-year interval is generally expected to experience more drought events compared to the baseline; some portions of the regions are predicted to experience fewer drought events or less intense ones than the baseline period (Figure 7.4-1). Most regions, however, are projected to have more frequent or more intense droughts by end of century. In the Midwest, more than 45 percent of the area in the region is projected to have an increase (Figure 7.4-1). These increases have the potential to place additional stress on vegetation, leading to increased mortality (J. S. Clark et al., 2016).



Baseline

Early Century Low (CCSM4 RCP 4.5)

Early Century High (GFDL RCP 8.5)

Mid-century Low (CCSM4 RCP 4.5)

Mid-century High (GFDL RCP 8.5)

Late Century Low (CCSM4 RCP 4.5)

Late Century High (GFDL RCP 8.5)

Figure 7.4-1 Maps of baseline and projections of Cumulative Drought Severity Index; left: low GHG emissions scenario, right: high GHG emissions scenario.
Time periods: baseline (1980–2009); early century (2010–2039); mid-century (2040–2069); late century (2070–2099).
Source: Matthew et al. (2018)

Increases in warming and drought are leading to more intense and frequent wildfires—an effect aggravated by a reduction in Indigenous land-use practices and fire stewardship critical to fire management (U.S. GCRP, 2023c). Wildfires result in loss of life and property, damage infrastructure and ecosystems, and pose adverse health effects. While many of the worst wildfires occur in the western United States, there are scattered areas of high wildfire risk throughout the Upper Midwest. Wildfire smoke from both local and distant sources (Figure 7.4-2) can pose a threat to human health by aggravating cardiovascular and respiratory conditions. For example, a 2024 report attributed high levels of particulate matter found in the air at Beloit in southern Wisconsin to Canadian wildfires in 2023 (Gunn, 2024).

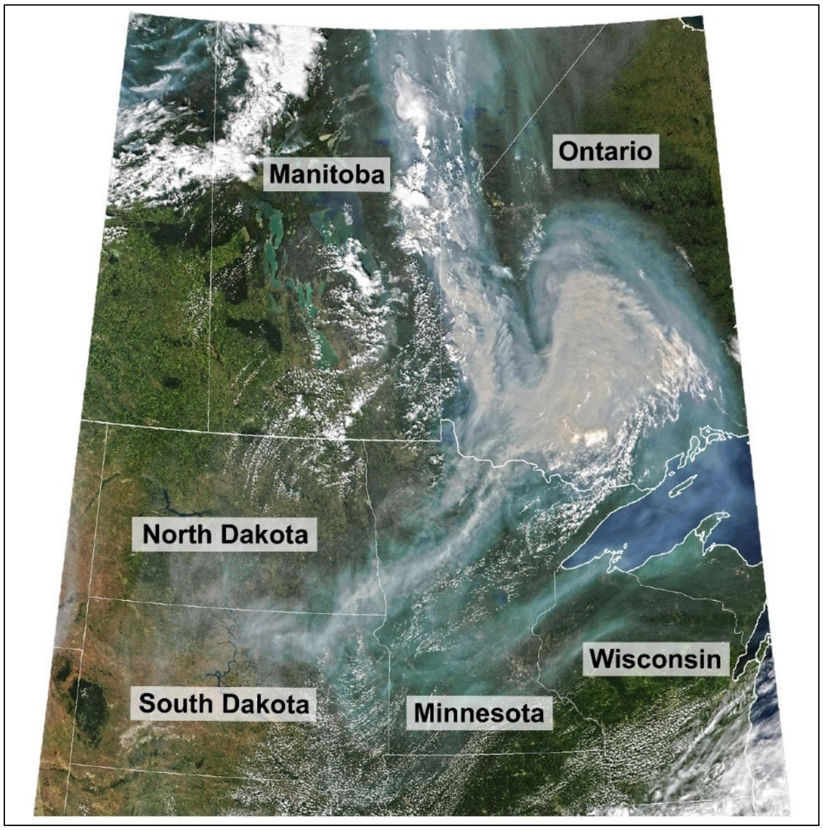


Figure 7.4-2 Impacts from wildfire smoke in the Midwest.
Source: Fifth National Assessment on Climate Change, Chapter 24: Midwest (U.S. GCRP, 2023d)

Long term changes in regional temperature can disrupt natural process and habitats (Section 7.4.3). This disruption can damage plants and animal species. If regional temperature changes occur faster than plants and animals can adapt, then those ecosystems are at risk of being lost. For example, Gichiigaming (Lake Superior) and the other Great Lakes are important cultural resources for the Ojibwe tribes (Section 4.2.1.4). Great Lakes surface water temperatures have been rising steadily since 1980 and have had nearly uniform increases in temperature across the upper Great Lakes (U.S. GCRP, 2023d). The 5th National Climate Assessment states that "coupled with increasing water temperatures is a decrease in winter ice cover, which is observed on all five lakes and has cascading effects on ecosystems and culture" (U.S. GCRP, 2023d). Climatic changes in the Great Lakes are also expected to exacerbate the increasing trend of invasive species, especially dreissenid mussels, and harmful algae blooms.

7.4.2 Impacts Related to Changing Precipitation

Extreme precipitation events can degrade aquatic ecosystems, threaten human health and safety, damage infrastructure and communities, and yield billions of dollars in economic damage. The conservation and management of natural lands can reduce these negative effects—reducing erosion and flood risk, improving water quality, increasing carbon sequestration, and reducing the economic cost of flooding. Landscape features and land management practices that slow the flow of water across the surface can improve habitat and water quality, reduce flood and drought risks, and have a variety of other benefits.

Flooding is a natural result of large rain events or spring snowmelt. The intensity and duration of rainfall along with volume affect the severity of flooding. Most areas across the United States are susceptible to flooding. According to EPA and USGS data, floods have generally become larger in rivers and streams in the Northeast and Midwest. The IPCC's October 2018 Working Group Report suggests climate change could cause flooding to become more frequent in some areas and less frequent in others. Enbridge's existing Line 5 and proposed pipeline relocation are in an area that has had increased occurrence and risk of flooding. For example, the July 2016 storm over the Bad River area (Figure 7.4-3) caused the Bad River to rise over 27 feet, which washed out roads, destroyed homes, caused power outages, and left community members stranded without access to medical care, medical supplies, food, or water (GLIFWC Climate Change Team, 2023). Flood damage to northern Wisconsin from the 2016 event is estimated at $35 million.

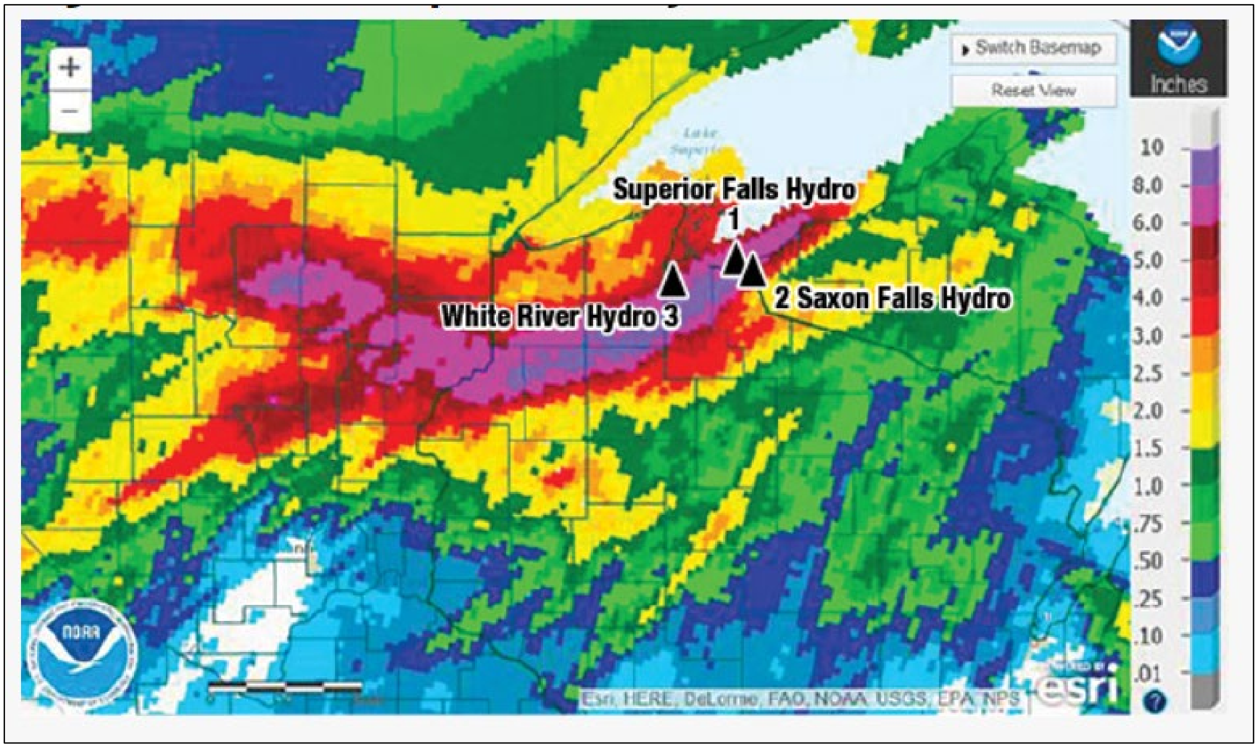


Figure 7.4-3 Cumulative rainfall during July 11-12, 2016 storm event.
Source: NOAA in (**Hydro Review, 2018**)

Outside of urban areas that have high concentrations of impervious surfaces, soil conditions are a significant factor in the extent of flooding. Large floods often result from large rainfalls over soils that have decreased infiltration capacity due to saturation from previous rainfalls, snow melt, or frozen ground. WICCI considered that increases in winter and spring precipitation would likely increase large runoff events resulting in soil erosion, channel erosion, sediment, and mobilization of sediment, among other things (WICCI, 2011).

As the climate continues to warm, as is expected, the frequency of these extreme events will likely continue to increase as well. Northern Wisconsin experienced these types of extreme precipitation events in 2012, 2016, and 2018 (WICCI, 2020). WICCI projects that extreme precipitation events will increase across Wisconsin and the very extreme rainfall amounts will see the largest change (WICCI, 2020).

7.4.3 Climate Change & Ecological Impacts

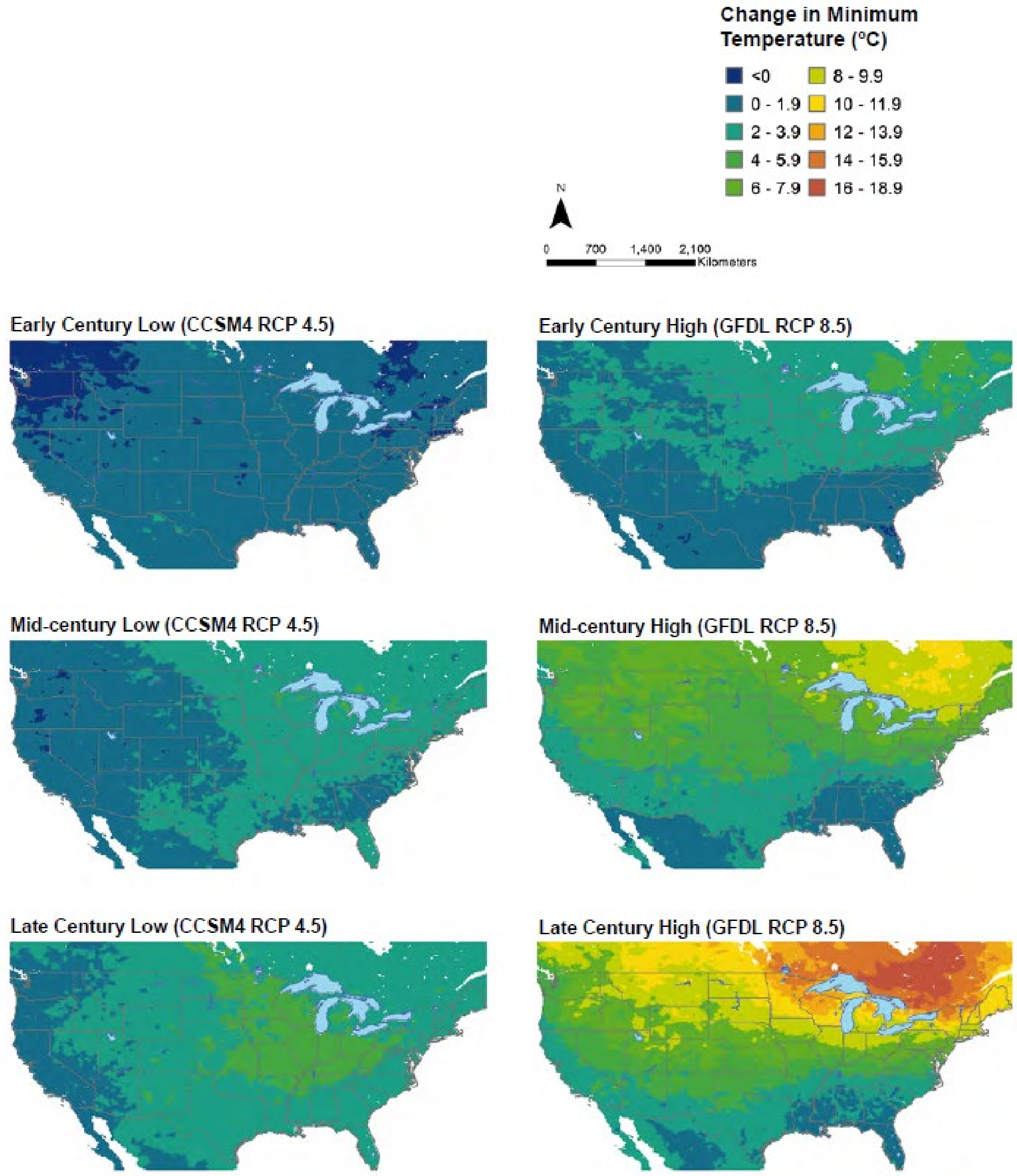
Increasing air temperatures and changes in precipitation are also expected to change natural community composition. Changing climate will no longer favor tree species such as aspen or communities like boreal forests that are currently at their southernmost range. Species that rely on these forest types such as snowshoe hare and grouse could see significant population declines or extirpation. However, species at their northernmost range such as some oaks could benefit from the change.

For climate sensitive species, even if GHG emissions fall substantially, the effects of climate change will continue to intensify over the coming decade. Specifically, species with the following characteristics are anticipated to be sensitive to climate change:

- Species having long generation times
- Species having narrow or restricted distributions
- Species having poor dispersal ability
- Habitat specialists
- Species sensitive to human activities

Based on average annual extreme minimum temperatures, plant hardiness zones provide a general indication of the extent of overwinter stress experienced by plants. Horticulturists use these zones to evaluate the cold hardiness of plants. Plant hardiness zones and subzones were delineated by 10° F (5.56° C) increments from zone 1 (-55° to -45.6° C) to zone 13 (15.7° to 22° C) of annual extreme minimum temperature. Because they reflect cold tolerance for many plant species, hardiness zones are most likely to reflect plant range limits. The U.S. Forest Service projected future plant hardiness zones under various GHG emissions scenarios (Matthews et al., 2018). Dramatic changes in zones caused by warming temperatures are projected by the mid-century onward (Figure 7.4-4). Such projections can be used to show the future range potential of different plant species. Most of the Midwest is projected to experience an increase in minimum temperature of at least 8–9° C with the entire distribution shifting toward warmer conditions (Matthews et al., 2018).

In addition to shifts in hardiness zones, warmer temperatures in spring and fall are projected to result in a longer growing season (the part of the year in which conditions allow for plant growth). The growing season is expected to increase across the Ceded Territories by an average of 19 to 23 days by the mid-21st Century relative to the 1980-1999 average (Figure 7.4-5) (Chiriboga, 2022).



Early Century Low (CCSM4 RCP 4.5)

Early Century High (GFDL RCP 8.5)

Mid-century Low (CCSM4 RCP 4.5)

Mid-century High (GFDL RCP 8.5)

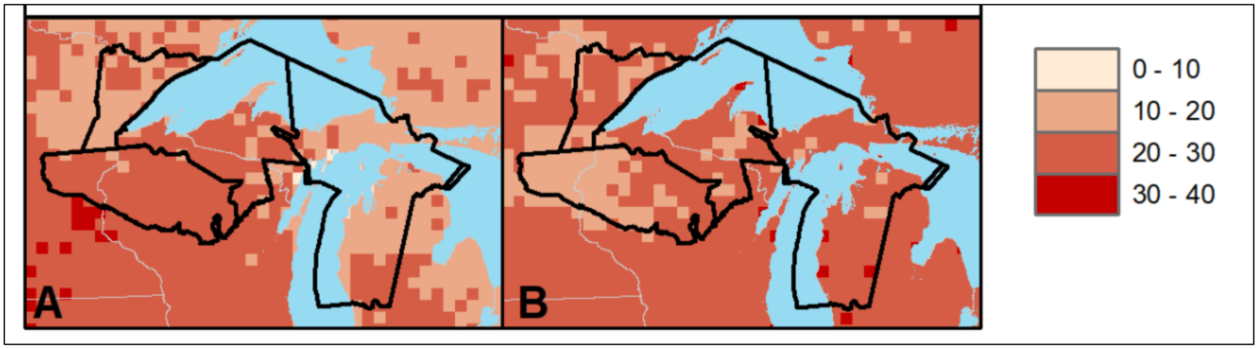
Late Century Low (CCSM4 RCP 4.5)

Late Century High (GFDL RCP 8.5)

Note: Time periods: early century (2010–2039); mid-century (2040–2069); late century (2070–2099).

Figure 7.4-4 Mapped projections of changes in minimum temperature.

Source: (Matthews et al., 2018)



Note: A = least projected change, B = most projected change

Figure 7.4-5 Projected increase in growing season (days) in the Ceded Territories.
Source: GLIFWC Climate Change Team (2023)

The changing timing of the seasons is predicted to alter life cycles of various organisms such that they may no longer be synchronized, which affects ecological system dynamics, and the modification of the migration behavior of wildlife. Wisconsin is expected to have shorter winters and longer summers with an increase in precipitation. Shorter winters might result in camouflage mismatch for species such as snowshoe hare, American marten, and weasels making them more susceptible to predation (Wilson et al., 2020). Increased precipitation will likely be in the form of rain rather than snow. Rain on top of snow results in a crust layer that will negatively affect snow roosting species such as grouse and American marten. A snow-crusted layer is believed to favor predators and disfavor some prey like deer.

Warming has shortened the length of persistent cold conditions and decreased snow cover in the Upper Midwest. Snow supports the survival of boreal wildlife, providing insulation from cold conditions. Some types of wildlife, such as moose, are threatened by warming winter conditions; declining moose populations have been recorded in the 1854 Ceded Territory over the last three decades. This loss, in turn, has cascading effects on cultural practices, human well-being, subsistence harvesting, and tourism.

Increasing air temperatures are anticipated to result in higher surface water temperatures. And predictably, higher surface water temperatures are anticipated to result in changing habitability of streams for cold-water fish species.

The threat of invasive species is amplified by climate change. However, invasive species can be perceived in different ways: many Native American communities have holistic views of invasives, or non-local beings, who encompass both positive and negative attributes. For example, dandelions and common plantain are used medicinally in Anishinaabe communities.

The GLIFWC compiled a report on the impacts of climate change on “beings of concern or interest” that were mentioned in Traditional Ecological Knowledge interviews. The GLIFWC Climate Change Team (2023) found swimmers (fish) to be the most vulnerable category, with stand outs in cool/cold-water swimmers having moderate to extreme vulnerability scores. Changes to cool-water streams common throughout Wisconsin will be affected under climate change. The GLIFWC Climate Change Team (2023) states “[t]he factors that had the most influence on the vulnerability of beings in this assessment were manidoonsag [pathogens] and predators, changing hydrological conditions, and an increase in disturbances.” The report also stated that climate change will cause new interactions and relationships to occur; “[W]hile Ojibwe people have adapted to changing relationships for millennia, the speed of these climate-related changes will affect their ability to maintain cultural relationships with beings that they have held for centuries.” (GLIFWC Climate Change Team, 2023)

7.4.4 Climate Change Impacts on Infrastructure

Midwest infrastructure, including dams, bridges, roads, wastewater facilities, and energy generation and distribution systems, need repair, with estimated costs for upgrading these systems totaling $7,547 (in 2022 dollars) on average per capita across the Midwest (U.S. GCRP, 2023d). Projected changes in precipitation and temperatures increase the risk of failure and cost. Although the Midwest has had numerous state and federally declared flood disasters, the risk of loss due to recurrent, underreported inland and urban flooding events increases as the frequency of intense precipitation events rises. Fluctuating water levels make efficient navigation of goods and services through the region's rivers and the Great Lakes more challenging.

The United States now experiences on average a $1 billion disaster every three weeks, up from one every four months in 1980. Billion-dollar weather and climate disasters are events where damages and costs reach or exceed $1 billion, including adjustments for inflation. Between 2018 and 2022, 89 such events affected the United States, including four droughts and heatwaves, six floods, 52 severe storms, 18 tropical cyclones, five wildfires, and four winter storm events (Figure 7.4-6). Increasing costs over time are driven by changes in the assets at risk and the increase in frequency or intensity of extreme events caused by climate change.

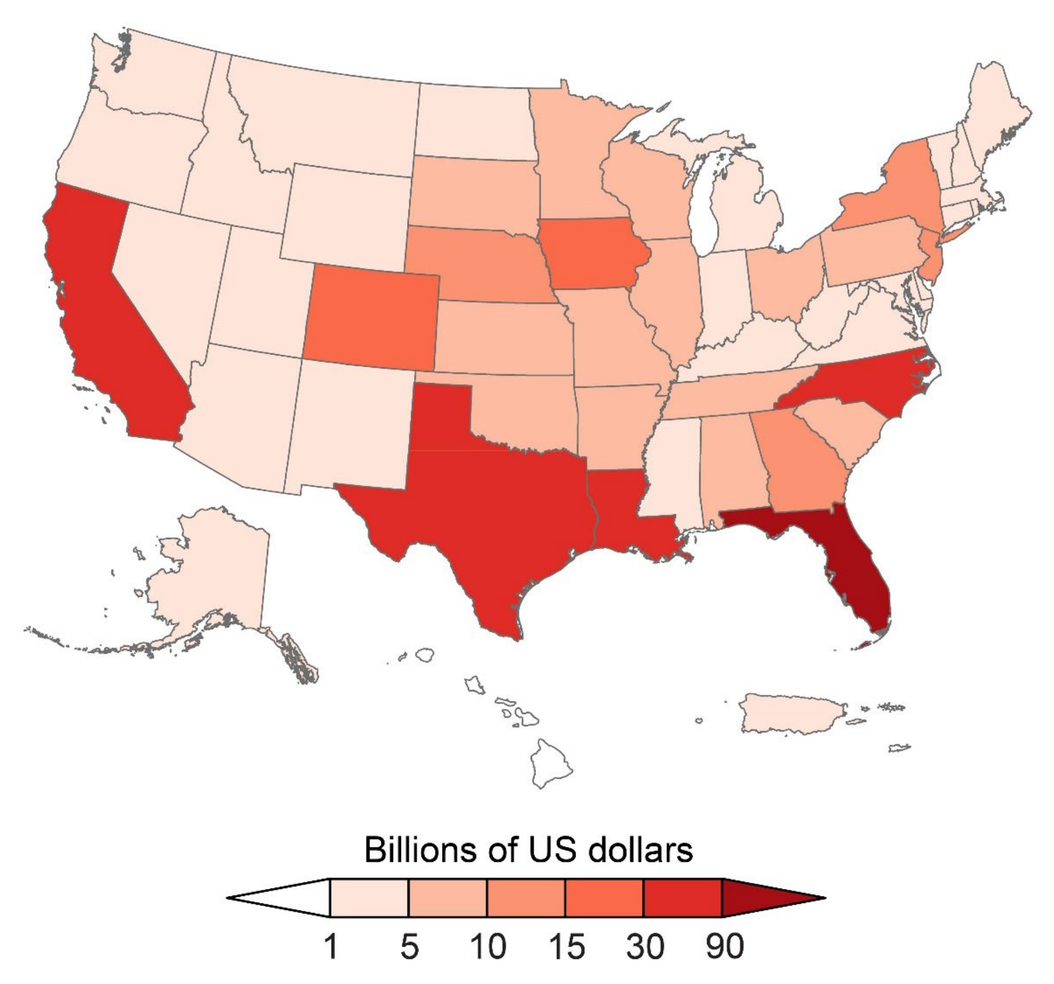


Figure 7.4-6 Damages by state from billion-dollar disasters, 2018-2022.
Source: U.S. GCRP (2023a)

Interest in the impacts of climate change on infrastructure has grown significantly over the last decade. Although improvements have been made, recent grades based on capacity, condition, funding, future need, operations and maintenance, public safety, resilience, and innovation across Midwestern states vary from a C to a D+. Significant repairs are needed in surface transportation, wastewater and stormwater, dams, ports, and the energy grid. Projected increases in temperature and more intense precipitation are expected to increase costs associated with rail and roads (amounting to hundreds of billions of dollars annually by 2090). For instance, projected rises in temperature are expected to increase the width of cracks caused by deicing salts in reinforced-concrete bridges.

7.4.5 Climate Change & Environmental Justice Effects

The 5th National Climate Assessment reports that, "people who have been excluded from the benefits of industrialization, or disproportionately harmed by industrial processes, might see the principal driver of climate change as the social systems and ethical arrangements that allowed for the simultaneous exploitation of land, animals, and peoples" (U.S. GCRP, 2023e). Additionally, the effects of climate change are not distributed equally, either globally or in the United States. Climate impacts disproportionally harm people and communities who have been marginalized, that is, communities that have been under-resourced and overburdened. This includes low-income groups, rural communities, communities of color, agricultural workers, among others. While climate change affects everyone, these communities feel especially acute effects because they are located at compounding multiple structural stressors such as: lack of water access, health access, shelter; face structural impediments; or experience general poor environmental conditions potentially because of environmental racism (Section 4.3.4). Examples of this include areas with poorly maintained or aging infrastructure that are more vulnerable to climate change impacts, making healthcare and resource access difficult. Communities with greater rates of existing medical conditions will more readily be impacted by climate change. Some highly vulnerable areas also have high economic losses from climate change—an effect that can foster intergenerational inequity.

Climate change accelerates the loss of beings, access, and connection to the land for Native American peoples. Wild rice is one of the most vulnerable culturally significant species to Midwest tribes (Section 4.2.1.10), and harvest rates have decreased due to warming and altered hydrology, potentially leading to a loss of cultural identity. Sugar maple is also culturally and economically important to Native American communities (Section 4.2.1.12). Warming winters have altered the timing and length of maple sugaring. Seasonal changes and shifting habitats can affect traditional knowledge, language, physical health, and mental well-being by altering the timing of cultural ceremonies, availability of beings needed for the ceremonies, and potential loss of culturally significant relatives (Section 4.2.3.4).

7.5 GHG Emissions, Climate Change, & Existing Line 5 Pipeline

Enbridge's Line 5 pipeline contributes to GHG emissions through the production, transport, and consumption of crude oil and NGLs (Figure 7.5-1). Estimates of the GHG emissions associated with each phase of the lifecycle are presented in Section 8.2.2.1. GHG emissions estimates for mainline valve sites are provided in Table 5.3-2.

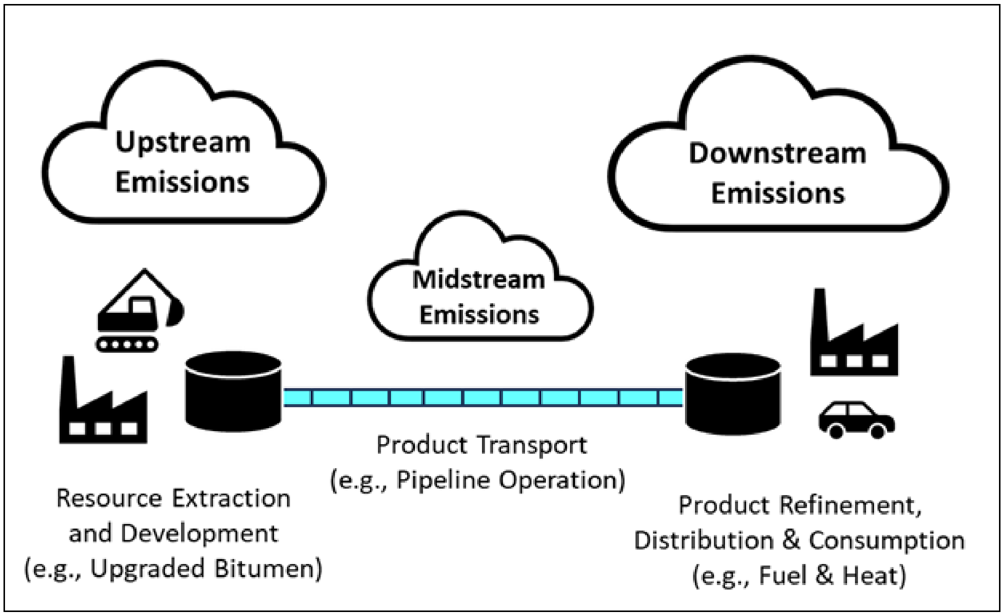


Figure 7.5-1 GHG emission sources associated with Line 5 pipeline.
Source: Adam C. Mednick, DNR

In addition to ecological and cultural effects summarized in Section 7.4, climate change poses direct threats to existing pipelines. As discussed in Section 7.4.2, northern Wisconsin has experienced increases in the frequency of intense rainfall events. Flooding events have occurred along the existing and proposed Line 5 rights-of-way, along with increased erosion effects from those flood events. The combination of floods and erosion increase the risk of pipeline exposure, pipeline damage, and crude oil spills (Section 6.2.2).

7.6 GHG Emissions, Climate Change, & Pipeline Construction

Enbridge's proposed Line 5 pipeline relocation would contribute to GHG emissions through construction, as well as through the production, transport, and consumption of crude oil and NGLs (Figure 7.5-1). Construction along any of the route alternatives would directly release GHGs from trucks hauling materials, workers commuting and operating construction equipment, and potentially burning timber and brush. These GHG emissions would be temporary and would stop upon completion of construction.

Large earth-moving equipment, skip loaders, trucks, and other mobile sources could be powered by diesel or gasoline and would be sources of combustion emissions, including GHGs. There are no applicable state or federal air pollution requirements with respect to GHG emissions for sources exempt from air permitting requirements, however, gasoline and diesel engines must comply with the EPA mobile source regulations in 40 CFR Part 86 for on-road engines and 40 CFR Part 89 for non-road engines. These regulations are designed to minimize emissions.

Enbridge proposes burning cleared materials if all applicable permits and approvals have been acquired. Burning wood material would release large volumes of CO_2, as well as particulate matter and carbon monoxide. Open burning of cleared materials from construction activities would be anticipated to affect local air quality, particularly with the large volume of trees that would be removed from the ROW (approximately 354.7 acres of forest lands for the proposed route).

GHG contributions from construction would by essentially the same irrespective of the route alternative selected. The additional components from a longer pipeline would result in additional long-term GHG emissions increases from the valves, pumps, connectors, and other fugitive piping components. Enbridge's proposed relocation project includes ten new mainline valve sites. estimates for fugitive GHG emissions from the mainline valve sites are provided in Table 5.4-2. Enbridge estimates that the east and west tie in locations to release GHG emissions ranging from 0.18 to 19.39 tons per year.

The No Action alternative could result in a decommissioned Line 5 and the termination of transport of crude oil and NGLs through the line. The effect that the No Action alternative would have on climate change depends, in part, on the changes in production, transport, and consumption of crude oil in response to a shutdown Line 5 (Section 8.2.2). The No Action alternative is the only alternative examined by the DNR that has the potential for a reasonably foreseeable decrease in GHG emissions.

7.7 GHG Emissions, Climate Change, & Pipeline Operations & Maintenance

Enbridge's proposed Line 5 pipeline relocation would contribute to GHG emissions through the production, transport, and consumption of crude oil and NGLs (Figure 7.5-1). For pipeline operations, electricity would be used to power the system's pumping stations and other infrastructure. No long-term emissions would result from operations associated with the proposed projects, except for fugitive GHG emissions from valves, pumps, and connectors. Maintenance activities along any of the route alternatives, including Enbridge's proposed Line 5 relocation route, would directly release GHGs from helicopters and ATVs used to monitor the ROW and from equipment used to remove encroaching woody vegetation. Enbridge proposes burning cleared materials if all applicable permits and approvals have been acquired. Burning wood material would release large volumes of CO_2, as well as particulate matter and carbon monoxide. Open burning of cleared materials from maintenance activities would be anticipated to affect air quality, particularly if large volume of trees would be removed from the ROW. GHG contributions from pipeline operations would be essentially the same irrespective of the route alternative selected, with only minor incremental increases in GHG emissions resulting from the slightly longer pipeline routes compared to the existing segment.

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8 NO ACTION ALTERNATIVE ANALYSIS

As described in Section 3.5.2, the No Action alternative is that the DNR would not issue the state permits to Enbridge that would be required to proceed with the proposed rerouting of the Line 5 pipeline. Because of other factors outside the control of the DNR, it is uncertain what the outcome of the No Action alternative would be. It could result in a decommissioning of Line 5, or it could result in continued operation of Line 5 either through the existing pipeline or an alternative route. To provide the most comprehensive analysis, this Final EIS analyzes the potential outcome that Line 5 is decommissioned.

The No Action alternative potential outcome of decommissioning Line 5 depends, in part, on potential substitute modes of crude oil and NGL transportation and alternative energy sources. This chapter considers the anticipated effects of pipeline decommissioning, risks of oil spills, implications for GHG emissions and climate change, as well as socioeconomic effects in the region including the social costs of carbon.

8.1 Effects Averted by No Action

The potential No Action alternative outcome of shutting down Line 5 would discontinue the transport of oil and NGLs through Line 5. In this outcome, all direct, indirect, and cumulative cultural, environmental, socioeconomic, and liquid petroleum spills-related effects described in Chapters 4, 5, and 6, would be averted. However, under this outcome of the No Action alternative, alternatives to Line 5 would likely be undertaken—but the exact configuration of such alternatives remains unknown.

8.2 Potential Effects of No Action

In analyzing the anticipated effects of the No Action alternative, the DNR assumed that consumers would substitute the petroleum and NGLs currently transported via Line 5 with a combination of the same products transported by other means, different products (e.g., alternative energy), improvements in energy efficiency, or some combination of these alternatives. Regardless of how they come about, these substitutions would have their own effects on the quality of the human environment, which in turn could offset or compound the direct, indirect, and cumulative effects of this outcome of the No Action alternative over time. Of particular interest to public commenters on the Draft EIS are the effects on GHG emissions and climate.

8.2.1 Environmental Effects of Pipeline Decommissioning

The shutdown of Line 5 would require decommissioning the existing pipeline, including the segment that crosses the Bad River Reservation. The entire decommissioned pipeline could remain in place or all or portions of the pipeline could be removed from the ground. If not taken out of service properly, pipelines can pose safety and environmental risks—including spills, emissions, or explosions.

Industry practice is to leave a mainline pipe, like the Line 5 pipeline, in the construction trench to prevent further environmental disturbances that could result from removing the pipe and other underground components (Pipeline 101, 2024). Pipeline operators that abandon a pipeline in place must follow PHMSA requirements in 49 CFR § 192.727. Pipeline 101 (2024) explains pipeline operators take several steps to minimize environmental effects and maintain safety when decommissioning a pipeline:

- Removing cathodic protection from the pipeline,
- Disconnecting the pipeline from operating facilities,

- Removing the product from the line,
- Flushing the line with fresh water, air, or inert gas, and
- Capping the pipe by welding steel caps to open ends.

Abandoning a pipeline in place can lead to long-term structural deterioration of the pipeline that could in turn lead to some measure of ground subsidence. Abandoned pipeline sections can be filled with concrete to prevent subsidence from occurring and Enbridge would consider filling pipeline sections abandoned in place underneath railways and roadways to prevent potential ground subsidence effects in these specific areas.

The likelihood of ground subsidence from pipeline deterioration is low and can be expected to be almost negligible in areas where the coating integrity is intact (Canada National Energy Board (NEB), 1996). Corrosion of a coated pipeline is normally restricted to those isolated areas where there are defects in the protective coating or where the coating has become disbonded from the pipe. It is extremely rare for corrosion to cover large areas of a pipeline and given the non-uniform nature of the corrosion process it is unlikely that significant lengths of an abandoned Line 5 pipeline would collapse at any one time. However, over the course of many decades with no monitoring or maintenance plan, some corrosion could occur, and larger diameter pipelines like the 30-inch Line 5 would be more susceptible to ground subsidence than smaller diameter pipelines. Over a long time, it can be assumed that as the coating adhesive degrades or is consumed by soil organisms, the pipeline coatings would eventually disbond and contribute to the corrosion process, although it is unknown how long this process would take because limited information exists regarding such long-term decomposition of pipeline coatings (NEB, 1996).

Exposure of the buried pipe at waterbody or wetland crossings could occur from either erosion of soils overlying the existing pipeline, stream degradation, or from flotation of an empty pipeline within a waterway. Filling the abandoned pipe with either concrete or other heavy material would prevent flotation in these areas. It would normally be assumed that any exposed section of pipeline would be repaired before, during, or after the abandonment.

Release of contaminants, including substances produced in the hydrocarbon stream and deposited on the walls of the pipeline, treatment chemicals, and pipeline coatings and their degradation products, could occur after a pipeline is abandoned in place or during pipeline removal. Consequently, pipe cleaning would be required prior to decommissioning to avoid contamination of soil and groundwater. Pipe cleaning would also reduce human health hazards (e.g., exposure to vapors) and flammability hazards. The removal of hazardous materials from the pipeline would be accomplished with a cleaning pig (Section 2.6.13). The NEB (1996) concluded that the small quantities of hydrocarbons left in an abandoned pipeline after a concerted pig cleaning effort would not result in any significant environmental concerns. Measures would be taken to prevent release of the substances resulting from the cleaning process including using collection trays to catch any residual fluids during pipe cutting operations. A specialized third-party consultant could test liquids removed from the pipe, which would be transported to an approved, licensed disposal facility.

Pipe segments to be used for another purpose after removal would be cleaned in place followed by supplementary cleaning techniques after the pipe has been removed from the ground. For pipe segments targeted for disposal, existing waste disposal regulations would determine the required cleanliness of the pipe.

The strategic placement of caps, plugs, or blind flanges would also help mitigate contamination concerns by preventing the movement of materials through the abandoned pipe. If the Line 5 pipeline would be abandoned in place, state and federal permitting agencies would recommend plugs be strategically placed at waterbody and wetland crossings, at the boundaries of sensitive land uses (e.g., natural areas, parks), and at the top and bottom of steep slopes. Examples of suitable plug materials include concrete grout or polyurethane foam.

The potential for damage to existing bank stabilization structures or destabilization of previously stable banks could occur with pipeline removal. Erosion and slope stability concerns for pipeline removal would be like those for pipeline construction. For example, traffic, soil compaction, and wind and water erosion of disturbed soil could occur. The pipeline could have become a structural support to some slopes over time such that its removal could affect the integrity of the slopes. In general, topsoil or other soil materials would be required to completely fill the trench after pipe removal. Additional topsoil or soil materials could be moved from the excavated area for the new section of the Line 5 pipeline or would need to be obtained from local borrow sources.

Pipeline removal at utility, road, and railway crossings could create short-term disruption to facility and traffic operations. Road closings would be temporary and like road closings required for pipeline installation, generally lasting less than one week. Appropriate post-removal filling would be required in all cases to maintain structural integrity of the crossings. Enbridge would coordinate with affected utility and infrastructure agencies and companies to ensure that the abandonment plans are appropriate for each crossing location.

If Enbridge would remove pipe segments rather than abandoning them in place, additional direct and indirect effects would occur along the existing Line 5 segment. These effects would be like those associated with the proposed pipeline construction (Chapter 5).

8.2.2 Effects on GHG Emissions, Air Quality, & Climate Change

The effect that decommissioning Line 5 would have on GHG emissions, air quality, and climate change would depend, in large part, on whether and to what extent companies that currently ship products via Line 5 would switch to alternative modes of transport. If the Line 5 products are moved using substitute transport modes, GHG emissions would be replaced or increased by those modes of transport. A comparison of the carbon intensity of each mode is outlined in Section 8.2.2.6.

Upon the decommissioning of Line 5, the propane distributors in Superior, WI, Rapid River, MI, and Sarnia, Ontario, would need to identify new suppliers to meet customer demands. This would lead to a revision of existing supply chain patterns and significant changes to the supporting logistics chain. Changes in transportation would be interrelated with the price of and consumer demand for crude oil, NGLs, and their end-products, as well as the price of and consumer demand for product substitutes, alternative energy, and energy conservation practices. Energy policy at different levels of government could further influence the effects of this scenario on GHG emissions, air quality, and climate change.

Should the decommissioning of Line 5 occur in combination with other events like a continued growth in renewable energy, increased electrification of residential, commercial, and industrial appliances like heat pumps, Wisconsin drivers opting to drive electric cars, or establishment of energy conservation and efficiency technologies and policies, GHG emissions would decrease compared to the lifecycle emissions associated with the existing Line 5 operation (Section 8.2.2.1). Such events are currently in progress and are increasingly encouraged with federal and state subsidies.

In the case of a Line 5 shutdown, climate change would continue to occur, and in practically the same way as in an approved permit alternative. However, the No Action alternative is the only alternative assessed by the DNR with a possible outcome that could result in a reduction in GHG emissions and could contribute to achieving the objectives of the Paris Agreement and Wisconsin’s 2025 goal for a 26 to 28 percent reduction in GHG emissions from 2005 levels (Sections 1.4.3.5 and 7.1).

8.2.2.1 GHG Emissions Associated with the Proposed Project

Enbridge's proposed Line 5 pipeline relocation would not provide for increased pipeline capacity or increased consumer demand for petroleum products. Permitting the proposed relocation, however, would result in a small increase in GHG emissions compared to current Line 5 emissions. The ten new main line valves (Section 2.1.4.2) would represent new sources of GHG emissions. As noted in Section 7.6, construction along any of the route alternatives would directly release GHGs from trucks hauling materials, workers commuting and operating construction equipment, and potentially burning timber and brush. These GHG emissions would be temporary and would stop upon completion of construction. Maintenance activities along any of the route alternatives, including Enbridge's proposed Line 5 relocation route, would directly release GHGs from helicopters and ATVs used to monitor the ROW and from equipment used to remove encroaching woody vegetation.

A sentiment expressed in public comments is that the indirect life cycle effects of continued pipeline operation should be considered when assessing Enbridge's proposed Line 5 relocation project and alternatives. The crude oil and NGLs transported by Line 5 are part of a larger fossil fuel system that includes land-use change, extraction, production, refinement, transportation, and end-use consumption (Figure 7.5-1). Line 5 is an integral part of the lifecycle of each barrel of crude oil or NGL transported by the pipeline. The GHGs associated with the raw material acquisition, processing, refining, transporting, and end-use combustion are reasonably foreseeable effects of Line 5. These lifecycle emissions would contribute to the cumulative effects of the proposed project. For example, extraction of Canadian oil sand crude contributes to a range of environmental effects, including the clearing of forests in Canada. According to the World Resources Institute (Petersen and Sizer, 2014), much of tar sands mining is done by clear cutting boreal forest and stripping off overburden soil, generating significant GHG emissions (Bošković and Leach, 2020) and destroying a type of forest that captures and stores twice as much CO_2 as tropical forest (Lieberman, 2020).

8.2.2.2 GHG Lifecycle Emissions Analysis

For this EIS, the DNR estimated emissions using lifecycle emissions factors for crude oil and end-use combustion emissions factors for NGLs. Emissions factors represent the amount of GHGs released with a material and are usually multiplied by the quantity of the material being used. A lifecycle analysis is a specific kind of emissions analysis that considers emissions that are created during the extraction, production, refinement, transportation, and end-use combustion stages for a material. As explained below, this EIS provides a partial lifecycle analysis of crude oil emissions factors, considering the upstream, midstream, and downstream stages (Figure 7.5-1), but the NGL emissions factors only consider emissions created during the end-use combustion stage.

From 2017 to 2022 (excluding 2020), Enbridge's existing Line 5 carried an average of 504,800 barrels of petroleum products per day (Table 1.3-1). Eighty-five percent of the total yearly volume was crude oil and 15 percent was NGLs including propane, butane, ethane, and natural gasoline. Approximately 80 percent of the crude oil that Line 5 carried during this time was derived from Canadian oil sands and the remaining 20 percent came from the Bakken formation in North Dakota and Montana. The DNR used the volume data from this period to produce an estimated range of GHG emissions and their associated social costs (Appendix AI).

Table 8.2-1 lists the subset of crude oil and NGL lifecycle emissions factors used by the DNR; all emissions factors considered are available in Appendix AI. Lifecycle emissions for propane and butane were unavailable, but the DNR identified end-use combustion emissions factors for these products. DNR staff multiplied the emissions factors by their associated product's volume (rounded to 505,000 total), converted the amounts to tons, and then annualized the emissions to create a figure that represents the pollutants released in a year of operation. Oil sands-derived crude is a more carbon intensive petroleum (591 to

615 Kg CO_2e/bbl) compared to other crudes due to the energy necessary to refine it. For comparison purposes, in 2019, IHS Markit (Birn et al., 2022) estimated the average barrel of crude oil refined in the United States emitted 456 Kg CO_2e/bbl, the average barrel of Arab Medium crude emitted 444 Kg CO_2e/bbl, and the average barrel of Mexican Maya crude emitted 479 KgCO_2e/bbl. Emissions from Bakken crude (429 to 476 Kg CO_2e/bbl) fall within the range of these other crudes.

Table 8.2-1 Crude oil and NGL emissions factors (Kg CO2e/bbl) used in the DNR's Line 5 lifecycle estimation of GHG emissions.

Canadian Oil Sands derived synthetic crude oil (lifecycle)	
Line 67 FSEIS[a] *Mined & upgraded light (synthetic) crude oil*	591
Line 67 FSEIS[a] *In-situ (cyclic steam stimulation) & upgraded light (synthetic) crude oil*	613
Line 67 FSEIS[a] *In-situ (steam-assisted gravity drainage) & upgraded light (synthetic) crude oil*	615
Bakken crude (lifecycle)	
The Right Measure, 2022 *Bakken*	429
Oil-Climate Index [b] *7.51% flare- 93% No flare U.S. Bakken (DNR weighted)*[c]	476
Natural gas liquids (end-use combustion only)	
EPA Emissions Factors Hub [d] *Propane*	240
EPA Emissions Factors Hub *Butane*	280
EPA Emissions Factors Hub *Ethane*	170
EPA Emissions Factors Hub *Natural Gasoline*	309

Note: Numbers rounded to the nearest whole number

[a] (U. S. Department of State, 2017)

[b] (Oil-Climate Index, 2016; IHS CERA, 2012)

[c] See Appendix AI

[d] (U. S. Environmental Protection Agency (EPA), 2024c)

The limitations of a lifecycle analysis lie in the quality of the emissions factors used. The emissions factors the DNR considered vary in data quality, and even vary in quality between their lifecycle stages. These emissions factors use imperfect data and usually differ in scope (e.g., some begin lifecycle at land-use change, others at oil extraction). Nonetheless, they provide a representative range for potential total GHGs emitted. These emissions factors are subject to change with improvements in technological changes (including improvements in refining efficiency) and changes in the supply chain. Currently, Enbridge has not proposed changing the products Line 5 carries. Much is also unknown about the exact refinery configuration or the mix of refinery configurations that resulted in the crude oil carried by Line 5. These configurations are variable and have effects on the GHG emissions. This analysis only considered studies that reported emissions factors in CO_2/barrel, as too many factors were unknown to use units reported in CO_2/MJ.

Using the 5-year average annual Line 5 volumes from 2017 to 2022 (excluding 2020), the estimated range of GHG emissions for the crude oil and NGLs that Line 5 ships is 94.6 to 99.1 MT CO_2e. Figure 8.2-1 displays the range of emissions estimates from the DNR's analysis. The range of lifecycle emissions from Enbridge's Line 5 is equivalent to the emissions from about 25 coal fired power plants operated for one year. Additionally, while these emissions are spread out geographically and encompass a variety of stages (extraction, refinement, transportation, end-use combustion, and even land-use changes), these emissions represent the equivalent of about two-thirds of Wisconsin's 2019 gross emissions, and about 1.5 percent of U.S. 2021 gross GHG emissions. The GHG emissions associated with the operation of (i.e., the lifecycle of) the material carried by Line 5 are not specifically considered in either the Wisconsin GHG inventory (DNR, 2021d) or the U.S. GHG inventory (EPA, 2024a).

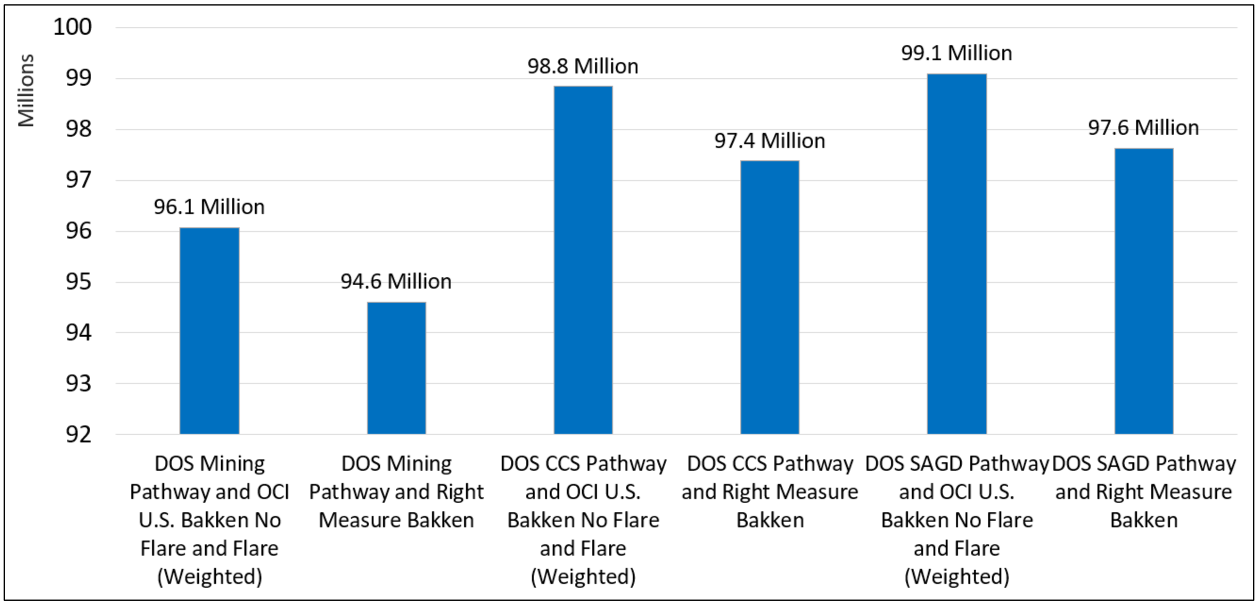


Figure 8.2-1 Line 5 lifecycle GHG emissions by scenario (MT CO_2).

Source: Emissions factors from: (U. S. Department of State, 2017; Oil-Climate Index, 2016); Appendix AI

8.2.2.3 Social Cost of GHGs

The Social Cost of GHG (SC-GHG) attaches a dollar value to the social and economic harms that occur with each extra ton of GHG emissions emitted into the atmosphere. To provide additional context for GHG emissions, the DNR estimated the Social Cost of GHGs associated with the fossil fuels carried by Line 5. This analysis uses the interim social cost estimates proposed by the Interagency Working Group on Social Cost of Greenhouse Gases (IWG) in 2021 (Table 8.2-2) and final estimates proposed by the EPA in December 2023 (Table 8.2-3), both at their 2.5 percent discount rate.

Table 8.2-4 outlines the range of social costs for the low, median, and high GHG lifecycle emissions as emitted in 2020. These figures represent the range of projected costs to society to extract, process, combust, and emit the material carried by Line 5 in a single year based on the 5-year average from 2017 to 2022 (2020 omitted).

Table 8.2-2 IWG social cost of carbon (2020 U.S. dollars per MT CO2).

	Discount rate		
Emissions year	5% average	3% average	2.5% average
2020	$14	$51	$76
2025	$17	$56	$83
2030	$19	$62	$89
2035	$22	$67	$96
2040	$25	$73	$103
2045	$28	$79	$110
2050	$32	$85	$116

Source: (IWG, 2021)

Table 8.2-3 EPA social cost of carbon (2020 U.S. dollars per MT CO2).

	Discount rate		
Emissions year	2.5%	2.0%	1.5%
2020	$120	$190	$340
2030	$140	$230	$380
2040	$170	$270	$430
2050	$200	$310	$480
2060	$230	$350	$530
2070	$260	$380	$570
2080	$280	$410	$600

Source: (EPA, 2023c)

Table 8.2-4 Estimated annual social cost of Line 5 pipeline lifecycle emissions.

Range	IWG 2.5% discount (2024 U.S. dollars)	EPA 2.5% discount (2024 U.S. dollars)
Low	$7.19 billion	$11.35 billion
Median	$7.41 billion	$11.70 billion
High	$7.53 billion	$11.89 billion

8.2.2.4 GHG Emissions Associated with Pipeline Construction & Operation

The No Action alternative would avoid GHG emissions and their associated contributions to climate change effects from the construction and operation of Enbridge's proposed Line 5 pipeline relocation (Sections 7.6 and 7.7). To understand the magnitude of such emissions, the DNR estimated the reasonable potential GHG emissions associated with construction using a per-mile emissions estimate based on information in the Enbridge Line 3 FEIS (Minnesota DNR, 2018).

For 41.2 miles of newly constructed pipeline, the relocation construction could emit approximately 20,382 MT CO_2e. This would be equivalent to a little over 4,000 homes' electricity use for one year or 4,851 gasoline-powered passenger vehicles driven for one year (EPA, 2015). This estimate represents 0.006 percent of GHG emissions from Wisconsin's farm equipment, construction equipment, recreation equipment, gasoline powered utility equipment, and heavy-duty gasoline and diesel-powered equipment in 2019 (DNR, 2021d)(Appendix AI). The construction aspect of Line 5 would emit a small amount of GHGs when compared to the total annual U.S. GHG emissions (6,343.2 MMT of CO_2e in 2022; Table 7.2-1) or the estimated Line 5 pipeline lifecycle emissions in a year (94.6 to 99.1 MT CO_2e; Section 8.2.2.1). The emission of GHGs from construction equipment would be short-term as construction equipment would stop adding new GHG emissions upon completion of the project. GHG emissions from construction would also be lower than the emissions from the alternate transport methods if Line 5 were decommissioned (Section 8.2.5). Some of the avoided construction emissions would likely be replaced by emissions from the deconstruction of some or all the existing Line 5.

Determining the amount of CO_2 being emitted by pipelines is difficult as many variables, such as pipe diameter, number of bends, pipe material, pump spacing, and material temperature all effect the efficiency of pipelines. Ongoing emissions due to the operation of a relocated Line 5 pipeline would mark a small increase compared to emissions from current operations due to the additional valve sites along the route. Operations emissions would be small compared to the lifecycle emissions, which would be like those from the current Line 5 operation. This is because relocation would not result in an increase in pipeline capacity or use. Nor would a relocated Line 5 provide crude oil or NGLs to new markets or new users (i.e., new emissions sources). Enbridge has pledged to reduce operations emissions by 35 percent by the year 2030 and to net zero by 2050.

8.2.2.5 GHG Emissions Associated with the Oil Industry

To put the DNR’s GHG emissions analysis numbers in context, according to the International Energy Agency, global CO_2 emissions from end-use oil combustion were 11.4 BMT CO_2 in 2022 (International Energy Agency (IEA), 2023). The DNR’s highest GHG lifecycle estimate (99.1 MMT CO_2e) for the annual emissions for the products transported by Line 5 is equivalent to 0.86 percent of global CO_2 emissions from all oil combustion in 2022. For additional context, the State of Wisconsin has a single oil processing facility. In 2022, emissions from the refinery located in Superior, WI, was 32,040 MT CO_2 (U. S. Environmental Protection Agency (EPA) and OAR, 2020).

According to the EPA (2024a), petroleum consumption represents 37.3 percent of emissions from energy activities. Natural gas represents 35.2 percent (Section 7.2.3; Figure 7.2-4; (EPA, 2024a)). Line 5 has a capacity of 540,000 barrels of product per day, equivalent to 2.26 percent of all daily U.S. energy consumption (using Line 5 2022 average daily volumes) of petroleum products (U.S. EIA, 2023c) and contributes about 6 percent of the total U.S. GHG emission from petroleum products.

Not all crude oil is converted into fuels to power transportation, heat buildings, or provide electricity. Some fraction of crude oil is used to make plastics and other materials that are not burned to release energy. However, most crude oil is ultimately burned and releases GHGs. By itself, the effect of removing petroleum products currently transported via Line 5 from the market would be minor relative to the global consumption of fossil fuels and would most likely be replaced in the market through other means of transportation. The decommissioning of Line 5 could affect the lifecycle emissions associated with the line: upstream GHG emissions from reductions in tar sands extraction in Alberta, Canada; midstream changes in alternative means of transportation that supply propane; and downstream changes in household behavior and adoption of non-fossil fuels in response to propane shortages and higher propane prices.

8.2.2.6 GHGs Associated with Alternative Transport Modes

The decommissioning of Line 5 would have different effects on air quality and GHG emissions depending on the extent to which alternative energy sources are used and alternative means of transporting oil, NGLs, and end-products are found—either individually or in combination. Under a scenario in which no system alternatives or other means of transporting oil and NGLs took its place, the consumption of oil, NGLs, and end products currently transported via Line 5 would decrease, with a proportional reduction in GHG emissions (up to an estimated 94.6 to 99.1 MT CO_2e, Section 7.3.1).

Should companies look to alternative means for transporting current Line 5 products, the share of Line 5 oil and NGLs that alternative modes of transport take up is interrelated with the price of and consumer demand for oil, NGLs and their end products, as well as the price of and consumer demand for product substitutes, alternative energy, and energy conservation practices. Energy policy at different levels of government could further influence the effects of this scenario on GHG emissions, air quality and climate change. The emissions resulting from decommissioning Line 5 would increase comparative to the approved project for every unit of product that continues to be transported by alternative means (rail, barge, truck) and have varying effects if some product is instead transported by another pipeline.

Enbridge evaluated trucks, rail, and barges as alternative transport methods for the materials and products conveyed by Line 5 (Section 3.6.3).

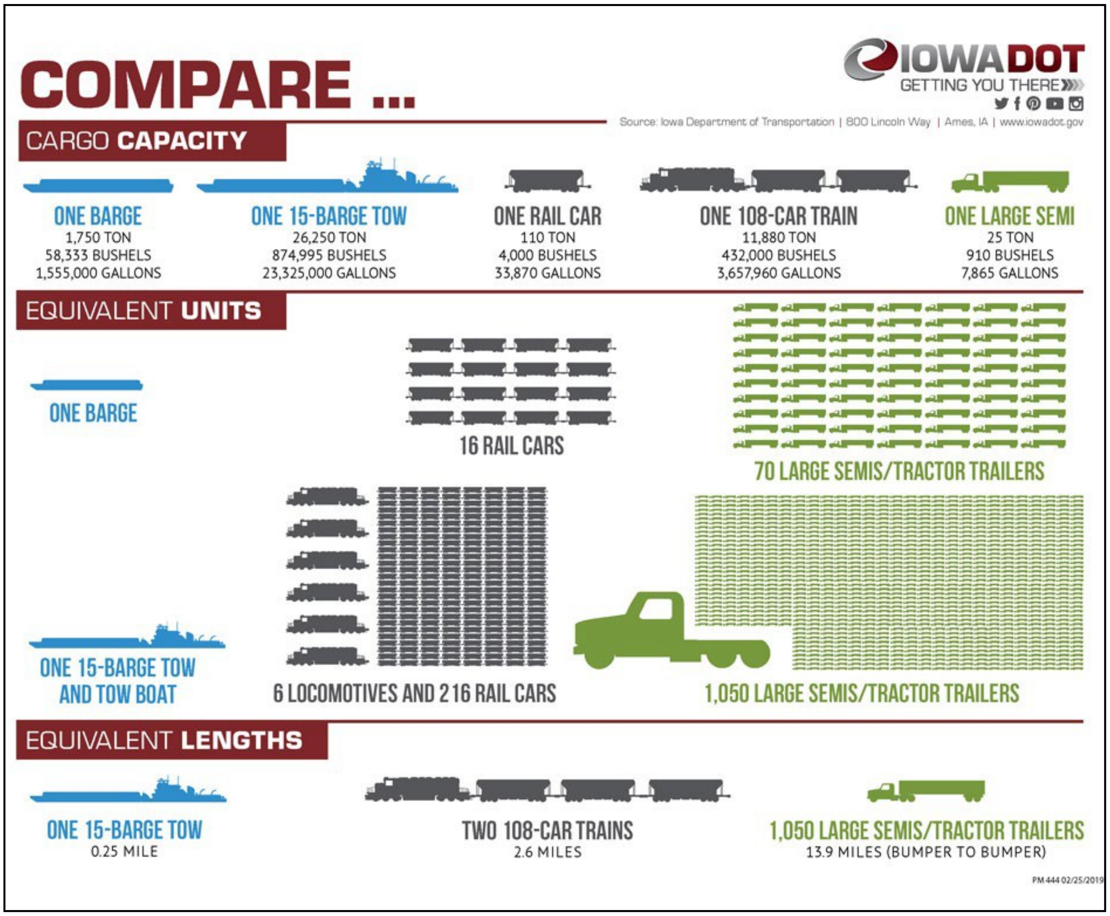


Figure 8.2-2 Comparison of the transport capabilities of barges, rail cars, and trucks.
Source: Used with permission. ©Iowa Department of Transportation.

The respective emissions intensities of pipeline petroleum transport and petroleum transport substitutes are explored in Table 8.2-5 and represented visually in Figure 8.2-3. A million ton-mile is the equivalent of one ton of freight transported one million miles. Tons of CO_2e/million-ton-mile represents how much CO_2e is emitted per one ton of freight transported one million miles.

Table 8.2-5 Transportation operation emissions intensities.

Mode of Transport	Tons of CO_2e/Million Ton-Mile in 2019
Rail	21.57[1]
Barge	15.08[1]
Truck	140.70[1]
Crude Oil Pipeline	1.82[2] (0.14-12.62)[3]

[1] (Center for Ports And Waterways and Texas A&M Transportation Institute, 2022)
[2] (Choquette-Levy et al., 2018) Line 5 specific emissions intensity
[3] Full range of operations emissions intensities studied

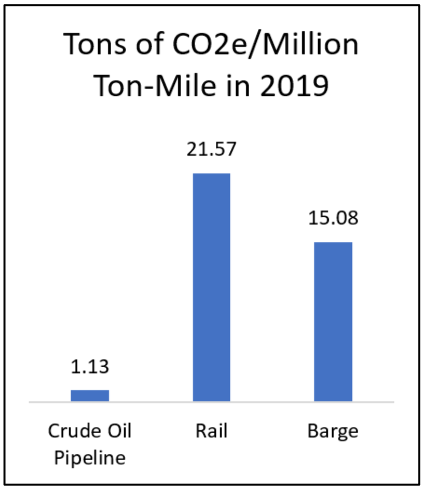


Figure 8.2-3 Transportation operation emissions intensities.

Source: DNR, Appendix AI; data from (Center for Ports And Waterways and Texas A&M Transportation Institute, 2022)

If the rail tank cars are used as alternative means of transportation, the number of trains required to replace the 540,000 barrels per day pipeline is approximately 15.4 trains to complete the two-day, one-way trip. This means there would constantly be more than 15 trains running daily. Environmental effects associated with railroad transport would include increased noise and air emissions associated with burning of fossil fuels.

Line 5 transports approximately 16 billion ton-miles per year. Using the emissions intensities in Table 8.2-5, the DNR estimates Line 5 emits approximately 18,300 T CO_2e per year. In general, transport operation emissions represent a small amount (about 4 to 10 percent) of the total GHG emitted during the lifecycle of a barrel of crude. In comparison to the DNR's total emissions estimates analysis (Section 8.2.2.1), 18,300 Tons CO_2e would represent approximately 0.02 percent of the total GHGs emitted during the lifecycle of the crude oil and NGLs transported by Line 5 in a year. Using rail to transport the same yearly ton-miles would represent 0.28 to 0.38 percent. If the transport of Line 5 petroleum products is substituted by transport by rail, truck, or barge, emissions would increase, depending on the proportions of substitutes used and would ultimately be small in comparison to the lifecycle emissions.

Other information concerning carbon intensity of transportation methods include a study in 2017 that found that a crude oil pipeline transporting 750,000 bpd over 3,000 km produced 61 to 77 percent fewer GHG emissions than rail in the same scenario. Line 5 is 645 miles long (1038 km) and carries an average of 453,000 barrels per day per year of crude oil (using data from 2017-2022). However, a study of the carbon footprint of oil and gas pipelines in China showed that the lifecycle emissions associated with the construction, operation, and other fugitive emissions were between 2.78 and 4.7 tons of CO_2e/ton-mile (4.47-7.56 million tons CO_2e/Million ton-mile) for a pipeline with a lifespan of 20 years.

GHG emissions will be higher if propane or butane is transported by rail or truck instead of pipeline. Trucks produce 187 times the amount of GHG emissions than rail to deliver one gallon of petroleum product (Public Sector Consultants (PSC), 2022). It is assumed that pipelines emit 70 percent less greenhouse gases than trains. Researchers at the University of Alberta, Faculty of Engineering (2016) have estimated that transport PSC (2022) compared the greenhouse gas emission from the annual household use of propane with the GHG emitted from transporting the same amount of propane by truck and by rail. Overall, transportation emissions were found to be small when compared to the emissions created when the transported fuel is used by customers for uses of propane or butane. Therefore, no-action effects could lead to more reduction of GHG emission in the long run if the propane use decreases and non-fossil fuel use increases over time.

Using the EPA Social Cost of Greenhouse Gas (SC-GHG) estimates at a discount rate of 2.5 percent, the SC of carbon using a pipeline to transport freight is estimated to be $145 per million ton-mile, rail is estimated to be $2,906 per million ton-mile, barge is estimated to be $8,136 per million ton-mile, and truck is estimated to be $23,245 per million ton-mile.

8.2.3 Effects on Regional & State Economy

Decommissioning Line 5 would not be expected to have an effect on the demand for petroleum from the existing markets in Wisconsin, Michigan, Ohio, Pennsylvania, Ontario, and Quebec. The extraction and refining of crude oil and NGLs would occur regardless of whether Enbridge's proposed Line 5 relocation is constructed and operated since there are other ways for crude oil and NGLs to reach markets.

Decommissioning Line 5 could: lead to a shortage of feedstocks to the fractionators/refineries that rely on Line 5 supply, reduce transportation and home heating fuel supply in the region, affect wholesale and retail fuel prices, affect the profitability and business viability of propane distributors/suppliers, lead to loss of jobs associated with the Line 5 pipeline, and reduce state and local taxes in Wisconsin. The extent of the effects, however, would depend on the amount of light crude oil and NGLs processed, and propane, diesel, gasolines, and jet fuels supplied by the fractionators serviced by Line 5. This Final EIS considers the effects of a Line 5 decommissioning in Wisconsin.

8.2.3.1 Effects on Petroleum Supply & Price

The Line 5 products constitute about three percent of North America's crude oil market ESAI Energy LLC (2022b). The supply of crude oil from Line 5 meets about one third of the total demand in the Midwest region (PLG Consulting, 2023). Line 5 supplies crude oil to ten refineries in Quebec (2), Ontario (4), Pennsylvania (1), Ohio (2) and Michigan (1) and contributes about 37 percent of the crude oil used by these refineries (ESAI Energy LLC, 2022a). No refinery entirely depends upon Line 5 for the supply of crude oil. Line 5 transported about 526,300 bpd of crude oil (446,000 bpd) and NGLs (80,300 bpd) in 2019 of which 70 percent (56,210 barrels) is propane, 26 percent (20,878 barrels) is butanes, 3 percent (2,409 bpd) is ethane, and 1 percent (803 barrels) is natural gasoline (Public Sector Consultants (PSC), 2022). Line 5 propane products constitute about 0.3 percent of the total propane production in the United

States (Public Sector Consultants (PSC), 2022). The Superior fractionator in Wisconsin separates 3,700 bpd of propane; Rapid River in Michigan separates 2,100 bpd of propane; and Sarnia separates 51,800 bpd of propane and 20,900 bpd of butane (PSC, 2022). Since the Superior fractionator also supplies propane to Minnesota, the Superior fractionator is estimated to meet less than 10 percent (3700 bpd) of the total propane demand (32,000 bpd) in Wisconsin in 2019 (Steiner, 2023).

Earnest (2022a) indicated that a Line 5 closure will result in a decrease in NGL deliveries of about 84,000 bpd of NGLs and about 334,700 bpd of crude oil to the Line 5 delivery area. Despite a Line 5 closure and reduction in deliveries, about 12 percent of the households that rely on propane to heat their homes would still need some fuel sources to heat their home in Wisconsin (Table 8.2-6). The closure could lead to an increase in propane prices, as the propane distributors would have to procure propane from an alternative costly supply chain. In the short-run, the propane price increases could lead to a reduction in propane use to a subsistence level or to an increase in the use of firewood, which emits higher Kg of $C0_2$ per mmBtu—a measure of heat energy, the most common unit for comparing energy sources or fuels. Households that are off the electricity grid rely on propane to heat their homes. Often propane heating systems are built into many old houses and lack the capability to switch fuel types. A study conducted in the United States found that wood energy consumption increases with the increase in non-wood energy prices (N. Song et al., 2012). Although reductions in propane use would reduce GHGs emissions, increased use of firewood would lead to respiratory problems and more GHG emissions. In the long run, households would have multiple options and time to cope with the propane price increase and adopt the use of clean fuel technology.

According to Plains Midstream, decommissioning Line 5 “is likely to result in the inevitable shutdown of Plains fractionation facilities in Superior, Wisconsin, Rapid River, Michigan, and Sarnia, Canada (Koch and Plains Midstream, 2022). Plains Midstream Canada reported that their fractionation facility at Sarnia processes the Line 5 feedstock to produce about 800 million gallons of propane and 400 million of butane per year and supplies the regional market, including Wisconsin (Koch and Plains Midstream, 2022). Further, refineries that mainly rely on Line 5 supply of light crude oil will be affected and the production of jet fuel, diesel, and gasoline will be reduced. Earnest (2022b) argues that the closure of Line 5, even for a period as short as several weeks, would affect all refiners in the Line 5 delivery area. Earnest (2022a) asserts that upon a Line 5 shut down, no capacity exists on other crude oil pipelines to replace the crude oil transported by Line 5, severely affecting the refiners and even leading to their closure if they did not receive minimum crude oil to safely operate. The local supply of gasoline, jet fuel, diesel, and asphalt would decrease. Since most of these refineries receive crude oil from other sources as well, refineries would be affected differently depending on the share of crude oil they received from Line 5 (ESAI Energy LLC, 2022a). Refiners could lose long-term competitiveness if they are not able to operate in their full capacity or if they face higher crude oil supply cost.

Steiner (2023) estimated the effect of the fractionator shutdown in Wisconsin and Michigan. Their IMPLAN model estimated the loss of economic output of about $11 million in both states. Further, Grainger (2022) claimed that a Line 5 closure would result in job losses and reduced economic output in the Great Lakes region. The report estimated that the Line 5 shut down would lead to reduced economic outputs to Wisconsin and Michigan of $121.3 million, including 275 lost jobs. The aggregate cost increase on Wisconsin consumers of gasoline, jet fuel, and diesel prices from an increase of 0.5 cents per gallon is estimated to be $20 million per year (Earnest, 2022a).

Upon a Line 5 closure, the propane distributors from Superior, Rapid River, and Sarnia would need to identify new suppliers to meet customer demands. This would lead to revision of existing supply chain patterns, significant changes to the logistics chain, and increased reliance on more expensive modes of transportation such as rail or trucking (Rennicke, 2022a). Rennike (2022b) estimates that the additional trains required to move Line 5 products would displace the transportation of basics goods and products shipped in Wisconsin. It is estimated that the Wisconsin portion of the most direct rail route between Edmonton and Sarnia would reach operating capacity of about 95 percent. This would affect the cost of transportation and the retail price of food commodities and basic goods.

A debate exists among expert witnesses in court proceedings on the extent of price increases from a Line 5 shutdown in Wisconsin. Earnest (2022b) and Rennike (2022b) assert that the cost to transport Line 5 products via truck from locations with higher propane prices or by rail across the Edmonton-Sarnia corridor would be 2.6 times higher for crude oil and 3.4 times higher for NGLs than that of Line 5 transportation costs. Grainger (2022) estimates that the retail propane price is projected to increase by $0.29 per gallon due to the added transportation cost. They argue that the added cost of transportation would be ultimately passed to the consumer increasing the propane retail price. Earnest (2022a) estimates that the propane cost increase for Wisconsin consumers would be at least $4 million per year assuming sufficient rail unloading capacity is constructed. The ESAI Energy LLC (2022a) estimated the effects of Line 5 closure on fuel prices. Similar to Earnest (2022a), ESAI Energy LLC (2022a) also found that the Wisconsin transportation fuel price is estimated to increase approximately by 0.5 cents per gallon from a Line 5 closure. The ESAI Energy LLC (2022a) argues that the increase of 0.5 cents per gallon is essentially no increase at all and that the petroleum product logistics in the Midwest can deliver additional products to Wisconsin at minimal cost. Meyer (2017) asserts that it is cheaper to ship heavy undiluted crudes by rail than by pipeline although rail transportation would be expensive if the diluent is added. PSC (2022) developed an excel-based model to estimate the cost of alternative propane supplies in the event of a Line 5 closure. Under the case with monthly shipment that aligns with expected monthly consumption based on normal weather, the model projects a wholesale cost reduction of $0.05 per gallon and retail cost reduction of $0.3 per gallon if propane originating in Edmonton, Alberta, would be directly transported to Superior, Wisconsin, by rail.

Earnest (2022b) asserts that the propane shortages from a Line 5 closure could lead to panic buying and prices increases. However PSC (2022) argues that the Line 5 closure will not create such panic buying behavior. PSC PSC (2022) asserts there has been about eight percent average annual growth of U.S. propane production since 2010. Such rapid growth in production of propane relative to its consumption assures adequate supply even in the event of a Line 5 closure. Brisben (2022) also argue that there are multiple alternative supply chains for crude and NGL feedstocks that can be implemented to address the shortages. A recent assessment by Brisben (2022) concludes that for both the crude oil and NGLs currently transported by Line 5, there exists a range of replacement options that are both commercially viable and operationally feasible. Given the advance notice, the energy market would adapt without supply shortages or price spikes. The report mentions that a number of strong market players (such as Midstream operators, ExxonMobil/Imperial, Shell, Plains, Valero, Pembina, Suncor, Marathon) that are engaged in supplying energy products to Line 5 markets are already aware of the possible shutdown of Line 5 since 2017. These companies have large tank car fleets under their own control either through ownership or lease and have significant leverage and buying power with tank car lessors and builders. They have built the capacity to adjust the supply chain strategies to address a fuel supply deficit from a shutdown of Line 5.

About 24,25,488 households uses fuel to heat their houses in Wisconsin (American Community Survey, 2022). Among them, 12 percent (2,84,024) use propane. The five counties that used highest volume of propane for house heating were Menominee (75%), Sawyer (56%), Burnett (53%), Adams (52%), and Bayfield (50%). The closure of Line 5 would be expected to affect these households through price increase of propane. Grainger (2022) asserts that propane has inelastic demand due to the availability of limited substitutes. Low-income households would bear the higher burden from the price increases as household heating expenses constitute a significant share of low-income households' budgets. Grainger (2022) opined that shutting down Line 5 would lead to shortages of critical heating fuels and refined products, resulting in an increase in prices, and widespread propane shortages in Wisconsin, northeastern Minnesota, and the Upper Peninsula of Michigan. Rennicke (2022b) argues that the shutdown of Line 5 would remove all resiliency in the system under the case of an energy emergency causing a perfect storm, with a shortage of tanker truck drivers or rail disruptions. Given these arguments, the propane price in Wisconsin is estimated to increase only by $0.05 per gallon assuming the similar price increase of propane in the Upper Peninsula of Michigan from a Line 5 closure (LEI 2018). ESAI Energy LLC (2022b) argues that the effects of increases in propane cost on energy expenditures in Wisconsin as the result of a Line 5 shutdown would truly be minimal when placed in the context of energy expenditures and overall economic activity. The propane cost increase of about $4 million per year for Wisconsin consumers as estimated by Earnest (2022a) represents an increase of less than one tenth of one percent (0.08%) of total energy expenditures even if borne only by residential consumers from Wisconsin (ESAI Energy LLC, 2022b).

Line 5 materials are converted to propane and supply a large portion of the propane used in the Upper Peninsula and the entire state of Michigan. This propane is used to heat homes, schools, hospitals, and businesses and industry. The following section will discuss the effect of closing Line 5 and how that could affect consumers and emissions.

A Detroit Free Press article discusses the effects of shutting down Line 5 and the complicated nature of such a shut down. Short-term effects would likely see a rise in consumer costs of propane by $0.25 per gallon. This increase in cost could drive demand down, slightly reducing consumer emissions proportionally to the demand decrease. However, consumer emissions for heat are likely to increase on the residential sector by consumers burning more firewood or using electric heat to supplement the heating of homes.

Table 8.2-6 Household use of propane as house heating fuel in Wisconsin, 2022.

County	Number of households using propane	Number of house-holds using house heating fuel	Percentage of house-holds using propane for house heating
Menominee	974	1,307	75%
Sawyer	4,581	8,210	56%
Burnett	3,684	6,989	53%
Adams	4,811	9,176	52%
Bayfield	**3,750**	**7,557**	**50%**
Buffalo	2,691	5,616	48%
Washburn	3,439	7,252	47%
Marquette	2,985	6,830	44%
Rusk	2,630	6,190	42%
Polk	7,794	18,534	42%
Richland	2,923	7,196	41%
Pepin	1,245	3,078	40%
Forest	1,497	3,723	40%
Door	5,479	13,841	40%
Juneau	4,124	10,598	39%
Waushara	3,919	10,158	39%
Jackson	2,981	7,990	37%
Florence	775	2,082	37%
Taylor	2,876	7,754	37%
Vilas	3,767	10,651	35%
Price	2,312	6,630	35%
Iron	**1,004**	**2,941**	**34%**
Dunn	5,787	17,257	34%
Vernon	3,961	11,991	33%
Barron	6,258	19,197	33%
Oconto	5,206	16,338	32%
Clark	3,944	12,649	31%
Pierce	4,812	15,857	30%
Lafayette	2,016	6,652	30%
Shawano	4,871	16,653	29%
Marinette	5,226	18,569	28%
Waupaca	6,271	22,355	28%
Lincoln	3,368	12,226	28%
Iowa	2,681	9,795	27%
Crawford	1,737	6,544	27%
Green	4,117	15,594	26%
Chippewa	6,764	26,326	26%
Ashland	**1,729**	**6,846**	**25%**
Monroe	4,258	17,992	24%
Grant	4,613	19,863	23%
Kewaunee	1,880	8,247	23%
Oneida	3,653	16,417	22%
Green Lake	1,778	8,025	22%
Douglas	**4,125**	**18,916**	**22%**
Trempealeau	2,683	12,370	22%
Sauk	5,608	27,313	21%
Langlade	1,696	8,443	20%
Columbia	4,688	24,068	19%
Portage	5,119	29,311	17%
Dodge	5,727	35,615	16%
St. Croix	5,788	36,004	16%

County	Number of households using propane	Number of house-holds using house heating fuel	Percentage of house-holds using propane for house heating
Marathon	8,991	56,484	16%
Wood	4,701	31,887	15%
Fond du Lac	5,492	42,368	13%
Manitowoc	4,100	34,860	12%
Jefferson	3,894	34,102	11%
Eau Claire	4,495	42,481	11%
Calumet	1,907	20,712	9%
Sheboygan	4,416	49,035	9%
Rock	5,443	66,439	8%
Outagamie	6,241	76,646	8%
Walworth	3,175	42,179	8%
Washington	4,089	56,279	7%
La Crosse	3,422	50,179	7%
Winnebago	3,567	71,943	5%
Dane	11,935	240,799	5%
Ozaukee	1,648	37,478	4%
Racine	2,757	79,100	3%
Brown	3,738	109,096	3%
Kenosha	1,601	66,705	2%
Waukesha	3,204	165,733	2%
Milwaukee	4,603	389,247	1%
Wisconsin (state as a whole)	284,024	2,425,488	12%

Source: American Community Survey 2022; propane includes liquid propane gas stored in bottles or tanks that are refilled or exchanged when empty. Bold text: counties where project construction occurs.

As time passes, Enbridge and local refineries would adapt to other modes of transportation and other sources of crude that would supply the existing refineries that produce the demand for propane. The alternative sourcing of crude would result in a higher cost of propane than if Line 5 were operating, but that cost would not be readily calculable and would likely stabilize somewhere less than the $0.25 per gallon increase seen in the short term. During the last five years propane prices in Michigan have varied from $1.56 to $2.25 per gallon. A $0.25 increase is an 11 to 16 percent increase in the cost of propane. It is unlikely this cost increase would drive many consumers to convert to solar heat. It is unlikely that closure of Line 5 would result in a significant decrease of greenhouse gas emissions at the residential consumer level.

There are a few studies that assess the effect of a Line 5 closure on the regional economy, but do not include Wisconsin. However, their findings can be applicable to the Wisconsin market given the regional influence. According to Weinstein and Clower (2021), a Line 5 shutdown would be expected to lead to an increase of 9.5 to 11.7 percent in regional fuel prices. A study by London Economics International (2018) suggested that the closure of line 5 would add an estimated $0.11 per gallon on an average basis to the cost of propane supply and the consumer price would increase by $0.05 per gallon in the Upper Peninsula of Michigan. The Dynamic Risk Assessment Systems (DRA) (2017) estimates that the propane supply cost would increase in the range of $0.10 to $0.35 per gallon (for winter months only). London Economics International (2018) argues that the upper bound cost of $0.35 estimated by DRA (2017) would only be relevant if the lower-cost alternatives did not exist. Similarly, a report commissioned by Environmental Defense argued that without Line 5, Ontario and Quebec would still be able to meet demand for oil and refined products and conclude that the consumer gasoline price would increase there by 1.8 cents per liter (Woodhouse and Brooks, 2021).

8.2.3.2 Effects on Wisconsin Tax Revenues

Decommissioning Line 5 would lead to a modest reduction in state and local tax revenues in the form of property and ad valorem taxes. In 2022, Enbridge paid $35 million in property tax, $5.6 million in sales and use taxes, and $4.4 million in corporate income tax across Wisconsin (Enbridge, 2023f). Enbridge estimated that approximately $0.5 million of annual property taxes and approximately $75,000 of sales and use taxes were attributable to Line 5.

8.2.3.3 Effects on Regional Employment

Decommissioning Line 5 without replacing it with another pipeline would preclude creation of new construction-related jobs. In an open letter to members of the Bad River Band, Enbridge stated that the Line 5 relocation project would create 700 family-supporting, union jobs (Schwartz, 2023). However, in response to a DNR information request, Enbridge mentioned that only about 350 workers would come from local union halls subject to availability (Enbridge, 2020g). Section 5.16.2 discusses the economic effects of the proposed relocation project in Ashland, Bayfield, and Iron counties and Wisconsin as a whole. The IMPLAN model run by the DNR estimated that the project would support about 1,000 jobs and lead to about $94 million in new spending in the three counties during the project construction period. Similarly, the IMPLAN model estimated that the project would support 1,726 jobs and lead to about $535 million of new spending in Wisconsin. However, all these effects would be temporary and no longer be felt after the 12- to 14-month construction period (Section 1.1.2).

Decommissioning Line 5 could also lead to a loss of some current jobs. No Wisconsin-based Enbridge employees currently work exclusively on maintenance and operation of the current Line 5 pipeline. Enbridge reported that it has 84 full-time employees who work on pipeline maintenance and operation in Wisconsin. These employees were paid a total gross income of $9,166,073 in 2022. Decommissioning Line 5 could lead to a loss of employment for some of these full-time employees. Further, Plains Midstream Canada has stated that a shutdown of its facilities at Sarnia, Rapid River, and Superior would affect the employment of 125 Plain's workers in the United States and Canada (Koch and Plains Midstream, 2022).

The employment effects of switching to alternative transport modes such as trucks, rails, or barges would involve an increase in job creation because of the need to construct infrastructure (i.e., rails or roads) and manufacture trucks or barges to support those system alternatives. There would also be a need to hire additional drivers and operators for these modes of transport. Some of these jobs could be anticipated in northern Wisconsin. At the same time, there would be a decrease in jobs from the discontinued operation of Line 5, but a net increase in jobs would be anticipated.

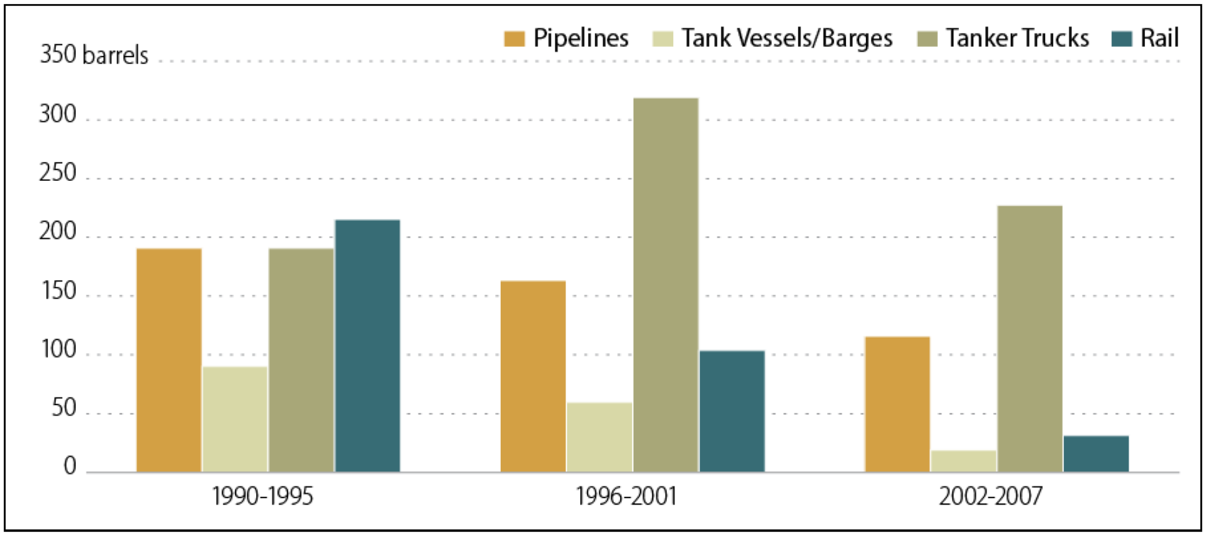
8.2.4 Effects on Oil Spill Potential

If Line 5 were decommissioned and not replaced with another pipeline in northern Wisconsin, the risks and potential effects of pipeline spills described in Chapter 6 would be avoided. In the event that crude oil and NGL producers who currently transport their product by Line 5 find substitute means of transport, the risk of spills would still be present, would no longer be confined to the area of the proposed project, and would be defined by the eventual mix of modes of transport (rail, barge, or truck). Substitute modes of transporting crude and NGLs have differing capacities (Table 8.2-7; Figure 8.2-2), which affect their spill risk. According to PHMSA, pipelines are the safest means of transporting oil and NGLs.

Table 8.2-7 Crude oil transportation capacity by transport mode.

Substitute transport mode	Average crude capacity
Rail Car	600 to 700 bbls
Barge (river barge)	10,000 to 30,000 bbls
Truck Tank	172 bbls

Between 2002 and 2007, tanker trucks spilled the most oil on a per billion-ton-mile basis, followed by pipelines, then rail, and then barges (Figure 8.2-4; Figure 8.2-5).



Sources: Prepared by CRS; oil spill volume data from Dagmar Etkin, *Analysis of U.S. Oil Spillage*, API Publication 356, August 2009; ton-mile data from Association of Oil Pipelines, *Report on Shifts in Petroleum Transportation: 1990-2009*, February 2012.

Figure 8.2-4 Crude oil and petroleum product spills during domestic transportation (barrels per billion-ton-miles).

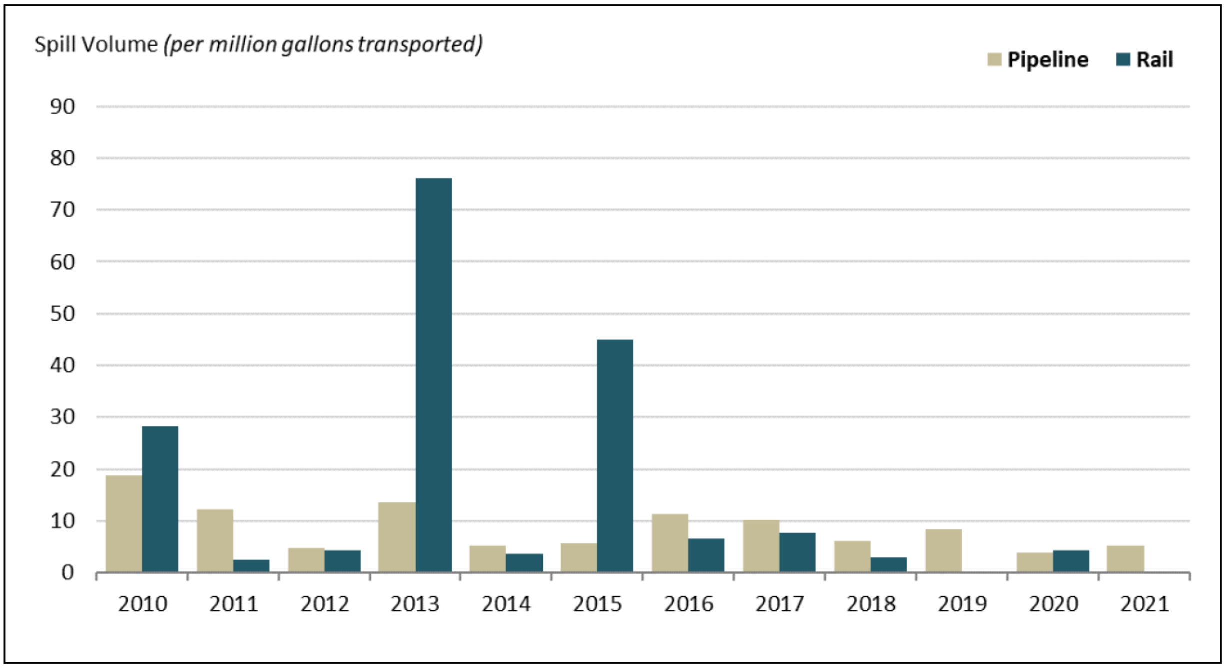


Figure 8.2-5 Pipeline vs rail crude oil spill volume, 2010-2021 (per million gallons transported).
Source: (Ramseur, 2023)

8.2.4.1 Rail

A report commissioned by Congress from PHMSA reported that from 2007 to 2016 pipelines had 14 serious injuries and three fatalities from incidents with crude oil releases. Rail had zero of each and trucks had one serious injury and three fatalities. Line 5 transported on average 495,333 barrels per day of crude oil and NGLs between 2017 and 2022. Transporting this amount of material by rail would represent 1.6 percent of what is exported to the United States from Canada annually (U.S. EIA, 2024b). 7,980 gallons would considered as a substantive spill. Modern freight trains average 73 cars, but top train length is 200 cars and growing. A 100-car rail train can haul 70,000 barrels (2,940,000 gallons) of oil or other product. Data from 2010-2021 show that the number of incidents per year by Rail has decreased. Large volume years of 2010, 2013, and 2015 are due to a small number of relatively large spills. (Section 3.6.3.1)

8.2.4.2 Truck

Tanker trucks can haul 190 barrels (7,980 gallons) of oil or other product. Tanker truck capacities vary, but 190 barrels is a representative volume. The number of trucks required to replace the 540,000 gallon/day pipeline is approximately 5,684 trucks to complete the two-day, one-way trip (Section 3.6.3.2). This means there would constantly be 5,684 trucks on the road daily that have the potential for spills.

8.2.4.3 Barge

In a 2018 report, PHMSA concluded that transporting oil by water has the lowest percent spilled relative to other modes. However, barges can also have an outsized environmental effect because spills would occur directly on water. Assuming an average barge or ship size of 200,000 gpd and an 8-day round trip time frame it would take 22 dedicated shipping tankers to replace Line 5 pipeline capacities (540,000 divided by 200,000 = 2.7) (2.7 times 8 = 21.6 ships). (Section 3.6.3.3) Since it is an 8-day round trip half the ships (approximately 11) would be carrying product at any given time.

8.2.5 Effects on Traffic Congestion & Noise

If the proposed relocation of Line 5 is permitted, Line 5 would remain in operation and the relatively small amount of traffic associated with operating and maintaining the pipeline would continue. Were Line 5 to be decommissioned and shut down, the overall effects to congestion and noise would be small. If, however, the transportation of oil and NGLs that would otherwise have been transported via Line 5 were switched to alternative modes of transport, the effects would vary. The sizes and carrying capacities of the different transport modes (Figure 8.2-2) would influence the distribution and extent of traffic and noise effects, which could be substantial.

8.2.5.1 Rail

At present, there are no existing railroad routes that connect Enbridge's Superior Terminal to delivery and receipt locations, the Plains Midstream facility in Rapid River, Michigan, and the Lewiston, Michigan, facility. Additional rail lines and siding facilities would be required at each location. There would be a need for construction of new lateral rail service lines that would consequentially cause additional risk and effects to landowners and the public. New railroad construction would result in additional railroad/road crossings along the routes. Enbridge estimates that a total of 3,092 rail tank cars would be necessary for the continuous daily transport of Line 5 volumes (Section 3.6.3.1). Lengthy rail operations could lead to repeated, lengthy traffic backups and delays where the rails cross roadways.

Transport by rail would require routing rail through or around the City of Chicago, which has a high population density and highly scheduled rail lines, and therefore, is prone to shipping delays. Extreme weather conditions could also result in shipping delays.

8.2.5.2 Truck

Enbridge estimates the number of trucks required to replace the 540,000 gallon/day pipeline is approximately 5,684 trucks to complete the one-way trips (Section 3.6.3.2). To continue delivering to the points Line 5 currently fulfills shipments to, trucks would need to travel on the highways and roads in Wisconsin, Michigan, Illinois, Indiana, and Canada. Data from other states affected by development in the Bakken Formation suggest that the use of trucking negatively affects communities and roadways (Kadrmas, Lee & Jackson, Inc., 2012).

In Wisconsin, the shortest route would use U.S. Highway 2, which traverses the Bad River Reservation, or would travel down Highway 53 to U.S. Highway 94. Both Highway 53 and 94 have a substantial amount of commercial vehicular traffic. The additional truck traffic and associated loads on Wisconsin roads would result in an increased need for road expansion and maintenance as well as road safety issues. In addition, the increase in truck traffic would alter the existing noise environment (Section 5.1.3) and contribute to local air quality concerns.

Truck transport would require routing shipments over the Straits of Mackinac or through or around the City of Chicago, which has a high population density and considerable traffic congestion, factors that would likely lead to shipping delays. Extreme weather and associated driving conditions could also result in shipping delays.

8.2.5.3 Barge

Currently, there is no crude oil and NGL traffic from barges and tankers on the Great Lakes. If Line 5 petroleum products were to be shipped using barges, traffic and noise would increase. Enbridge estimates approximately five 120,000-barrel articulated tug-barge vessels could be used per day to attempt to transport Line 5's crude and NGL volume across the Great Lakes, totaling approximately 1,606 loaded vessel trips per year and an equal number of empty return trips (Section 3.6.3.3). The Port of Duluth-Superior currently averages around 800 vessel visits annually. Barge operations would be limited by lake ice in winter months; the Port of Duluth-Superior's navigation season runs from March through January.

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10 ACRONYMS & ABBREVIATIONS

–A–

APE	Area of potential effect
API	American Petroleum Institute
APP	Agricultural Protection Plan
ASNRI	Areas of Special Natural Resource Interest
ATV	All-terrain vehicle

–B–

bbl	Barrel
BMP	Best management practice
BIA	Bureau of Indian Affairs
bpd	Barrels per day
BTEX	Aromatic hydrocarbons, including benzene, toluene, ethylbenzene, and xylene

–C–

CAPP	Canadian Association of Petroleum Producers
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CNW	Commercially navigable waterway, an HCA
CO_2	Carbon dioxide
COVID-19	Corona Virus SARS-CoV-2 identified in 2019
CPM	Computational Pipeline Monitoring System
CWA	Clean Water Act

–D–

DATCP	Wisconsin Department of Agriculture, Trade, and Consumer Protection
dB	Decibel
dBA	A-weighted decibel
DNR	Department of Natural Resources
DO	Dissolved oxygen
DSPS	Department of Safety and Professional Services
DW	Drinking water resource, an HCA

–E–

ECP	Erosion control plan
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EIR	Environmental impact report
EIS	Environmental impact statement
EPA	Environmental Protection Agency
ESA	Ecological resource unusually sensitive area, an HCA
EO	Element occurrence

–F–

FERC	Federal Energy Regulatory Commission
FERP	Field Emergency Response Plan
FQI	Floristic Quality Index

–G–

GBIF	Global Biodiversity Information Facility
GHG	Greenhouse gas
GIS	Geographic information system
GLIFWC	Great Lakes Indian Fish and Wildlife Commission

–H–

HCA	High consequence area

HDD	Horizontal directional drilling
HPA	High population area, an HCA

–I–

ICP	Integrated Contingency Plan

–K–

km	Kilometer, 1,000 meters

–L–

LAWCON	Land and Water Conservation Fund
LTTD	Low temperature thermal desorption

–M–

Mean C	Average coefficient of conservatism
MDOT	Michigan Department of Transportation
MMT	Million metric tons
MP	Milepost

–N–

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGL	Natural gas liquids
NGPL	Natural gas plant liquids
NHD	National Hydrography Dataset
NHI	Natural Heritage Inventory
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRC	National Response Center

NRHP	National Register of Historic Places
NRS	National Response System
NST	National Scenic Trail
NWI	National Wetland Inventory

–O–

OPA	Other population area, an HCA
OSHA	Occupational Safety and Health Administration

–P–

PAH	Polycyclic aromatic hydrocarbon
PEM	Palustrine emergent wetland
PFO	Palustrine forested wetland
PHMSA	Pipeline and Hazardous Materials Safety Administration
$PM_{2.5}$	Particulate matter less than 2.5 microns
PM_{10}	Particulate matter less than 10 microns
ppm	Parts per million
PSC	Public Service Commission of Wisconsin
PSS	Palustrine scrub-scrub wetland

–R–

RA	Route alternative
ROW	Right-of-way
RRT	Regional response team

–S–

SGCN	Species of greatest conservation need
SHPO	State Historic Preservation Officer
SNA	State Natural Area

SSURGO	Soil Survey Geographic Database
STEO	Short-term energy outlook

–T–

TAS	Treatment as State
TBM	Tunnel boring machine
TCP	Traditional cultural property
TCR	Traditional cultural resource
THPO	Tribal historic preservation officer
TMC	Forest habitat type associations of eastern hemlock and wild lily-of-the-valley

–U–

UNT	Unnamed tributary
USA	Unusually sensitive area
USACE	United States Army Corps of Engineers
USC	United States Code
USDOT	United States Department of Transportation
USDOS	United States Department of State
USEIA	United States Energy Information Administration
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

–V–

VOC	Volatile organic compound

–W–

WEPA	Wisconsin Environmental Policy Act
WFQA	Wetland floristic quality assessment
WGNHS	Wisconsin Geological and Natural History Survey

WICCI	Wisconsin Initiative on Climate Change Impacts
Wis. Adm. Code	Wisconsin Administrative Code
Wis. Stat.	Wisconsin Statutes
WPR	Wisconsin Public Radio
WRAM	Wetland Rapid Assessment Methodology
WWI	Wisconsin Wetland Inventory

11 GLOSSARY

Additional Temporary Workspace. Construction areas that are temporarily needed outside and along the permanent construction ROW to stage equipment, stockpile spoil material, and conduct material fabrication and assembly**.**

Aggradation. Non-local, long-term changes in a stream's channel bed elevation resulting from sedimentation. Aggradation is hazardous because it will eventually increase the elevation of the channel bottom; thereby decreasing the capacity of the channel and potentially allowing more frequent overtopping of the channel banks.

Agricultural Monitor. On-site, third party monitor who would be responsible for auditing Enbridge's compliance under the APP.

API Gravity. A measure of Crude Oil's density compared to water. An API Gravity of less than 10° means oil will sink in water, whereas a value above 10° means it will float. A higher API Gravity means a less dense, "lighter" crude.

Avulsion. The sudden separation of land from one location and its attachment to another, especially by flooding or a change in the course of a river. Avulsion can be temporary in high flows or become permanent because of high sedimentation loads and flows which allow the overtopping of banks and the erosion of new channels. This event is hazardous to a pipeline where the new channel may be at a location where the pipeline is not designed with a channel crossing in mind.

Bakken Light Crude. A Shale Oil occurring in large deposits in the Bakken Formation of northwestern North Dakota, northeastern Montana, and southern Saskatchewan Canada. The oil is extracted by hydraulically fracturing (fracking) shale rock. It has an API Gravity between 40° and 43° and is Sweet Crude with a sulfur content of less than 0.2 percent.

Bank erosion. The movement of a river or stream channel's banks due to erosion. This is hazardous to a pipeline crossing because it decreases the horizontal distance between the channel boundary and the transition between the typical pipeline bury depth and the depth of the pipeline at the channel crossing.

Booming. A method of deploying temporary floating barriers to contain oil spills, enhance recovery by skimmers or other collection methods, and reduce impacts to shorelines. Booms come in a range of materials, shapes, and sizes.

Bitumen. A viscous (i.e., thick/sticky) mixture of hydrocarbons occurring in large deposits in northern Alberta Canada, as well as Venezuela. In Alberta, Bitumen is extracted from shallow "tar sands" mined in open pits; or from deeper deposits, by injecting steam and solvents. Undiluted Bitumen has an API Gravity of less than 10°, meaning it sinks in water. It also typically contains considerably more sulfur, metals and heavy hydrocarbons than Crude Oil.

Breakup. Also known as spring melt, breakup is the short transition period between winter and spring when thawing begins, ice thins and/or breaks up, and river flows increase substantively and quickly, often to flood stages.

Caliper Pig. A secondary inspection tool used to continuously measure interior pipeline diameter. They are constructed to travel through the entire pipeline, being able to pass through constrictions.

Candidate Species. Plant and animal species considered for possible addition to the list of endangered and threatened species. For these species, the USFWS has on file sufficient information on biological vulnerability and threats to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions.

Cathodic Coating. A coating that prevents corrosion of metal by providing a barrier against oxygen and water.

Cathodic Protection. A technique using a low-voltage electrical current to prevent external corrosion. A cathode (positive current) attracts electrons resulting in corrosion of the cathode rather than the metal it is protecting.

Ceded Territories. Areas in which the United State Supreme Court affirmed that, based on their sovereign rights, members of Native American tribes are allowed to hunt, gather, and fish off-reservation.

Class I Railroads. Freight railroads with a 2013 operating revenue of $467.0 million.

Cleaning Pig. A tool to clean the interior pipeline removing solid and semi-solid deposits.

Conventional Oil. Conventional oil is oil that is refined from crude oil extracted from the ground. It differs from synthetic oil, which is engineered in a lab.

Critical Habitat. Defined in the Endangered Species Act, it is a specific geographic area which contains essential features for the conservation of endangered or threatened species.

Crude Oil. A mixture of hydrocarbons used as raw material (feedstock) for petroleum products. Natural crude oil exists in liquid phase in underground reservoirs and remains liquid at atmospheric pressure.

Cumulative Effects/Impacts. Additive or interactive effects that result from incremental impacts of a proposed action when added to other past, present, and reasonably foreseeable future actions in a similar timeframe and geographical location.

Cultural Resources. The material remains of human activity, including sites, buildings, structures, objects, districts, and landscapes. Cultural resources include archeological resources, which may be prehistoric or historic, and historic resources, which consist of the built environment. Cultural resources also include properties of religious and cultural significance (including **Traditional Cultural Properties**).

Custody Transfer Metering. Raw or refined petroleum products transferred from one operator to another is custody transferring. Measurement of the amount of product transferred is done via metering. Due to the high level of accuracy needed at the time of product transfer all meters used must be approved by the American Petroleum Institute.

Degradation. Non-local, long-term changes in a stream's channel bed elevation resulting from erosion. Degradation is hazardous to a pipeline crossing because it will eventually decrease the depth of cover between the pipeline and the channel bottom.

Densitometer/viscometer. An online device used to continuously measure the density of crude oil within a pipeline; it can determine the quantity of material passing through. Densitometers are used for pipeline leak detection where relatively small leaks can be identified by comparing pressures and flow rates at points along a pipeline.

Dilbit. Bitumen diluted with Natural Gas Liquids (NGLs) and other diluents to reduce viscosity and thereby enable transport as a liquid.

Direct Effects/Impacts. Impacts directly caused by a proposed action that occur at the same time and place as the action.

Direct Pipe. A trenchless pipe installation method where the drillhead is attached to the pipe and the drill path is created and the pipe pushed in place in a single operation.

Dispersant. A chemical mixture of solvents and emulsifiers used in response to an inadvertent oil release event to break oil into smaller droplets which are easier to biodegrade by microbes.

Earthen Trench Plugs (Hard Plugs). Barriers used during construction to block off a trench or ditch and direct surface run-off to an interceptor dike or collection pond.

Element Occurrence. An element occurrence (EO) is a locational record representing a single, extant habitat, which sustains or otherwise contributes to the survival of a population or self-sustaining example of a particular element.

Emergency Response Action Plan. A region-specific, concentrated version of the Integrated Contingency Plan (ICP) focused on unique features of the region specifically designed to be used by first responders and Enbridge personnel in the field.

Encroachment. A decrease in the horizontal distance between a stream channel boundary and the pipeline. Encroachment is unique in that it affects a pipeline that runs parallel to the channel and does not cross it.

Endangered Species. Plant and animal species in danger of extinction throughout all or a significant portion of its range, as listed under the federal Endangered Species Act.

Environmental Inspector. An individual that routinely investigates construction work sites to ensure that all environmental regulations are followed.

Environmental Justice. The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Erosion Control Devices. Physical barriers to control, reduce, or prevent wind and water erosion on construction sites, typically berms, silt fences, or mulch cover.

Farmland of Statewide Importance. Land other than **prime farmland** or unique farmland that is of statewide or local importance for the production of food, feed, fiber, forage, or oilseed crops. Farmland of statewide importance is a soil classification, as opposed to a land use, that may or may not be used as agricultural land.

Federally Listed Species. Species listed as endangered, threatened, proposed, or candidates by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act.

Fish Entrainment. The entrapment of fish into water pumps used in waterbodies.

Forest Crop Law and **Managed Forest Law Programs.** Landowner incentive programs that encourage long-term, sustainable management of private woodlands by providing tax benefits.

Freeze-up. The transition time in the fall when lakes and rivers begin to freeze over.

Frost Heave. An upwards swelling of soil during freezing conditions caused by an increasing presence of ice as it grows toward the surface, which can sometimes push buried objects, including pipelines, upward. Frost heave typically occurs in very cold climates including Northern Canada and the northern Midwest United States and Alaska.

Fugitive Dust. Dust that is not emitted from a single location, typically occurring as a result of blasting or vehicle traffic.

GIS Polygon. A polygon feature is a GIS object that stores its geographic representation—a series of x and y coordinate pairs that enclose an area.

Greenfields. Undeveloped and naturally vegetated land.

Greenhouse Gasses (GHGs). Gases in the Earth's atmosphere that absorb infrared (thermal) radiation re-emitted from the Earth's surface, thereby trapping heat within the atmosphere. GHGs associated with the extraction, production and consumption of **Petroleum Products** include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Hand Broadcasting. Scattering seed by hand over an area during site restoration.

High-Consequence Areas. Areas along a pipeline where a release would result in a significant impact such as densely populated areas, drinking water sources, or ecologically sensitive areas.

Historic Properties. Any district, archeological site, building, structure, or object that is either listed, or eligible for listing, in the National Register of Historic Places.

Horizontal Directional Drilling (HDD). This installation method involves drilling a pilot hole under a surface resource like a waterbody and banks and then enlarging the hole through successive ream borings with progressively larger bits until the hole is large enough to pull a pre-welded segment of pipe into place.

Hydrophytic Species. A plant that grows either partly or totally submerged in water or in waterlogged soils.

Hydroseeding. A slurry of mulch and seed hosed over a large area to establishing groundcover, typically used for erosion control and bank stabilization.

Hydrostatic Testing. Filling a segment of the pipeline with water and maintaining a prescribed pressure for a specified amount of time.

Indirect Effects/Impacts. Impacts caused by a proposed action that occur later in time or farther removed in distance from the action.

Integrated Contingency Plan. Enbridge's emergency response plan prepared for their pipelines to meet PHMSA requirements.

Integrity Management Program. PHMSA-required suite of actions taken to ensure the long-term maintenance of an existing pipeline including examining comprehensive and integrated integrity results, including internal inspection data, and projected future maintenance activities.

Invasive Species. Non-native plants or animals that have the potential to directly or indirectly cause economic or environmental harm or harm to human health.

Leak Detection System. Permanent monitors installed in crude oil handling systems (e.g., pipelines, storage tanks) to detect and alert inadvertent oil releases.

Lease Condensate. Condensate is a mixture of light liquid hydrocarbons, similar to a very light (high API) crude oil. It is typically separated out of a natural gas stream at the point of production (field separation) when the temperature and pressure of the gas is dropped to atmospheric conditions.

Light Crude. Various Crude Oils characterized by low viscosity and low density, such that they flow readily above-ground under normal conditions. Definitions vary, but generally speaking, an oil with an API Gravity between 35° and 40° is considered a light crude.

Line Locates. The profession of locating buried utility lines.

Macrophytes. An aquatic plant that is large enough to be seen by the naked eye.

Manifold Tie-ins. The equipment used to connect the pipeline to a storage tank, the manifold connects several smaller pipelines into a larger pipeline which is then run to the storage tank.

Mashkiiziibii. The Ojibwe word for “Medicine River,” which Europeans named the “Bad River.”

Mat Decking. Matting put in place to increase stability and safety of work sites by creating a flat, rigid area for rigging and other equipment.

Meander Cutoff. When a channel forms between the closest parts of a meander loop/oxbow to form a new channel, cutting off the prior existing loop. Meander cutoffs become particularly hazardous when the breach is between two points of much differing elevations which may be within a path of a pipeline crossing.

Meter Prover. A physical test which determines the accuracy of a meter used in transfer of raw or refined petroleum products.

Mitigation. Avoiding, minimizing, rectifying (repairing), reducing, eliminating, compensating for, or monitoring environmental impacts.

National Ambient Air Quality Standards (NAAQS). Standards established by the U.S. Environmental Protection Agency (EPA) under authority of the Clean Air Act that apply for outdoor air throughout the country. The EPA has established NAAQS for seven criteria pollutants: sulfur dioxide, nitrogen dioxide, particulate matter (10-micron diameter or less and 2.5-micron diameter or less), carbon monoxide, ozone, and lead.

National Land Cover Database. A database which provides spatial and descriptive data for a range of land use across the United States used to assess ecological health and biodiversity as well as develop land management policy.

National Response System. A network of cooperating response teams consisting of personnel from federal, state, and local agencies as well as organizations with specialized skills and knowledge that can be called on to respond to oil spill emergencies.

Natural Gas Liquids (NGLs). Heavier components of unprocessed natural gas, including ethane, propane, butane, isobutane, and pentane. Also known as "condensates," NGLs are separated from natural gas (methane) in field facilities or larger gas processing plants.

No Action Alternative. The alternative of not constructing or operating a proposed project.

Nominal Flow Rate. The volume of liquid passing through a system under specific pressure conditions.

Nonlisted Species. Species that do not receive protection under the Endangered Species Act.

Noxious Weeds. Largely non-native plant species that have been deemed harmful to crops, horticulture, and/or ecosystems by a local, state, or federal agricultural authority. Noxious weeds in state statutes (s. 66.0407, Wis. Stat.) and the federal Plant Protection Act.

Open Cut. The excavation of a trench to install individual pipe sections, after which the excavation is backfilled.

Palustrine Emergent (PEM) Wetlands. Nontidal, freshwater wetlands dominated by trees, shrubs, and persistent emergent herbaceous plants.

Palustrine Forested (PFO) Wetlands. Wetlands dominated by woody vegetation 20 feet or taller.

Palustrine Scrub-Shrub (PSS) Wetlands. Wetlands dominated by woody vegetation, including true shrubs, young, trees, and trees/shrubs that are less than 20 feet tall.

Palustrine Unconsolidated Bottom (PUB) Wetlands. Areas of water with at least 25 percent cover of particles smaller than stones (less than 6 to 7 cm) and a vegetative cover less than 30 percent.

Petajoules. One petajoule equals 1 000 000 000 000 000 (1015) joules. Joule is a unit of energy equaling 0.24 calories. 1 PJ = 31.6 million m^3 of natural gas or 278 million kilowatt hours of electricity.

Petroleum Products. Saleable products derived from Crude Oil, Natural Gas Liquids, and other petroleum-based raw materials (feedstocks). Petroleum products include fuel for transportation (e.g., gasoline, diesel, and jet fuel), heating (e.g., propane), and electrical generation (e.g., natural gas), as well as asphalt, road oil, and the numerous petrochemicals, plastics, and synthetic materials found in widespread consumer products, industrial and agricultural inputs, etc.

Pipeline Maintenance (PLM) Shops. Shops equipped with emergency response equipment including apparatus to contain and absorb oil released to water including various booms (e.g., river booms, sorbent booms, containment booms), pumps and portable dam systems, skimmers, sorbent pads and rolls; boats and response vessels to handle water-based activities; and specialized equipment for land- based activities including portable tanks, generators, and trailers.

Potholing Equipment. Equipment used for to excavate a small test hole to expose underground utilities or other subsurface features.

Pour Point. The temperature at which a liquid becomes semisolid and loses its flow characteristics. For crude oil, a high pour point is generally associated with a high paraffin content, typically found in crude deriving from a larger proportion of plant material.

Pressure Control Valves. A safety feature which keeps pressure below the upper limit in hydraulic systems.

Prime Farmland. Defined by the U.S. Department of Agriculture as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses.

Prohibited Species are invasive species that the DNR has determined are likely to survive, spread, and cause harm if introduced into the state, but which are not found in the state, or in that region of the state where the species is listed as prohibited, with the exception of isolated individuals, small populations, or small pioneer stands of terrestrial species, or in the case of aquatic species, that are isolated to a specific watershed in the state or the Great Lakes, and for which statewide or regional eradication or containment may be feasible. Prohibited species are listed in Chapter NR 40, Wis. Adm. Code.

Proposed Species. Species of plants of animals that have been proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act.

Public Scoping. Public participation in determining the scope and topics to be addressed in an Environmental Impact Statement.

Pump Station. Stations containing electric pumping units which are positioned along the pipeline route to increase pressure and ensure continued transfer of oil along the route within safe limits.

Receiving Traps. A receiving trap is the exit terminal for a caliper or cleaning pig where it would be removed from the pipeline.

Regional Response Teams. Teams with defined roles and responsibilities within the National Response System, consisting of a standing team of federal, state, and local government representatives and an incident-specific team that can be activated for a response to an oil spill.

Restricted Species. An invasive species that the DNR has determined are already established in the state, or in that region of the state where the species is listed as restricted, and that causes or has the potential to cause harm, and for which statewide or regional eradication or containment may not be feasible. Restricted species are listed in Chapter NR 40, Wis. Adm. Code.

Right-of-Way (ROW). A linear easement granting an entity the right to cross another's property for transportation or transmission purposes, such as roads, powerlines, and pipelines. For new pipeline projects, the limited-term ROW for constructing/installing of the pipeline is generally wider than the ROW for operating and maintaining it.

Sampling Facility. A facility used to test environmental samples to ensure regulatory compliance.

SCADA System. The Supervisory Control and Data Acquisition (SCADA) system is used for remote monitoring and control over newly constructed pipelines and station systems.

Scour. The short-term, local deepening of a stream channel due to a channel characteristic such as a bend, contraction, event specific flow, or obstruction. Scour is hazardous to the pipeline crossing as it may rapidly decrease the depth of cover between the pipeline and the channel bottom.

Sediment Barriers. Barriers constructed to reduce/prevent sediment from entering waterways (e.g., silt fence, straw bales, bio-logs).

Seed drilling. The process of using a seed drilling machine to sow seeds in the soil at equal distances and depth and cover them.

Shale Oil. Crude Oil contained in petroleum-baring shale rock formations.

Skimmers. Equipment used to remove/recover oil from water surfaces after an inadvertent oil release and come in a wide variety specific to the body of water and release type.

Slope Breakers. Barriers created from soil or hay to slow and redirect surface run-off away from the construction area. Typically, these run diagonal across the pipeline ROW.

Special Status Species. Plants or animals listed as threatened or endangered by Federal or State authorities.

Species of Greatest Conservation Need. Defined in Wisconsin’s Wildlife Action Plan as native wildlife species that have low or declining populations and that are most at risk of no longer being a viable part of Wisconsin’s fauna.

Splash Pup. A device to help dissipate energy at the discharge point of dewatering activities, such as hydrostatic testing, thus reducing onsite erosion.

Spoil. Soil, rock, and other material excavated during the construction process.

State or Federal Undertaking. A project or activity that requires a state or federal permit, license, or approval.

Stringing. The process of connecting individual segments of pipes into a string and moving pipe sections into position.

Submerged Oil Recovery Plan. A plan to recover oil submerged in water including methods to identify areas containing submerged oil after an oil spill and methods to recover submerged oil (e.g., raking, tilling, air injection, chain dragging).

Sweet Crude. Generally, **Crude Oils** with a sulfur content below 0.5 percent.

Synthetic Light Crude. A Light, Sweet Crude produced from Bitumen through a process called as Upgrading.

Temporary Clear Span Bridges. Structures placed above the ordinary high-water mark and completely across a waterway that allow vehicles, equipment, or people to safely cross from one side of a waterway to the other. temporary clear span bridges are generally constructed from construction matting.

Teratogens. An agent that can disturb the development of an embryo or fetus.

Threatened Species. Animal or plant species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, as listed under the ESA.

Topsoil. The thin, top layer of soil where the majority of nutrients for plants is found.

Traditional Cultural Property. A property that is eligible for inclusion in the National Register of Historic Places (NRHP) based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community.

Trench Breakers. Temporary or permanently installed barriers within the pipeline trench during construction to reduce water flow in the trench, similar to Earthen Trench Plugs. Trench breakers are also installed to limit erosion, minimize the flow of water from the waterbody into the trench, reduce the potential to drain or partially drain a wetland or reduce the movement of groundwater through the trench.

Unconventional Oil. Crude oil obtained through methods other than traditional vertical well extraction. Among others, examples include Bitumen extracted from tar sands and Bakken Crude extracted through the hydraulic fracturing (fracking) of oil-bearing shale in the Bakken Formation.

Upgrading. A process by which Bitumen is transformed into Synthetic Light Crude.

Usufructuary Rights. A Civil Law term referring to the right of one individual to use and enjoy the property of another, provided its substance is neither impaired nor altered.

Viscosity. The thickness and fluidity of a liquid.

Volatile organic compounds (VOCs). Chemical compounds which are gaseous at room temperature that are regulated due to their toxic, carcinogenic nature.

Weathering. The alteration of crude oil when released into the environment by various chemical, physical, and biological processes (dispersion, evaporation, dissolution, emulsification, photo- oxidation, adsorption/sedimentation, and biodegradation).

Wetlands. An area of land which is saturated by water seasonally or permanently long enough to develop unique ecosystem characteristics in the soil, flora, and hydrology.

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