

Enbridge's Line 5

MEDIA BACKGROUND

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environmental
defence

The pipeline's ongoing environmental risks to the Great Lakes and the climate

Context

Line 5 is a 68-year-old pipeline operated by Enbridge Energy. **It carries up to 540,000 barrels-per-day or 87 million litres of oil and natural gas liquids per day**, from Superior, Wisconsin, to Sarnia, Ontario, taking a shortcut through Michigan and along the lake bottom of the Straits of Mackinac. As the pipeline travels through the Straits of Mackinac it diverges into two, 20-inch-diameter, parallel pipelines. This is why people sometimes call the Line 5 pipeline system the “dual” or “twin” pipelines.

Figure 1. Map of Line 5 pipeline route¹



The Mackinac Straits section of Line 5 with a design lifetime of 50 years, has been plagued by a series of issues, ranging from missing protective coating to three dents left by an anchor strike just this past April. It lies in what University of Michigan researchers have called “the worst possible place for an oil spill” in the Great Lakes.² The Great Lakes are of utmost importance to protect as they hold 21 per cent of the world’s surface freshwater and 84 per cent of North America’s surface freshwater.³ Most of the liquids shipped on Line 5 are delivered to the Sarnia terminal; from there, they supply refineries in Ontario and as far east as the Quebec cities of Montreal and Levis.⁴ After the anchor strike in April 2020, and ensuing concern about a spill from Line 5, Enbridge proposed to build a tunnel under the Straits of Mackinac to house this leg of Line 5.

Michigan Governor Whitmer ordered a shutdown of Line 5 for May 12, 2021, citing environmental risks and violation of Michigan’s Public Trust doctrine as well as violations of the 1953 Easement.⁵ The Public Trust doctrine protects the public's right to use the waters of the Great Lakes for purposes such as navigation, hunting, and fishing. On November 13, 2020, after a year-long review of the easement that allows Enbridge to use the Great Lakes for its private oil pipeline, Governor Whitmer revoked the easement.⁶ Enbridge has refused to comply and are keeping the pipeline in operation. The company has taken the matter to court, and it is still being decided whether it will get settled in state or federal court.⁷

Environmental Harm/Ongoing Risk to the Great Lakes, and Serious Concerns Regarding Safety

Line 5 has been plagued by a series of issues and has leaked at least 29 times since 1953, spilling 4.5 million liters of oil into the environment, causing harm to nearby communities and waterbodies.⁸

Enbridge has not been proactive when it comes to maintaining Line 5, which is concerning, especially in light of the company's track record when it comes to oil spills and pipelines.⁹

Pipeline support violations

The 1953 Easement¹⁰ requires the dual pipelines to be supported at least every 75 feet to prevent a breach. Long unsupported spans are dangerous because they allow vibrations that can stress the pipeline metal and potentially cause it to rupture and fail. Enbridge documents show that from 1963 to 2012, it knew that multiple unsupported spans exceeded the 75-foot limit and failed to fix them.¹¹ One unsupported length of the pipeline was **421 feet long**. Other dangerously long spans were 200', 216', 221', 278', 286', 292', 311', and 359'. Enbridge documents suggest it only repaired unsupported spans greater than 140 feet, almost twice the Easement limit.¹²

Coating violations

The Easement requires Enbridge to maintain a protective coating on the dual pipelines to prevent steel corrosion, which is one of the major causes of pipeline failure. Since at least 2003, Enbridge was notified that a heavy accumulation of biota, like zebra and quagga mussels, made it impossible to inspect the pipeline coating.¹³ For 13 years after that notice, Enbridge made little to no effort to address the biota problem.¹⁴ This means that no one could properly inspect Line 5 for possible coating failure for at least 13 years. When some coating delamination was found in 2014 and 2016, Enbridge took no action until a federal

court order forced it to fully inspect the dual pipelines' exterior. In March 2017, Enbridge told Michigan it had found no coating gaps. Five months later, Enbridge changed its story and reported that three gaps had been found. Enbridge then disclosed that it knew about the gaps since 2014 but did not report them to the State.¹⁵

Minimum curvature violations

The Easement specifies how much the pipelines can bend or deviate from a straight line, known as its minimum curvature. This rule is intended to prevent dangerous structural stresses from being placed on the pipelines. Enbridge documents reveal 20 to 25 times that the curvature exceeded this specification. These curvature violations remain uncorrected. There is no documented proof that Enbridge attempted to comply with the pipeline curvature limits during the original installation of Line 5, suggesting that the curvature limits were ignored by Enbridge from the very beginning. This is a fundamental violation of the Easement.¹⁶

Unreasonable Risk of Harm

Pipelines spill for many reasons: material failures, insufficient maintenance, human error, and external events. There is no fail-safe way to guarantee pipeline safety, so there will always be a risk of harm. For example, in a recent two-year span, there were multiple events that could have caused Line 5 to fail and spill:¹⁷

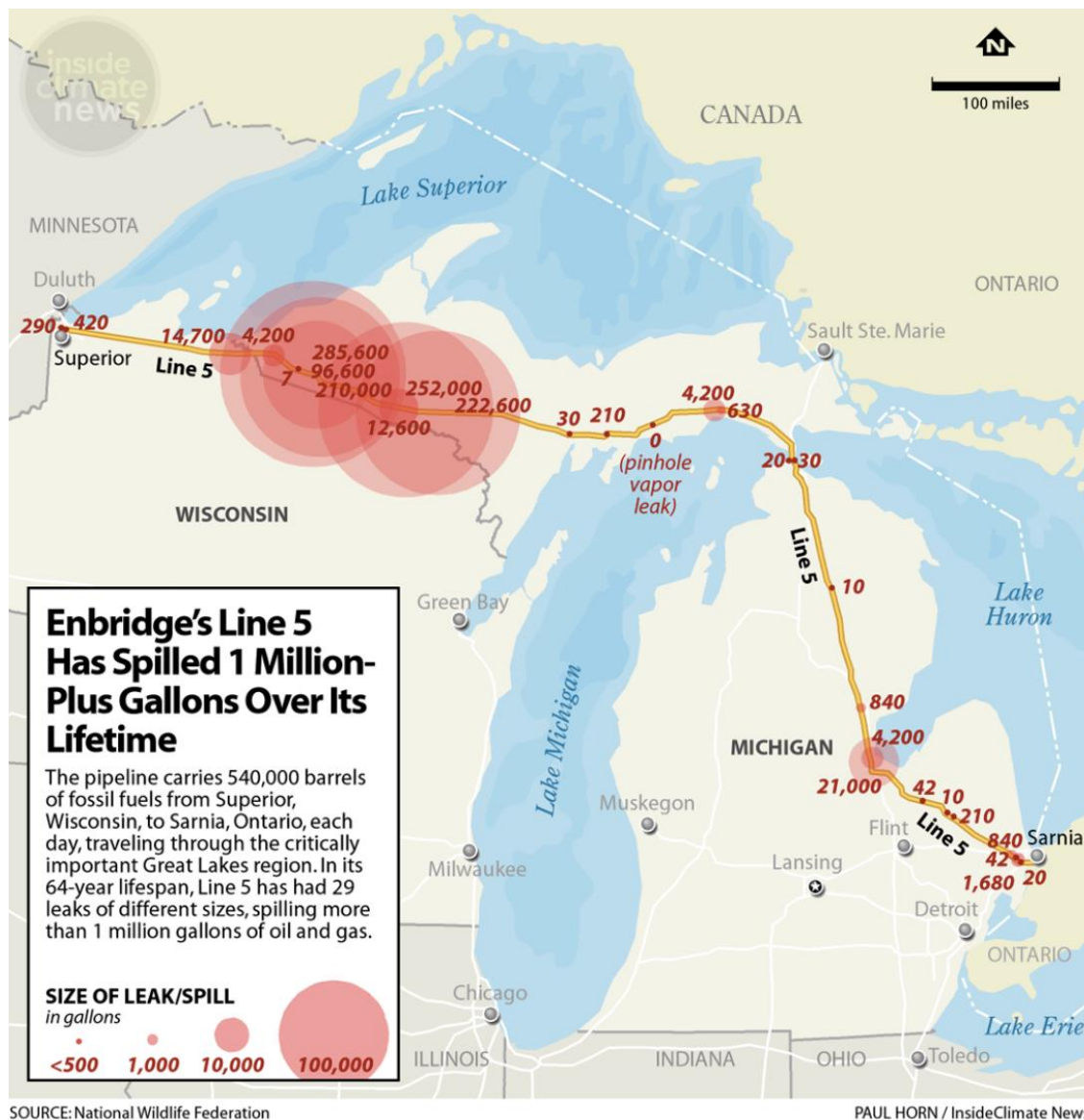
- In 2018, the pipelines were struck and damaged by a ship's anchor, even though a no-anchor zone was in place.
- In 2019, pipeline supports were severely damaged by Enbridge contractors by mistake. Despite prevention and warning measures, the damage was not discovered for a year.

Enbridge has been in violation of the terms of the Easement. The failure to monitor and react promptly to incidents is reminiscent of the attitudes and behaviours that led to the 4.1-million-litre oil spill from Enbridge's Line 6B into the Kalamazoo River in 2010.¹⁸ That spill took 17 hours to shut down and was discovered by a local utility worker and not by Enbridge's leak technology.¹⁹

The risk of harm associated with Line 5 is even greater because modeling shows the extreme currents of the Straits could spread spilled oil over a 1000 kms of Great Lakes shoreline. This is one of the reasons why University of Michigan scientists called the Straits of Mackinac the worst possible place for an oil spill in the Great Lakes.²⁰

The image below shows the route that Line 5 traverses through the lands and waters of the Great Lakes basin. The image also shows the 29 documented and known incidents where Line 5 has spilled. An interactive version of the 29 incidents can be found [here](#).

Figure 2. Map of Line 5 pipeline route and documented spills²¹



GHG emissions & Climate Impacts

The deal signed between Enbridge and former Michigan Governor Snyder before he left office was to extend the operation of Line 5 for 99 years by building a tunnel through the Straits of Mackinac.²² It would continue to transport 87 million liters of oil and natural gas liquids daily, that when burned, will yield over 57 million metric tons of atmospheric carbon annually – more carbon than is emitted by the United States 3 largest coal plants combined.²³ This long-term investment in fossil fuel infrastructure is directly at odds with the broad scientific consensus that immediate steps must be taken to decarbonize the economy to avoid the most catastrophic effects of climate change.

On top of this, a recent study from Harvard showed that fossil fuels contribute to one in five deaths worldwide.²⁴

Economic Implications

Supply and demand of crude oil in Canada and the United States

Canada produces more crude oil than it can consume. Crude oil production in the United States and Canada has grown substantially over the past several years. In contrast to the strong growth in supply and exports, crude oil demand in the U.S. and Canada has been essentially flat.^{25,26,27,28} This growth in oil supply has been accompanied by new pipelines and some existing pipelines have been expanded. Enbridge says the tunnel will take four years to complete but it is more likely to take on the upwards of ten years to complete. In fact, the original proposal given by Enbridge was for 10 years.²⁹ Court delays, permitting delays –and construction delays, if they ever get the permits –will all likely cause the tunnel to take longer than four years to complete.

Demand for crude oil is only going to continue to drop as fossil fuels are phased out in the coming decade and beyond. The International Energy Agency recently released a flagship report *Net-zero by 2050: A Roadmap for the Global Energy Sector* which clearly sets out a plan to phase out fossil fuels.³⁰ It sets out a pathway, resulting in a clean, dynamic, and resilient energy economy dominated by renewable power like solar and wind instead of fossil fuels. It also sets out more than 400 milestones to guide the global journey to net zero by 2050. **These include, from today, no investment in new fossil fuel supply projects, and no further final investment decisions for new unabated coal plants. By 2035, there are no sales of new internal combustion engine passenger cars, and by 2040, the global electricity sector has already reached net-zero emissions.**

Considering the pipeline is a ticking time bomb and threat to the Great Lakes, this is a vital opportunity to tackle two issues at once – protecting the Great Lakes and winding down the oil and gas sector in North America. The Great Lakes region is the heart of the automotive industry of North America and big names like GM have committed to only selling electric vehicles by 2035 and Ford has committed to 40 per cent EV sales by 2030.^{31,32}

Impacts on refineries, jobs, and gas prices – what we know so far

Enbridge and allies claim that shutting down Line 5 would cause shortages of crude oil for refineries in Michigan, Ohio, Pennsylvania, and eastern Canada, as well as propane shortages in northern Michigan. None of those predictions materialized when both legs of the dual Line 5 pipelines in the Straits were shut down for more than a week last June and one leg remained closed until about mid-September following damage that the U.S. Coast Guard said likely was caused by an Enbridge-contracted vessel. Research conducted during the partial shutdown by former Dow Chemical engineer Gary Street found that in August 2020 after more than 50 days with at least one leg of Line 5 closed, gasoline prices and supply were unaffected in Michigan and Canada.³³

London Economics International estimated spare capacity on the pipeline system which accesses the Detroit/Toledo refineries and the broader Line 5 demand area. Available capacity and flexibility to meet most of, if not all of the energy demand in the Great Lakes region in the event of a Line 5 closure already exists in the North American energy pipeline

system operated by Enbridge and its competitors without threatening our public waters and economies that depend on the Great Lakes.³⁴

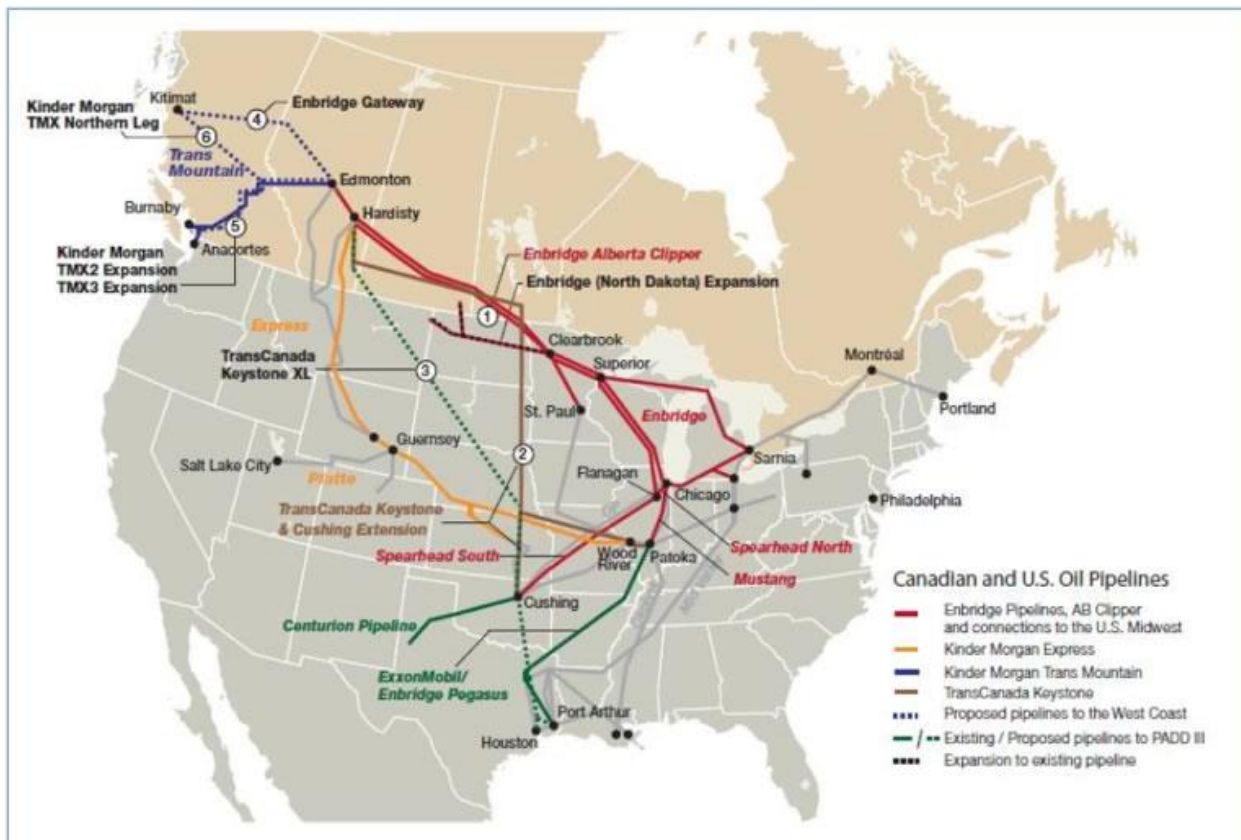
Initially, Dynamic Risk Assessments Inc. did a report that was funded by Enbridge that looked at alternatives to Line 5. The State of Michigan ended up firing Dynamic Risk after investigation revealed a conflict of interest involving Dynamic Risk simultaneously working on Enbridge Energy's behalf in Minnesota while working on the Line 5 assessment – which Dynamic Risk failed to disclose to the Michigan State.³⁵ Following this development, an independent report published by London Economics International (LEI) showed that at least three other options for shipping large volumes of oil are less expensive than the one alternative which was examined by Dynamic Risk.³⁶

Following the 2010 spill from Enbridge's Line 6B pipeline into the Kalamazoo River, Line 78 was built to replace it and has been designed to carry roughly double the capacity of what Line 6B carried. Line 61 also traverses through the region to carry crude oil to the area where the terminal for Line 78 is located. Additionally, the Mid-Valley Pipeline also serves the region. Currently Line 78 is operating at about 500,000 barrels per day. If Enbridge operated Line 78 at 800,000 barrels per day (which Enbridge has indicated it can do), the Detroit/Toledo refineries would not need trucked crude oil or crude by rail. They could receive all their crude oil by pipeline, for a tariff increase of approximately \$0.40 USD per barrel. That is still not accounting for the fact that the design capacity for Line 78 is 889,000 barrels per day depending on pressure.³⁷

This means there are other routes not only from the Canadian oilsands but also from the US South, for oil to make its way to market at the Detroit, Toledo, and Sarnia refineries besides Line 5. The North American pipeline system is a major pipeline system. There is flexibility for meeting energy needs in the region while the energy transition occurs and old pipelines are shut down, and energy supply needs are replaced with renewable energy sources.

The image on the next page shows the pipeline system that traverses throughout Canada and the United States and the many territories of Tribal, First Nations, and Métis peoples.

Figure 3. Map of major pipeline system throughout Canada and the United States^{38*}



*Note that TransCanada Keystone XL and Enbridge Gateway expansions did not go through.

Figure 4. Line 5, Line 78, and Mid-Valley pipeline capacity³⁹

Pipeline	Capacity (thousand barrels per day)	Terminal	Type of crude oil
Enbridge Line 5	540	Sarnia	Light
Enbridge Line 78 (6B)	570 - 800	Stockbridge	Various
Mid-Valley	240	Toledo	Various
Total	1,350 to 1,580		

Source: Map, EIA; Data: Enbridge Energy "Enbridge's Energy Infrastructure Assets." July 12, 2018. https://www.enbridge.com/~/_media/Enb/Documents/Factsheets/FS_EnergyInfrastructureAssets.pdf?la=en, and Energy Transfer Partners SEC Filing 10-k, and Michigan Public Service Commission Case No. U-17020 Exhibit A-2 p. 5 April 16, 2012. <https://mi-psc.force.com/sfc/servlet.shepherd/version/download/068t0000000wdBtAAI>

Line 5's operating capacity has been 540,000 barrels per day to the greater Line 5 region that supplies Detroit, Toledo, Sarnia, Nanticoke, and Montreal refineries. Even if Line 78 is operated at 570,000 barrels per day (it's low end nameplate capacity) into Stockbridge, Detroit/Toledo refiners would be able to get a significant portion of their crude oil from Line 78 and the Mid-Valley Pipeline (a total of 398,221 barrels per day), *which is 15 percent lower than their maximum requirement of 466,800 barrels per day.*⁴⁰ But with full operating capacity of Line 78 at 889,000 that would add another 319,000 barrels a day that could be shipped via alternative means through the Mainline System.

Figure 5. Total pipeline capacity servicing the region (without Line 5) and total refinery capacity servicing the region (U.S. and Canada)

Pipeline	Owner	Capacity (bbl/day)
Line 78	Enbridge	889,000
Mid-Valley	Energy Transfer Partners (formerly Sunoco Logistics)	240,000
Total		1,129,000
		Capacity (total refinery demand)
Refinery – U.S.		
Detroit, MI	Marathon	139,000
Toledo, OH	BP Husky	155,000
Toledo, OH	PBF Energy	172,800
Total		466,800
Refinery - Canada		
Sarnia, ON	Imperial	121,000
Sarnia, ON	Suncor	85,000
St. Clair, ON	Shell Corunna	75,000
Warren, PA	United	65,000
Nanticoke, ON	Imperial	112,000
Montreal, Quebec	Suncor	137,000
Levis, Quebec	Valero	235,000
Total		830,000
Total pipeline capacity - total refinery demand (= pipeline capacity shortfall)		-167,000

Table adapted from London Economics International. (2018, Sept. 12). Michigan Refining Sector: Alternatives to Line 5 for Transportation.

The LEI report shows that Line 78 and Mid-Valley pipeline have an operating capacity of 1,040,000 barrels per day and that is assuming Line 78 operates at 800,000 barrels per day. If Line 78 operated at its design capacity of 889,000 barrels per day then the combined

operating capacity of Line 78 and the Mid-Valley pipeline would be 1,129,000 barrels per day.⁴¹ The report also shows that the total oil needed by the Detroit/Toledo refineries has been 466,800 barrels per day and that the maximum crude oil demand for the refineries that serve Sarnia all the way to Montreal and Levis in Quebec is 830,000 barrels per day. This means that total crude oil needed for these refineries during the time of the report was 1,296,800 barrels per day.⁴² This means that without Line 5 there would be a shortfall across this region of 167,000 barrels per day.

This shortfall could be spread across the region and accounted for in other ways, such as improved energy efficiencies and renewable energy sources.

Cost to consumers

LEI estimated the increase in cost to refiners in Detroit/Toledo to be \$0.45 USD per barrel on the high end (assuming Line 78 operates at 570,000 barrels per day). This would amount to a rise of less than one cent (0.65 cents USD) to gasoline prices even assuming the refiners could pass along the whole cost increase. On the low end (assuming Line 78 operates at 800,000 barrels per day) the impact on Detroit/Toledo refiners would be \$0.40 USD per barrel; and the impact on gasoline prices would be about a half of one cent (0.58 cents USD per gallon) if the refiners could pass along the whole cost increase.⁴³ This all converts to 1/5th of a cent CAD per liter. And refiners may indeed only be able to charge to customers a portion of that increase. Weekly retail gasoline prices in the area during 2015/17 were as low as \$1.60 USD per gallon and as high as \$2.87 USD per gallon. A price increase of less than one cent would be insignificant relative to the price volatility of Midwest retail gasoline prices.⁴⁴

Implications for jobs that are dependent on local refineries

Given the above information, impacts on employment could be assumed to be minimal. Regardless, Canada has committed to developing a just transition act for the workers who are going to be inevitably impacted by the phasing out of fossil fuels as they are replaced with renewables. Line 5 provides an impetus for that work to begin in earnest.

Economic Impacts of a worst-case oil spill – what we know so far.

A rupture of Line 5 could inundate over 1000 kms of shoreline.⁴⁵ It is a threat to the many jobs and massive economy (including tourism) that the Great Lakes support. It crosses 400 smaller waterbodies in the Michigan area alone. A recent study in 2019 calculated a worst-case oil spill from Line 5 into the Straits of Mackinac would cost \$1.3 billion USD in economic damages for drinking water supply, shoreline recreation, fisheries, tourism, and businesses. This number does not include impacts to human health and does not include impacts to Ontario shorelines due to a lack of data.⁴⁶ Enbridge does not have insurance to cover that amount.⁴⁷ Another study showed that damages could actually reach closer to \$6.8 billion USD and looked at a scenario that would involve damages to approximately 1450 kms of shoreline across 15 counties in Michigan's Upper and Lower Peninsulas, who would suffer the greatest damages due to their proximity to the Straits of Mackinac from a spill resulting from technological failure and delay in human response.⁴⁸

Indigenous Perspective and Implications for Indigenous Sovereignty and Rights

All 12 Federally Recognized Tribes in Michigan have committed resolutions calling on the shutdown of Line 5. Five federally recognized tribes adjudicated Treaty Rights to harvest fish from the Great Lakes, thanks to the 1836 Treaty of Washington. A 2000 Consent Decree gave the 1836 Treaty Tribes co-management authority of the Great Lakes. The State of Michigan did not consult Michigan Tribes prior to the 1953 easement. Line 5 crosses numerous inland waterways that threaten inland tribal treaty rights.⁴⁹

Recently in Canada, the Anishinabek Nation which represents 39 First Nations communities in Ontario has come forward and supported a Line 5 closure citing the risk it poses to the Great Lakes and the lands and waters that would be impacted by a spill.⁵⁰ They also cited the need for Canada to respect and honour the treaties it has made with First Nations peoples when it comes to making decisions about land and resources as well as infrastructure.⁵¹

In 2010, when Line 6B ruptured into the Kalamazoo River, the oil spilled into the lands and waters of the Nottawaseppi Huron Band of the Potawatomi Tribe. The tribe still has lands that they cannot access or harvest from and it is a decade later.⁵²

Indigenous peoples have made it very clear that Line 5 threatens the way of life for their nations and communities who reside in the nearby shoreline communities. These communities depend on safe water for fishing, harvesting, and the traditional, spiritual, and cultural importance of the Great Lakes.

References

¹ CBC. (2021, May 10). Canadians who rely on Line 5 on edge as Michigan's deadline looms to shut Enbridge pipeline. Retrieved from <https://www.cbc.ca/news/canada/windsor/line-5-pipeline-deadline-1.6020665>

² Erikson, Jim. (2014, July 10). Straits of Mackinac 'worst possible place' for a Great Lakes oil spill, U-M researcher concludes. University of Michigan News. Retrieved from <https://news.umich.edu/straits-of-mackinac-worst-possible-place-for-a-great-lakes-oil-spill-u-m-researcher-concludes/>

³ US EPA. (2021). Facts and Figures About the Great Lakes. Retrieved from <https://www.epa.gov/greatlakes/facts-and-figures-about-great-lakes>

⁴ London Economics International. (2018, Sept. 12). Michigan Refining Sector: Alternatives to Line 5 for Transportation. Retrieved from http://blog.nwf.org/wp-content/blogs.dir/11/files/2018/09/LEI-Enbridge-Line-5-Michigan-Refining_9_12_2018.pdf

⁵ State of Michigan. (2021, Nov. 13). Governor Whitmer Takes Action to Shut Down the Line 5 Dual Pipelines through the Straits of Mackinac After a Reasonable Transition Period to Protect the State's Energy Needs. Retrieved from https://www.michigan.gov/whitmer/0,9309,7-387-90499_90640-545110--,00.html

⁶ State of Michigan. (2020, Nov. 13). Notice of Revocation and Termination of Easement. Retrieved from https://www.oilandwaterdontmix.org/notice_of_revocation_and_termination_of_easement

⁷ Detroit News. (2021, April 23). 17 state leaders join Michigan's plea for state sovereignty in Line 5 battle. Retrieved from <https://www.detroitnews.com/story/news/local/michigan/2021/04/23/enbridge-line-5-michigan-state-sovereignty-lawsuit-straits-of-mackinac/7356515002/>

-
- ⁸ Ellison, Garret. (2018, April 26). Enbridge Line 5 has spilled at least 1.1M gallons in past 50 years. MLive. Retrieved from https://www.mlive.com/news/2017/04/enbridge_line_5_spill_history.html
- ⁹350. (2017). Enbridge Major Spills 1996-2014. Retrieved from https://world.350.org/kishwaukee/files/2017/02/EnbridgeMajorSpills_1996-2014.pdf
- ¹⁰ 1953 Straits Easement for Line 5. Retrieved from <https://mipetroleumpipelines.org/document/1953-straits-easement-line-5>
- ¹¹ State of Michigan, Governor of the State of Michigan, Michigan Department of Natural Resources. (2020, Nov. 13). State of Michigan v. Enbridge, Complaint (11.13.20). Retrieved from https://content.govdelivery.com/attachments/MIEOG/2020/11/13/file_attachments/1600921/State%20of%20Michigan%20v.%20Enbridge,%20Complaint%20%2811.13.20%29.pdf
- ¹² State of Michigan, Governor of the State of Michigan, Michigan Department of Natural Resources. (2020, Nov. 13). State of Michigan v. Enbridge, Complaint (11.13.20). Retrieved from https://content.govdelivery.com/attachments/MIEOG/2020/11/13/file_attachments/1600921/State%20of%20Michigan%20v.%20Enbridge,%20Complaint%20%2811.13.20%29.pdf
- ¹³ State of Michigan v. Enbridge, Complaint (11.13.20). Retrieved from https://content.govdelivery.com/attachments/MIEOG/2020/11/13/file_attachments/1600921/State%20of%20Michigan%20v.%20Enbridge,%20Complaint%20%2811.13.20%29.pdf
- ¹⁴ State of Michigan v. Enbridge, Complaint (11.13.20). Retrieved from https://content.govdelivery.com/attachments/MIEOG/2020/11/13/file_attachments/1600921/State%20of%20Michigan%20v.%20Enbridge,%20Complaint%20%2811.13.20%29.pdf
- ¹⁵ State of Michigan, Governor of the State of Michigan, Michigan Department of Natural Resources. (2020, Nov. 13). State of Michigan v. Enbridge, Complaint (11.13.20). Retrieved from https://content.govdelivery.com/attachments/MIEOG/2020/11/13/file_attachments/1600921/State%20of%20Michigan%20v.%20Enbridge,%20Complaint%20%2811.13.20%29.pdf
- ¹⁶ Ibid
- ¹⁷ Oil & Water Don't Mix. (2021, May 9). 5 Things You Need To Know About the Enbridge Line 5 Shutdown. Retrieved from https://www.oilandwaterdontmix.org/5_things_you_need_to_know_about_the_enbridge_line_5_shutdown
- ¹⁸ Belt Magazine. (2019, July 12). The Enduring Legacy of the 2010 Kalamazoo River Oil Spill. Retrieved from <https://beltmag.com/kalamazoo-river-line-6b-oil-spill/>
- ¹⁹ U.S. EPA. (2016, April). FOSC Desk Report for the Enbridge Line 6B Oil Spill. Retrieved from <https://www.epa.gov/sites/production/files/2016-04/documents/enbridge-fosc-report-20160407-241pp.pdf>
- ²⁰ Schwab, Dave. (2016, March). Statistical Analysis of Straits of Mackinac Line 5: Worst Case Spill Scenarios. University of Michigan Water Center. Retrieved from <http://graham.umich.edu/water/project/mackinac-oil-spill>
- ²¹ Sierra Club. (2021). Enbridge Line 5 has spilled at least 1 million plus gallons over its lifetime. Retrieved from <https://www.sierraclub.org/wisconsin/line-5>
- ²² Michigan State. (2018, Oct. 3). Agreement paves way for Enbridge to permanently shut down, replace Line 5 in Straits of Mackinac. Retrieved from https://www.michigan.gov/formergovernors/0,4584,7-212-96477_90815_57657-479938--,00.html
- ²³ For Love of Water. (2020, Dec. 9). Enbridge's Proposed Oil Tunnel Would Significantly Affect and Endanger Human Environment. Retrieved from <https://forloveofwater.org/enbridges-proposed-oil-tunnel-would-significantly-affect-and-endanger-human-environment/>
- ²⁴ Vohra et. al. (2021, April). Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem. *Environmental Research*. Retrieved from <https://www.hsph.harvard.edu/c-change/news/fossil-fuel-air-pollution-responsible-for-1-in-5-deaths-worldwide/>
- ²⁵ Statista. (2021). Total crude oil production in Western and Eastern Canada from 2014 to 2035. Retrieved from <https://www.statista.com/statistics/543225/projected-canadian-crude-oil-production-by-region/>
- ²⁶ Statista. (2021). Oil consumption in Canada. Retrieved from <https://www.statista.com/statistics/264824/oil-consumption-in-canada/>
- ²⁷ Worldometer. (2016). Canada Oil. Retrieved from <https://www.worldometers.info/oil/canada-oil/>
-

-
- ²⁸ U.S. Energy Information Association. (2020). U.S. Petroleum consumption, production, imports, exports, and net imports, 1950-2020. Retrieved from <https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php#:~:text=Also%20in%202020%2C%20the%20United,3%20about%2018.12%20MMb%2Fd.&text=However%2C%20some%20of%20the%20crude,fuel%E2%80%94that%20the%20U.S.%20eports>
- ²⁹ Great Lakes Now. (2018, Nov). Full Senate vote on Enbridge Line 5 tunnel proposal delayed. Retrieved from <https://www.greatlakesnow.org/2018/11/full-senate-vote-on-enbridge-line-5-tunnel-proposal-delayed/>
- ³⁰ International Energy Agency. (2021, May). Net-zero by 2050: A Roadmap for the Global Energy Sector. Retrieved from <https://www.iea.org/news/pathway-to-critical-and-formidable-goal-of-net-zero-emissions-by-2050-is-narrow-but-brings-huge-benefits-according-to-iea-special-report>
- ³¹ NBC News. (2021, January 28). GM to go all electric by 2035, phase out gas and diesel engines. Retrieved from <https://www.nbcnews.com/business/autos/gm-go-all-electric-2035-phase-out-gas-diesel-engines-n1256055>
- ³² CNBC. (2021, May 26). Ford ups EV investments, targets 40 percent electric cars by 2030 under latest turn around plan. <https://www.cnbc.com/2021/05/26/ford-ups-ev-investments-targets-40percent-electric-car-sales-by-2030-under-latest-turnaround-plan.html>
- ³³ Stebbins, Laina. (2020, Aug. 10). Study: Partial Line 5 shutdown has not impacted gas prices, despite Enbridge warnings. Retrieved from <https://www.michiganadvance.com/2020/08/10/study-partial-line-5-shutdown-has-not-impacted-gas-prices-despite-enbridge-warnings/>
- ³⁴ London Economics International. (2018, Sept. 12). Michigan Refining Sector: Alternatives to Line 5 for Transportation. Retrieved from http://blog.nwf.org/wp-content/blogs.dir/11/files/2018/09/LEI-Enbridge-Line-5-Michigan-Refining_9_12_2018.pdf
- ³⁵ Oil & Water Don't Mix. (2017, July 12). New evidence emerges showing deep conflicts of interest in Line 5 reports. Retrieved from https://www.oilandwaterdontmix.org/new_evidence_emerges_showing_deep_conflicts_of_interest_in_line_5_reports
- ³⁶ London Economics International. (2018, Sept. 12). Michigan Refining Sector: Alternatives to Line 5 for Transportation. Retrieved from http://blog.nwf.org/wp-content/blogs.dir/11/files/2018/09/LEI-Enbridge-Line-5-Michigan-Refining_9_12_2018.pdf
- ³⁷ Ibid
- ³⁸ Auburn University. (2017, Feb. 1). Oil pipelines and spills. Retrieved from <https://cla.auburn.edu/ces/energy/oil-pipelines-and-spills/>
- ³⁹ London Economics International. (2018, Sept. 12). Michigan Refining Sector: Alternatives to Line 5 for Transportation. Retrieved from http://blog.nwf.org/wp-content/blogs.dir/11/files/2018/09/LEI-Enbridge-Line-5-Michigan-Refining_9_12_2018.pdf
- ⁴⁰ Ibid
- ⁴¹ Ibid
- ⁴² Ibid
- ⁴³ London Economics International. (2018, Sept. 12). Michigan Refining Sector: Alternatives to Line 5 for Transportation. Retrieved from http://blog.nwf.org/wp-content/blogs.dir/11/files/2018/09/LEI-Enbridge-Line-5-Michigan-Refining_9_12_2018.pdf
- ⁴⁴ Ibid
- ⁴⁵ University of Michigan News. (2016, Mar. 31). More than 700 miles of Great Lakes shoreline potentially vulnerable to Straits of Mackinac oil spills. Retrieved from <https://news.umich.edu/more-than-700-miles-of-great-lakes-shoreline-potentially-vulnerable-to-straits-of-mackinac-oil-spills/>
- ⁴⁶ Melstrom et. al. (2019, Dec.) Economic damages from a worst-case oil spill in the Straits of Mackinac. *Journal of Great Lakes Research*. Retrieved from <https://www.sciencedirect.com/science/article/abs/pii/S0380133019301649>
- ⁴⁷ State of Michigan. (2019, Oct. 29). An Analysis of The Enbridge Financial Assurances Offered to the State of Michigan On Matters Related To The Operation of The Enbridge Line 5 Pipeline At the Straits of Mackinac. Retrieved from https://www.michigan.gov/documents/ag/Master_Michigan_Enbridge_10_29_final_670367_7.pdf
-

⁴⁸ Richardson, Robert B. & Brugnone, Nathan. (2018, May). Oil Spill Economics: Estimates of the Economic Damages of an Oil Spill in the Straits of Mackinac in Michigan. Retrieved from http://media.mlive.com/grpress/news_impact/other/FLOW_Report_Line%205_Final%20release.pdf

⁴⁹Grand Traverse Band Natural Resources Department. Line 5 Pipeline 101: Facts about the Pipeline Threatening Our Great Lakes. Retrieved from http://www.gtbindians.org/downloads/line_5_pipeline_101.pdf

⁵⁰ Anishinabek Nation News. (2021, May 6). Anishinabek Nation leadership supports shut down of Line 5 pipeline. Retrieved from <https://anishinabeknews.ca/2021/05/06/anishinabek-nation-leadership-supports-shut-down-of-line-5-pipeline/>

⁵¹ Anishinabek Nation News. (2021, May 7). Robinson Huron First Nation leadership calls on Canada to do better. Retrieved from <http://anishinabeknews.ca/2021/05/07/robinson-huron-first-nation-leadership-calls-on-canada-to-do-better/?fbclid=IwAR3H3mMIC8i-QVF3XT9C7ctE28HfXNELKPNrgg469FjrwSp5hvuyypoe8YWs>

⁵² Grand Traverse Band Natural Resources Department. Line 5 Pipeline 101: Facts about the Pipeline Threatening Our Great Lakes. Retrieved from http://www.gtbindians.org/downloads/line_5_pipeline_101.pdf