Delivered via electronic mail

March 22, 2022

St. Paul District Corps of Engineers
CEMVP-RD
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Saint Paul, MN 55101-1678
CEMVP-L5WSR-PN-Comments@usace.army.mil

RE: Comments on U.S. Army Corps of Engineers Permit Application No.: MVP-2020-00260-WMS

Dear Chief Konickson:

Midwest Environmental Advocates, on behalf of Honor the Earth and Sierra Club of Wisconsin, and Clean Wisconsin submit these comments on Enbridge Energy, LP's Clean Water Act Section 404 and Rivers and Harbors Act Section 10 permit application for its proposed new segment of Line 5 in northern Wisconsin.

Sincerely,

/s/

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COMMENTS ON U.S. ARMY CORPS OF ENGINEERS PERMIT APPLICATION NO.: MVP-2020-00260-WMS / CWA § 404 AND RHA § 10 PERMIT APPLICATION FOR ENBRIDGE'S PROPOSED NEW SEGMENT OF LINE 5 IN NORTHERN WISCONSIN

The existing Line 5 is a 645-mile-long hazardous liquid pipeline that begins in Superior, Wisconsin, traverses northern Wisconsin and the upper and lower Michigan peninsulas, and terminates in Sarnia, Ontario. Line 5 began operating in 1953, has never been subject to comprehensive environmental review under the National Environmental Policy Act (NEPA) or state level equivalents, and continues to transport an average of 22 million gallons of oil per day despite exceeding its designed life expectancy and being subject to multiple legal actions in state and federal courts.

In Wisconsin, Enbridge proposes to build 41 miles of new pipeline in northern Wisconsin beginning in Ashland County and terminating in Iron County. Enbridge then proposes to decommission 20 miles of existing pipeline and build a new segment of Line 5 that skirts the southern border of the Bad River Reservation. Enbridge's stated purpose is to "continue transporting crude oil and natural gas liquids [] through its Line 5 pipeline . . ."[1]

Enbridge has proposed to discharge permanent fill material into 0.02 acres of waters of the United States and temporarily discharge fill material into 101.08 acres of wetlands and 0.2 acres of non-wetland waters of the United States. Enbridge also proposes to perform horizontal directional drilling (HDD) under the White River. As part of this project, Enbridge proposes to convert 33.95 acres of forested or scrub-shrub wetland into "emergent wetland" and prevent that wetland from returning to its current state.[2]

Enbridge has sought numerous state and federal permits as part of this project, including state wetland, waterway permits, and discharge permits, and a federal Clean Water Act § 404 permit to discharge fill into waters of the United States. The U.S. Army Corps of Engineers ("Corps") is considering this request as part of an individual permit process and plans to prepare an environmental assessment, although that document has not yet been released as of the submission of these comments.

The proposed project is a complex undertaking, covering diverse terrain and impacting more than 1000 water features along the way. If approved, the project will facilitate the continued operation of Line 5, putting the people, land, and waters of northern Wisconsin at risk for another generation or longer. The time to transition away from our dependence on fossil fuels is now, and that goal cannot be accomplished by continuing to invest in dirty infrastructure and

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[1] U.S. ARMY CORPS OF ENGINEERS, ST. PAUL DISTRICT, PUBLIC NOTICE at 3 (Jan. 6, 2022), available at https://www.mvp.usace.army.mil/Portals/57/docs/regulatory/Enbridge/EnbridgeLine5/2020000260SP.pdf (also, on file with author).
[2] *Id.* at 4.

perpetuating the status quo. We encourage the Corps to keep that in mind as it subjects Enbridge's application to the utmost scrutiny.

I. REQUEST FOR PUBLIC HEARING AND COMMENT PERIOD EXTENSION.

For the reasons stated in Midwest Environmental Advocates (MEA) and Clean Wisconsin's February 22, 2022, letter to the Corps, incorporated here by reference, and for reasons set forth more fully below, we request a public hearing on this permit. Corps regulations provide that "[r]equests for a public hearing [] shall be granted, unless the district engineer determines that the issues raised are insubstantial or there is otherwise no valid interest to be served by a hearing."[3] As noted in our February letter, there are many substantial issues raised by Enbridge's permit application, and public interest considerations weigh heavily in favor of holding a hearing on the application.

In addition, the Corps should extend the comment period until it has completed a full environmental review under NEPA of the connected federal actions that authorize the continued operation of Line 5, including a review of the Corps' approvals in Wisconsin and for the Enbridge Line 5 tunnel and pipeline relocation project in Michigan ("Michigan Tunnel Project"). The Corps has already announced that it will prepare an Environmental Impact Statement (EIS) for its approval of the Michigan Tunnel Project and announced that it hired a third-party contractor to complete the EIS process on March 7, 2022, with a plan to publish a "notice of intent" to issue an EIS in the Federal Register at some later date.[4] It is clearly not too late to combine the EIS for the Michigan Tunnel Project with an EIS that addresses the Line 5 relocation project in Wisconsin.

The principal goals of NEPA are to ensure that (1) "the public has been informed regarding the decision-making process"; and (2) "relevant environmental information is identified and considered early in the process in order to ensure informed decision making by Federal agencies."[5] Without full consideration of these connected actions, the public cannot be adequately informed of the decision-making process and cannot meaningfully comment on the cumulative impacts of the projects. Moreover, the Corps will fail to satisfy its legal duties to consider connected actions in a single environmental review document.[6]

At a minimum, the Corps should delay the public comment deadline until the Wisconsin Department of Natural Resources (DNR) has completed its environmental review. We have serious concerns about that review, as discussed below, but should the resulting state EIS comply with applicable statutory and regulatory standards, it will provide a more complete view of the project, allowing the public to understand the impacts of the proposed project and to

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[3] 33 C.F.R. § 327.4(b).
[4] U.S. Army Corps. *Enbridge Line 5 Tunnel*, DETROIT DIST., https://www.lre.usace.army.mil/Missions/Regulatory-Program-and-Permits/Enbridge-Line-5-Tunnel/ (update of 3/7/2022)).
[5] 40 C.F.R. § 1500.1.
[6] *See infra* § III.b (discussing review of connected actions).

meaningfully comment on the proposed Corps permits. The Corps seems to be using information provided in DNR's draft EIS ("DEIS"), having relied on the September 2021 Wetland and Waterbody Crossing Table attached to the DEIS as Appendix G to develop the most recent Waterway Crossing Table[7] rather than the Wetland and Waterbody Crossing Table that was submitted with the application as Appendix K. The Corps should provide the public with the same opportunity to use that information but only once DNR's environmental review is complete and the glaring inadequacies of the DEIS are addressed.

II. COMMENTS ON CWA § 404 ISSUES.

a. Legal Background.

The Clean Water Act (CWA) was enacted by Congress in 1972 to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[8] To achieve this goal, section 404 of the CWA prohibits the discharge of any pollutant, including dredged soil or other fill material, into navigable waters unless authorized by a permit.[9]

The Corps oversees the CWA § 404 permit process and must comply with guidelines promulgated by the U.S. Environmental Protection Agency (EPA), which are incorporated into the Corps' own regulations.[10] The EPA guidelines pertinent to this project are set forth in EPA's § 404(b)(1) regulations, at 40 C.F.R. § 230. The intent behind the regulations is that dredged or fill material should not be discharged if it will result in an unacceptable impact on the aquatic ecosystem.[11]

In general, the regulations provide that no discharge of dredged or fill material shall be permitted: (1) if there is a practicable alternative to the proposed discharge; (2) if the discharge causes or contributes to violations of applicable state water quality standards; (3) if the discharge will cause or contribute to significant degradation of the environment; and (4) unless all appropriate steps have been taken to minimize potential adverse impacts.[12] The Corps' regulations also require that destruction of wetlands is to be avoided to the extent practicable.[13]

The regulations further provide that "practicable alternatives" include "not discharging into the waters of the U.S. or discharging into an alternative aquatic site with potentially less damaging consequences."[14] If a project is not "water dependent," as is the case with hazardous liquid pipelines like Line 5, the guidelines contain a presumption that a less environmentally damaging

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[7] The current version of the Waterway Crossing Table may still be underinclusive, further establishing the need to extend the comment period. *See infra* § II.h.
[8] 33 U.S.C. § 1251(a).
[9] *Id.* § 1344.
[10] *Id.* § 1344(b)(1); 33 C.F.R. §§ 320.4(b)(4), 325.2(a)(6).
[11] 40 C.F.R. § 230.1(c).
[12] 40 C.F.R. § 230.10.
[13] 33 C.F.R. § 320.4(r).
[14] 40 C.F.R. §§ 230.5(c), 230.10(a).

practicable alternative exists and require that the applicant clearly demonstrate that practicable alternatives which would not involve discharge of fill material into special aquatic sites are not available.[15]

In addition, the regulations require that when information is prepared by the applicant, it shall be independently evaluated and verified by the Corps as required by 40 C.F.R. § 1506.5(a).[16] Under 40 C.F.R. § 1506.5(b): "The agency shall independently evaluate the information submitted . . . and shall be responsible for its accuracy. . . . It is the intent of this paragraph [] that acceptable work not be redone, but that it be verified by the agency."

The Corps also has authority under Section 10 of the Rivers and Harbors Act (RHA), 33 U.S.C. § 403 to prohibit the unauthorized obstruction or alteration of any navigable water of the United States. Activities requiring Section 10 permits include structures and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to the navigable waters of the United States.

b. Enbridge's Application is Incomplete, and the Corps Must Independently Evaluate the Information Provided.

As discussed more fully below, Enbridge has provided insufficient information to enable a conclusion that the proposed project is the least environmentally damaging practicable alternative, that the project will not violate state water quality standards or significantly degrade aquatic resources, or that the project will appropriately mitigate for unavoidable impacts to waters of the United States. Given these information gaps, the Corps cannot grant Enbridge an individual permit.

In addition, the CWA requires that the Corps independently evaluate and verify the information supplied by the applicant in determining whether to issue a section 404 permit.[17] As such, the Corps must not take Enbridge's analysis of impacts and possible alternatives at face value. The Corps must independently determine the scope and extent of impacts to aquatic ecosystems and the environment and determine whether there are any other less damaging alternatives to the proposed pipeline. The Corps must demonstrate to the public that it has completed this independent analysis to ensure meaningful public participation.[18]

The pipeline construction plans are insufficiently described to evaluate the true impacts to wetlands and fail to include critical pre-construction baseline monitoring. Enbridge must provide baseline hydrological data, including flow direction at the surface through the uppermost

[15] 40 C.F.R. § 230.10(a)(3).
[16] 33 C.F.R. Part 325 app. B.
[17] 40 C.F.R. § 1506.5(a)-(b).
[18] 33 U.S.C. § 1344(a).

vegetated surface layer.[19] Critically, Enbridge has not provided sufficient information about the seepage direction related to the adjacent groundwater system (whether recharging from or discharging into the groundwater system), which would allow a clearer evaluation of the environmental impacts of construction and fill in that wetland.[20] This seepage direction must be determined with an array of paired piezometers.[21] Without this data, the Corps and DNR cannot ensure protection of wetland functional values, necessary to satisfy Wisconsin state water quality standards and the Corps' duties under the CWA.[22] Seasonal variation in surface water depths, level and direction of flow of near surface groundwater patterns, among other factors, are critical to the evaluation of potential impacts and adequate protection and restoration techniques. Relying on existing data sets is inadequate to evaluate impacts to wetlands.[23] In addition, better characterization of the location of aquifers could avoid dewatering wetlands (and other waterbodies) through shallow aquifer breaches, as occurred during construction of Line 3.[24] Those risks must be evaluated by the Corps.

Enbridge still has not provided sufficiently detailed information about the impacts of its planned construction on wetlands. Enbridge's Environmental Protection Plan (EPP) provides high-level details about wetland impacts from construction that do not allow the Corps to fully evaluate the proposed impacts to each and every wetland to be filled as part of this project. As one example, rather than provide clear performance metrics to guide construction activities, Enbridge explains only that "[a] backhoe is typically used to excavate the trench in wetlands."[25] As another example, Enbridge has not provided a full list of waterways and wetlands that will be subject to blasting. In response to an information request from DNR, Enbridge explained that "[t]he final evaluation of whether or not blasting will be required will be made *during construction once the trench has been opened* and construction crews can accurately identify the depth of the rock."[26] In addition, the application does not include any analysis on the potential subsurface effects on wetland hydrology post-blasting and soil replacement.

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[19] *See* ALMENDINGER ENVIRONMENTAL, MEMORANDUM TO MIDWEST ENVIRONMENTAL ADVOCATES [hereafter "ALMENDINGER ENVIRONMENTAL MEMO."] 3-4 (Mar. 8, 2022) (attached hereto).

[20] *See id.* at 3-4.

[21] *Id.* In Minnesota, during construction of Line 3, as discussed more fully in the NEPA section of these comments, a clay layer was breached "delivering large amounts of turbid water to nearby receiving waters"—an issue that could have been avoided with better pre-construction monitoring. *Id.* at 4.

[22] DNR is required to protect wetland functional values, including hydrologic function and "the discharge of groundwater to a wetland, the recharge of groundwater from a wetland to another area and the flow of groundwater through a wetland." Wis. Admin. Code § NR 103.03(1)(b). To ensure maintenance or enhancement of functional values, DNR must use regulatory criteria including identifying "[h]ydrological conditions necessary to support the biological and physical characteristics naturally present in wetlands . . ." Wis. Admin. Code § NR 103.03(2)(e). DNR cannot use the criteria to "assure" anything without baseline and post-construction hydrologic data. *See* Wis. Stat. § 281.36(3b)(b) (department may not issue an individual permit unless it determines that the discharge "will comply with all applicable water quality standards.").

[23] ALMENDINGER ENVIRONMENTAL MEMO., *supra* note 19, at 4.

[24] *See infra* § III.d.iii.

[25] ENBRIDGE ENVIRONMENTAL PROTECTION PLAN at 9 (ver. 9/2021), attached as DEIS App. C [hereinafter ENBRIDGE EPP].

[26] ENBRIDGE, RESPONSE TO DNR'S QUESTIONS OF NOVEMBER 3, 2020 at 20 (Dec. 11, 2020) (on file with author), https://widnr.widen.net/s/fwvvhdbw7p/l5wsrp-information-response-to-wdnr-final-12112020x (emphasis added).

Enbridge has also not provided any details about its post-construction right-of-way management, including detailed site-specific final plans on vegetation management using herbicides or other chemicals that will be used in right-of-way wetlands and directly affect wetland functional values. In short, the Corps lacks the information that would allow it to determine that the project meets the applicable regulatory standards and therefore cannot grant Enbridge an individual permit under the CWA or RHA.

c. The Corps Must Choose the Least Damaging Practicable Alternative.

The Corps must consider alternative pipeline routes and choose the least damaging practicable alternative.[27] Practicable alternatives include those not presently owned by the applicant but that could be obtained to fulfill the purpose of the proposed activity.[28] In addition, they include not discharging into waters of the United States.

Enbridge proposes to cross dozens of jurisdictional waters using HDD. At each proposed crossing of a waters of the United States, the Corps must evaluate the use of horizontal direction drilling versus other methods to evaluate impacts to the landscape. This alternatives analysis must be based on a site-specific analysis, considering the specific geology and hydrology of *each proposed wetland crossing* whether open trench drilling, blasting, HDD, or some other method is the least environmentally damaging practicable alternative. This analysis should include the impacts that will come from the use of fracking fluids that can have water quality effects and other impacts to the local ecology. As described elsewhere, during HDD, a slurry of bentonite clay and undisclosed additives are injected into the ground. The pressurized mud can escape along fractures in the overburden or through permeable layers and reach the surface or stream channels.[29] The mud flows kill vegetation and imperil aquatic life.[30] During the construction of Line 3 in northern Minnesota, 28 frac-outs occurred at 19 stream and wetland crossings and at 12 of the crossings, drilling fluid reached the waterway.[31] Enbridge has failed to provide sufficient information to show that waterway crossings using HDDs will be performed in a manner to avoid frac-outs and thereby avoid environmental pollution. In addition, Enbridge has not provided a full list of waterways and wetlands that will be subject to blasting.[32]

This alternatives analysis must also be based on the critical pre-construction baseline monitoring described above. Without the baseline information listed above, including adequate hydrological

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[27] 40 C.F.R. § 230.10(a).
[28] 40 C.F.R. § 230.10(a)(2).
[29] *Id.*
[30] *Id.*
[31] ALMENDINGER ENVIRONMENTAL MEMO., *supra* note 19, at 6.
[32] ENBRIDGE, *supra* note 26 (emphasis added). As noted above, Enbridge explained that "[t]he final evaluation of whether or not blasting will be required will be made during construction once the trench has been opened and construction crews can accurately identify the depth of the rock."

monitoring data, the Corps cannot perform the required alternatives analysis and must therefore deny Enbridge a wetland permit.

Thus, not only does the Corps not know the full environmental impacts of the proposed project, it also, based on this information, cannot perform an adequate alternatives analysis for each wetland impacted and thereby ensure that impacts to wetlands are minimized.

d. The Corps May Not Approve the Proposed Project Because it Causes or Contributes to Water Quality Degradation.

The Corps' own guidelines state that "[n]o discharge of dredged or fill material shall be permitted if it: (1) Causes or contributes . . . to violations of any applicable State water quality standard[.]"[33] As discussed below, the proposed discharges into wetlands will cause violations of Wisconsin's wetland water quality standards in part because the discharges are mischaracterized and the true impacts to wetlands are unknown and understated. Further, the mitigation plan is insufficient because it fails to fully address these impacts, in part because the application materials and the plan do not grapple with the proposed project's full impacts to the environment.

i. <u>Longer-term wetland impacts misclassified as "temporary".</u>

First, Enbridge's application mischaracterizes what are likely to be permanent impacts as mere temporary impacts to wetlands. On its face, the idea that a 41.2-mile-long section of pipeline, along with access roads and other alterations of the natural environment, can be constructed while only permanently impacting .02 acres of wetland is outlandish. .02 acres is about 871 square feet, or about the size of an average apartment. Enbridge reaches this number by classifying essentially all wetland impacts as either temporary or "conversions" of wetlands from one type of wetland to another.[34] These classifications are doubtful. As the U.S. Environmental Protection Agency Region 5 stated in its comment letter on Line 5 in Wisconsin, "[i]mpacts to 33.95 acres of wetlands resulting in permanent conversion of forested and scrub-shrub wetland to emergent wetlands should be considered as a permanent, not temporary impact, especially if the wetlands will be **permanently** maintained by the Applicant as emergent wetland within the right-of-way."[35]

"Temporary impacts" is not currently defined in statute or regulation. However, proposed revisions to the applicable state regulations also suggest that the impacts are misclassified, which affects whether the project will have impermissible impacts to state water quality standards. The

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[33] 40 C.F.R. § 230.10(b).
[34] WIS. DEPT. OF NAT. RES., DRAFT ENVIRONMENTAL IMPACT STATEMENT 200, tbl. 6.11-1 [hereinafter DEIS].
[35] Letter from Tara Fong, Division Director, U.S. EPA Region 5, to Col. Karl Jansen, District Commander, U.S. Army Corps of Engineers at 6 (Mar. 16, 2022) (submitted by email as a comment on the Line 5 project and on file with author) [hereinafter "Letter from U.S. EPA Region 5"].

proposed revisions of Wis. Admin. Code ch. NR 350 *do* include a new definition of this "temporary impacts", which is as follows:

> "Temporary impacts" means adverse impacts to wetlands that are not permanent and are the result of a permitted or exempt project and meet one or more of the following requirements:
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> (a) Only occur during the non-growing season.
> (b) Result in negligible impacts to wetland function or area.
> (c) Restore preexisting wetland function at or soon after the conclusion of the permitted or exempt activity.
> **Note:** Temporary impacts may include, but are not limited to, open trenching, timber mat placement, or temporary vegetation clearing.[36]

This definition does not apply to Enbridge's proposed project which clearly extends beyond a growing season and will not have "negligible" impacts to wetland function or area given the admitted impacts. There is no reason to believe that full wetland functioning will be restored "soon after the conclusion" of the construction. While "soon" is a relative concept, it is not a blank check to impact wetlands for some unknown amount of time. The Environmental Impact Report (EIR) characterizes the impacts as follows:

> In emergent wetlands, the impact of construction will be relatively brief, since herbaceous vegetation will typically regenerate within one or two growing seasons. In forested and shrub dominated wetlands, the impact will last longer due to the longer recovery period of these vegetation types. Clearing of wetland vegetation will also temporarily remove or alter wetland wildlife habitat. In areas where the pipeline is collocated with other utilities or roads in wetlands, the minor effect on those wetlands due to a small increase in the corridor width would not cause a loss of wetland functional values.[37]

Enbridge thereby acknowledges that impacts to forested and shrub dominated wetlands are longer than one or two growing seasons. In addition, the idea that emergent wetlands would grow back to their previous state in one or two growing seasons is not supported by any documentation or examples from previous projects. Enbridge asks the Corps to simply take its word that the emergent wetlands will respond within 1-2 seasons. As noted above, that is not how this process works. Instead, the Corps must make its own independent evaluation of this point when estimating wetland impacts, and, as discussed more fully below, the Corps must also acknowledge that construction will cause soil compaction and the pipeline itself is likely to disrupt wetland hydrology. In its DEIS, DNR acknowledges that "[o]nce disturbed, wetlands recover very

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[36] WIS. DEPT. OF NAT. RES., SCOPE STATEMENT INCLUDING PROPOSED AMENDMENTS TO NR 350 at 8, available at https://dnr.wi.gov/topic/wetlands/documents/studyCouncil/DNRNR350RevisionDraftJune2020.pdf.
[37] Enbridge Energy, LP, Environmental Impact Report at 96 (Aug. 2020), available at https://widnr.widen.net/s/kgqkrwvswk/el5_enbridge-eir_updated-submittal_8-28-2020.

slowly—especially in colder climates like northern Wisconsin—and research has shown that present restoration efforts fail to restore original functions of wetland ecosystems even after decades of restoration[.]"[38]

Thus, the Corps cannot properly characterize these impacts as "temporary" and must reallocate the totals to present the real impact of the project in its evaluation of whether the project will cause significant adverse impacts. It must also require that Enbridge properly mitigate those non-temporary impacts.

ii. Failure to adequately account for short- and long-term construction impacts to wetlands.

In addition, the true impacts of the project, both truly temporary or permanent, are unknown for several reasons. As noted, *supra*, Enbridge has not proposed any pre- or post-construction hydrological monitoring and characterization to evaluate wetlands impacts.

First, Enbridge's application describes as wetland "conversion" what is likely to be in some cases permanent wetland destruction, or at least such a degradation in wetland functional value that crediting it as mere conversion is inaccurate and inadequate. Removing trees and overstory from a forested wetland does not convert it to a viable "emergent wetland"; rather, it destroys the existing forested wetland.

Second, Enbridge fails to account for impacts to the wetland water quality from trench water discharges even though Enbridge has no specific plan for preventing discharge of sediment to any specific wetland and does not plan to monitor discharges. Pipeline projects through wetlands require trench dewatering and the water disposed during that process often has high turbidity[39] that may exceed applicable wetland water criteria for total suspended solids (TSS).[40] Turbid water impairs wetland functional values like the capacity for filtration or storage of sediments or nutrients,[41] providing habitat for aquatic and amphibian organisms,[42] and other values.[43] Temporary trench dewatering can also cause irreversible sediment consolidation and mobilize nutrients, which can significantly affect wetland functional values.[44] These impacts can propagate through the landscape such that the predicted acreage of wetlands affected in the application is too low to be an accurate assessment of impacts to wetlands. Enbridge clarifies that it will "collect and analyze samples of the discharge water if specified by the applicable permit conditions,"[45] but evidently, not otherwise. Enbridge specifies that it has no concrete plan for preventing

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[38] DEIS, *supra* note 34, at 220.
[39] *See* ALMENDINGER ENVIRONMENTAL MEMO., *supra* note 19, at 5.
[40] *See* Wis. Admin. Code § NR 103.03(2)(d)-(f).
[41] Wis. Admin. Code § NR 103.03(1)(c).
[42] Wis. Admin. Code § NR 103.03(1)(e)-(f).
[43] *See generally* Wis. Admin Code § NR 103.03(1).
[44] *Id.* at 6.
[45] ENBRIDGE EPP, *supra* note 25, at 24.

sediment uptake or preventing discharge of sediment-laden waters but, instead, will “assess” each “water discharge situation,” and provides a suite of possible, unrequired measures.[46] The Corps therefore has no assurance that the construction techniques or filtering devices Enbridge may use will filter water such that state water quality criteria for TSS are achieved.

Third, Enbridge does not account for additional impacts from HDD. As described above, the pressurized mud to drill under wetlands can escape along fractures in the overburden or through permeable layers and reach the surface or stream channels.[47] The mud flows kill vegetation and imperil aquatic life.[48] Enbridge has failed to provide sufficient information to show that wetland crossings using HDDs will be performed in a manner to avoid frac-outs and thereby avoid impacts to wetland functional values such that the Corps can issue a wetland permit for these crossings.

Fourth, wetland impacts persist after pipeline construction. Studies have shown that, even decades after pipeline construction, “wetlands may not fully recover their prior ecological function.”[49] These impacts occur because pipelines can block or dam water flow across a wetland surface or highly-permeable subsurface layers.[50] And, in areas where the pipeline does not block flow directly, nearby access roads can reduce hydraulic conductivity and thereby dam lateral flow through a wetland.[51] These long-term hydrologic impacts can cause significant adverse impacts to wetland function values by changing the nutrient composition of the soils, causing knock-on effects to water quality, and increasing greenhouse gases.[52] These impacts are not described or quantified in Enbridge’s application.

Fifth, the application fails to acknowledge impacts to local wildlife and the ability of wetlands to support local wildlife, including birds. Habitat fragmentation from pipeline construction in forested wetlands will increase edge effects, and as DNR recognizes in its DEIS, “[f]orest interior birds would be negatively impacted by fragmentation.”[53] This statement does not fully acknowledge the critical role of nesting, roosting, foraging, and dispersal habitat for birds and does not attempt to measure the impact to the bird communities as opposed to the proposed (likely underestimated) impacts to the forest.

Sixth, the application does not describe post-construction right-of-way (ROW) management protocols and, even now that DNR has produced a DEIS, even *DNR* cannot clearly describe any potential long-term and cumulative ecosystem disturbances of Enbridge’s maintenance of the

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[46] *Id.* at 23.
[47] *Id.*
[48] *Id.*
[49] *See Id.* at 5.
[50] *Id.* Enbridge proposes to use soil decompaction in many wetlands but has expressly noted that “[t]he presence of stumps and roots may preclude the activity in forested areas where ditch plus spoil segregation occurred.” ENBRIDGE EPP, *supra* note 25, at 11.
[51] *See* ALMENDINGER ENVIRONMENTAL MEMO., *supra* note 19, at 6-7.
[52] *See id.*; *see also* Wis. Admin. Code § NR 103.03(1)-(2) (describing wetland water quality standards).
[53] DEIS, *supra* note 34, at 219.

ROW corridor. Instead, DNR describes this proposed maintenance by stating that Enbridge will manage the permanent ROW easement "on a regular basis by removing brush and trees to prohibit the growth of woody vegetation over the pipelines for safety and pipeline integrity issues."[54] This description does not describe possible ROW management techniques like herbicide treatment, mowing, arial herbicide, and other ROW management that could cause significant impacts to wetlands within the ROW. In addition, Enbridge's revised EPP provides no detail about controlling invasive species once the pipeline is installed and during long-term ROW management. Its discussion focuses on prevention and control of invasive species propagation during construction but not after.[55] DNR acknowledges that invasive species are generally located along utility corridors and roadsides,[56] and by creating a new utility corridor, Enbridge will likely exacerbate the spread of invasive species. Once Enbridge establishes the full ROW maintenance plan, the Corps must evaluate the true impacts of the project, including cumulative and long-term impacts, considering shifts likely due to climate change.[57] ROW maintenance and the spread of invasives will impair wetland functional values and cause violations of the state wetland water quality criteria, such that the Corps cannot grant this individual permit.

Seventh, Enbridge insufficiently describes its trench soil profile restoration standards for wetlands to ensure that wetlands will be restored post-construction. Instead, Enbridge leaves significant discretion to the contractor and allows the soil to mound more up to 12 inches above the adjacent, undisturbed soil.[58] In unsaturated wetlands, Enbridge may specify a lower maximum height "based on site conditions."[59] Or, Enbridge commits only that if uneven settling or documented surface drainage problems occur, it "will take appropriate steps to remedy the issue."[60] These are not performance standards and are not binding on the company. The Corps cannot fully evaluate construction impacts to wetlands without understanding the post-construction performance standards for every wetland. General statements about "appropriate steps," particularly without baseline monitoring data, are insufficient.

Eighth, Enbridge does not address the impacts of a spill of product from the pipeline once it is operational. Pipeline operation and spills must be considered. Pipeline spills are a matter of "when" not "if." The U.S. Forest Service's review of Pipeline and Hazardous Materials Safety Administration (PHMSA) data showed that from 2004 to 2017, there were an average of 186 incidents involving crude oil pipeline systems in the United States annually, averaging 42,517 barrels of crude oil released per year.[61] Twenty-nine percent of that oil was never recovered from

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[54] *Id.* at 59.
[55] ENBRIDGE EPP, *supra* note 25, at 2-3.
[56] DEIS, *supra* note 34, at 119.
[57] *See, e.g.*, *id.* at 117 (acknowledging that climate change will amplify the potential for the spread of invasive species).
[58] ENBRIDGE EPP, *supra* note 25, at 10.
[59] *Id.* at 10.
[60] *Id.* at 10-11.
[61] TROY R. THOMPSON, USDA FOREST SERVICE, REGION 9, U.S. FOREST SERVICE HYDROGEOLOGICAL ASSESSMENT OF THE ENBRIDGE PIPELINE SECTION ON THE CHEQUAMEGON-NICOLET NATIONAL FOREST: TECHNICAL REPORT 4, (2019).

the environment.[62] In addition to the environmental costs attendant with allowing the Line 5 pipeline to continue to operate, there are costs associated with the construction and operation of this project. These costs include the risks and harms to species, wetlands, and water quality detailed throughout these comments.

For all these reasons, Enbridge fails to describe the true impacts of the project, both temporary and permanent and the Corps cannot make a full evaluation as required under its regulatory authorities without making its own independent evaluation. Once the full wetland impacts of the project are assessed it will be clear that the project cannot go forward without violating state water quality standards or significantly degrading aquatic resources.

iii. <u>Failure to adequately characterize cumulative impacts.</u>

As part of its public interest evaluation, discussed more fully below, the Corps must evaluate the cumulative impacts attributable to the proposed project that may occur by considering "the probable impacts, including cumulative impacts" and carefully weighing all relevant factors.[63] Enbridge has failed to adequately characterize the project's anticipated impacts to wetlands in connection with the cumulative impacts on the landscape. For this additional reason, the Corps is unable to assess impacts to wetlands from the proposed project.

In the project area, land use changes like conversion to agriculture and road-building have already altered the landscape and increased soil erosion and the mobility of toxics and nutrients.[64] Sediment cores collected from lakes in northern Wisconsin in 2012 and 2014 showed that soil sedimentation rates increased by 50-150% since approximately 1900.[65] The road network also added lead to the lakebed sediment from historic use of leaded gasoline causing air deposition.[66] Enbridge proposes to install the pipeline on top of this disturbed landscape and thus the Corps must consider the impacts of pipelines to wetlands cumulatively with the impacts from roads and other land use changes when addressing impacts to wetland functional values. As already described, a cumulative increase in turbidity and erosion will impact several wetland functional values.

For example, Enbridge proposes to disturb Feature ID wirc013f, a large, forested wetland area associated with Vogue Creek.[67] The complex is comprised of thousands of acres of relatively undisturbed wetland, but Enbridge proposes to cross it using an open trench pipe installation technique with an estimated impact of 3.61 acres of temporary impact and 1.75 acres of converted forest wetland to marsh habitat. Given the remoteness of this proposed crossing, the

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[62] *Id*.
[63] 33 C.F.R. § 320.4(a).
[64] *See* ALMENDINGER ENVIRONMENTAL MEMO., *supra* note 19, at 8.
[65] *Id.* at 8-9.
[66] *Id.* at 9.
[67] DEIS, *supra* note 34, at app. H pp.40.

initial disturbance of the construction work, the hypothetical restoration of the wetland vegetation quality and routine disturbance from long-term maintenance activities, the cumulative impacts of the pipeline will very likely be much higher and certainly not documented or considered in the application. More generally, Enbridge proposes other open trench crossings through wetlands but fails to define performance standards for the restoration or assess these impacts together with past impacts or future reasonably anticipated projects.

In addition, Enbridge does not sufficiently describe the impacts of increased, intense rainfall events on the significant impacts to wetlands when pipeline construction occurs during those rainfall events. The project area experienced extremely high rainfall events in 2012, 2016, and 2018. In particular, a 2016 storm in the project area caused widespread flooding and landscape changes, in addition to tragic loss of life, numerous injuries, and loss of homes and other property damage.[68] The Corps must consider information such as the likely increase in high rainfall storm events as well as other anticipated impacts of climate change when evaluating the project's impacts to wetlands. The increase in high intensity rainfall events must also be considered when evaluating the risk of a spill.[69]

e. The Proposed Project Must Not Cause or Contribute to the Degradation of the Environment.

In addition to determining whether there are less damaging alternative routes or activities to the proposed pipeline project, the Corps also must take all appropriate steps to minimize the project's adverse impacts.[70] Enbridge has still provided little information about its intent to mitigate the impact of wetland disturbance, setting aside whether those impacts are undercounted for all the reasons described above.

The route passes through high quality wetlands, but the proposed mitigation does not address how any compensatory mitigation might compensate for impacts to these high-quality wetlands. For example, Enbridge identifies two mitigation banks but does not evaluate whether they are functioning, whether they have available credits for sale of the particular types and sizes needed to compensate for the wetland impacts to high quality wetlands proposed in the project, or whether Enbridge has made any efforts to secure those credits.[71]

In addition, Enbridge has straightforwardly recognized that "the wetland banks may not have adequate available credits for the [palustrine forested] wetland type impacts, which may require an alternative compensatory mitigation strategy such as purchasing additional [palustrine scrub-

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[68] NORTHWEST REGIONAL PLANNING COMMISSION, NORTHWEST WISCONSIN FLOOD IMPACT STUDY, HAZUS-MH LEVEL 2 ANALYSIS 1-3 (Nov. 2018), *available at* https://nwrpc.com/DocumentCenter/View/1494/Northwest-Wisconsin-Flood-Impact-Study?bidId= (last visited July 6, 2020).
[69] *See also* MEA July 2020 Comments at 16-18.
[70] 40 C.F.R. § 230.10.
[71] *See* DEIS, *supra* note 34, at 206.

shrub] credits or using the [in lieu fee] option."[72] Table 3-2 in the permit application narrative documents that 30.06 acres of palustrine forested wetland and 3.89 acres of palustrine scrub-shrub wetland will be permanently converted to a different habitat type. However, Table 4-4 in Enbridge's Mitigation Strategy document clearly shows that there are inadequate wetland mitigation credit acres of "hardwood swamp or coniferous" habitat types.[73] The currently available wetland mitigation credits for that habitat type, between the two appropriate mitigation banks, only add up to 12.04 acres.[74] This lack of wetland mitigation credits will result in an undocumented and additional temporal loss of wetland functions and values to the region.

Enbridge has also proposed using the In-Lieu-Fee Program through the Wisconsin Wetland Conservation Trust,[75] but those currently undefined future wetland credits will take years to come to fruition. These temporal losses of habitat values are not addressed in the permit application. This loss is multiplied by the replacement of mature forested wetlands with young, newly planted wetlands that will take decades to truly replace the lost resources.

In addition, the proposed mitigation ratios are too low for high quality wetlands. The proposed mitigation ratio for high quality forested wetland is 1:0.7 (replacement versus existing acre) and 1:0.6 for low and medium quality wetland. Similarly for palustrine scrub-shrub habitats, the proposed replacement ratio for high quality areas is at 1:0.6 and low and medium quality areas at 1:0.5. These ratios will categorically result in a decrease in forested and scrub-shrub habitat acres in the project area through both temporal and cumulative losses. The lost habitat types should at a minimum be at a replacement ratio of at least 1:1, perhaps even higher for high quality and more mature forested habitats. Likewise, EPA Region 5 recommends that Enbridge revise the mitigation plan to include a scientifically-based rationale for the ratios proposed, including a mitigation/waterbody restoration plan for *all* of the 72 federally jurisdictional waterbody crossings.[76] We add that this restoration plan must compensate for the proposed ROW management that may continue to affect wetlands throughout the life of the pipeline.

Enbridge is required to avoid, minimize, or mitigate wetland impacts for each wetland impacted, otherwise it cannot be issued an individual permit for its project. Its mitigation plan is insufficiently described and Corps cannot approve the wetland fill application on that basis alone.

For all of the foregoing reasons, a lack of baseline hydrological monitoring, failure to adequately describe impacts to wetlands, lack of information sufficient to perform a true alternatives analysis for impacts to each wetland, and an insufficiently described mitigation plan, Enbridge's

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[72] Enbridge, Line 5 Segment Relocation Project: Compensatory Mitigation Strategy (Nov. 2021) [hereafter "Mitigation Strategy Document"] available at https://www.mvp.usace.army.mil/Portals/57/docs/regulatory/Enbridge/EnbridgeLine5/L5R_Mitigation_Plan_20211130.pdf?ver=ICqiMkh86AOT8LxF7Fi2aw%3d%3d.
[73] *See id*. at 8.
[74] *Id.*
[75] *Id.* at 8, 10.
[76] Letter from U.S. EPA Region 5, *supra* note 35, at 6, 17-18.

wetland permit application must be denied because it cannot show that the project meets the applicable regulatory standards and would appropriately mitigate for unavoidable impacts to waters of the United States.

f. The Proposed Project Must Avoid Destruction of Wetlands and Waterways to the Extent Possible.

The Corps is required to avoid losses "to the extent practicable."[77] As further guidance, the Corps' 404(b)(1) guidelines state that a section 404 permit should only be issued if the applicant takes "all appropriate and practicable steps to avoid and minimize adverse impacts to waters of the United States."[78]

Although the Corps has historically not considered conversion of wetland type a permanent loss of waters of the United States even if that conversion results in the permanent loss of certain functions, which would require compensatory mitigation,[79] this position is contrary to that taken by EPA Region 5 as discussed above. It also does not allow the Corps to avoid evaluating the adverse impacts of wetland conversion and resulting loss of wetland function. Any deforestation of wetlands or other conversion of wetlands is a loss of waters, and the Corps' policy effectively permits projects that will permanently deforest unlimited acreage of high-quality forested wetlands. Indeed, such impacts, including loss of certain wetland functions, must not go unanalyzed or unmitigated. Enbridge's application for an individual permit understates impacts and therefore does not provide sufficient mitigation.

In addition, Enbridge must conduct water quality monitoring to ensure that the waterways it proposes to cross will not affect cold water fishing communities or other high-quality waters by increasing temperature or decreasing dissolved oxygen. Enbridge must be required to install water quality monitoring to capture baseline conditions and implement adaptive management measures to ensure that waters are not impaired because of construction or operation of the pipeline.[80] This adaptive management plan must also address any possible environmental impacts from the blasting proposed in wetlands and waterways. Without baseline and ongoing water quality monitoring and fully developed adaptive management and mitigation plan, the Corps cannot avoid losses "to the extent practicable" or ensure that the applicant takes "all appropriate and practicable steps" to avoid adverse impacts, as required by law.

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[77] 33 C.F.R. § 320.4(r).

[78] 40 C.F.R. § 230.91(c)(2).

[79] In its recent Nationwide Permit reauthorization, the Corps did acknowledge "permanent adverse effects," from conversion of wetland type. *See* MAJOR GENERAL GRAHAM JR., U.S. ARMY, DECISION DOCUMENT AND ENVIRONMENTAL ASSESSMENT, NATIONWIDE PERMIT 12 at 20, 90-91 (Jan. 4, 2021) (on file with author).

[80] Letter from U.S. EPA Region 5, *supra* note 35, at 14-15.

g. The Corps Cannot Find that Issuing the Permit is in the Public Interest.

To issue a permit to Enbridge, the Corps must determine that the project is in the "public interest" by considering all of "the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest," and carefully weighing all relevant factors.[81] The project's benefits "must be balanced against its reasonably foreseeable detriments."[82] The balancing "should reflect the national concern for both the protection and utilization of important resources,"[83] and the protection of the ecosystem of northern Wisconsin as well as the Great Lakes, the largest freshwater system in the world, is of undoubtedly high concern. The Corps must consider "[a]ll factors which may be relevant to the proposal . . . including the cumulative effects thereof[.]"[84]

Enbridge failed to provide the Corps with the information it needs to determine that the benefits of the project outweigh the costs. The Corps' regulations list the public interest factors to be considered, including: "conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership and, in general, the needs and welfare of the people."[85]

As part of the public interest balancing, the Corps must consider "[t]he relevant extent of the public and private need for the project." Enbridge to date has not provided the Corps with information about how project construction will impact erosion in a site-by-site manner, has performed an insufficient cultural and historic properties review, has not fully modeled impacts to private wells, or impacts to water quality and fish habitat from an inevitable oil spill. All of these issues must be fully evaluated in the Corps' public interest review. For example, as discussed further below in the NEPA section,[86] the Corps must consider the lack of long-term demand for the oil; the need for Line 5 after the Trans Mountain Expansion Project pipeline is built in eastern Canada by 2023, the risk of oil spills; and climate change, in addition to the other topics raised below Enbridge has not provided the Corps with sufficient information to conduct a public interest balancing evaluation and the Corps cannot therefore conclude that the project is in the public interest.

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[81] 33 C.F.R. § 320.4(a).
[82] *Id*.
[83] *Id*.
[84] *Id*.
[85] *Id*.
[86] *See infra* § III.

i. The public interest evaluation must also include an independent review of the economic benefits and costs under 33 C.F.R. § 320.4(q).

In addition, as part of this public interest evaluation, the Corps may make an independent review of the economic benefits "from the perspective of the overall public interest."[87] Although, according to the regulations, it will generally be assumed that a proposal is economically viable based on "the appropriate economic evaluations," where, as here, that assumption is called into question because of material facts about the necessity of the project after 2023,[88] the Corps must undertake an independent review to ensure that the project is indeed economically viable from a public interest perspective. That review must also account for the economic costs of the project, including the socioeconomic costs from greenhouse gas emissions and other climate change impacts of the project and its effect of allowing the continued operation of Line 5.

ii. The public interest evaluation must evaluate the economic and environmental costs of an oil spill.

For purposes of the public interest balancing evaluation and the specific economic evaluation, the Corps must appropriately account for the risk of an oil spill. As explained elsewhere, pipeline spills are a matter of "when" not "if." The U.S. Forest Service's review of PHMSA data showed that from 2004 to 2017, there were an average of 186 incidents involving crude oil pipeline systems in the United States annually, averaging 42,517 barrels of crude oil released per year.[89] Twenty-nine percent of that oil was never recovered from the environment.[90] According to a review of PHMSA records, Line 5 has spilled more than a million gallons of oil and natural gas.[91] In addition to the costs attendant with allowing the Line 5 pipeline to continue to operate, there are costs associated with the construction and operation of this project. These costs include the risks and harms to species, wetlands, and water quality detailed throughout these comments.[92]

iii. The public interest evaluation must evaluate the impact of the intended use of the proposed activity on access to public trust resources given 2019 Wisconsin Act 33.

As part of the public interest evaluation, the Corps must consider, in addition to relevant factors such as impacts on navigation and recreation, "[t]he extent and permanence of the beneficial

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[87] 33 C.F.R. § 320.4(q).
[88] *See infra* § III.c.
[89] Thompson, *supra* note 61, at 4.
[90] *Id.*
[91] Drew YoungeDyke, *Line 5 Oil Pipeline System Spanning Michigan Has Had 29 Known Spills, Nearly Doubling the Number Previously Believed to Have Occurred*, NAT'L WILDLIFE FED'N Press Release (Apr. 24, 2017), *available at* https://www.nwf.org/Latest-News/Press-Releases/2017/4-24-17-Line-5-Oil-Pipeline-System-Spanning-Michigan-Has-Had-29-Known-Spills.
[92] *See infra* § III.d.iii.

and/or detrimental effects which the proposed structure or work is likely to have on the public and private uses to which the area is suited."[93]

Everyone in Wisconsin has a state constitutional right to enter any navigable water[94] from a public access point and engage in public trust uses, including navigation, hunting, fishing, and other recreational activities, in the entire navigable water so long as they keep their feet wet.[95] However, the Wisconsin Legislature recently enacted a trespass statute, 2019 Wisconsin Act 33, that criminalizes engaging in traditional uses on public trust properties where an oil pipeline operates. The Corps must consider the impact the intended use of the proposed activity—to continue operating Line 5—will have on access to public trust resources and the full enjoyment thereof once the new segment becomes operational.

Act 33 made it a Class H felony, punishable by up to six years in prison, a $10,000 fine, or both, for anyone who "intentionally enters an energy provider property without lawful authority and without the consent of the energy provider that owns, leases, or operates the property."[96] Energy provider is defined to include "[a] company that operates a[n] . . . oil, petroleum, refined petroleum product . . . generation, transportation, or delivery system."[97] Energy provider property is defined as "property that is part of an . . . oil, petroleum, refined petroleum product . . . generation, transmission, or distribution system and that is owned, leased, or operated by an energy provider."[98]

The language of this new criminal statute can be broken up into two parts, which can then be divided into subparts or elements. The first part of the statute is the crime itself—intentionally entering energy provider property. Subparts of the crime include (1) the mens rea element, intentionally; and (2) the actus reus element, entering an energy provider property. The second part of the statute is the exception to the crime, which requires the actor to have both (1) lawful authority to enter the energy provider property; and (2) the consent of the energy provider to enter that property.

The mens rea element is defined in statutory law:

> "Intentionally" means that the actor either has a purpose to do the thing or cause the result specified, or is aware that his or her conduct is practically certain to cause that result. In addition . . . the actor must have knowledge of those facts

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[93] 33 C.F.R. § 320.4(a)(2).
[94] "Navigable water" has a much broader definition under Wisconsin state law than it does under federal law and must be analyzed under the public interest test accordingly. *See* Wis. Stat. § 30.10(1), (2)(a); *see also State v. Kelley*, 2001 WI 84, ¶ 30, 244 Wis. 2d 777, 629 N.W.2d 601 (2001).
[95] See, e.g., *Doemel v. Jantz*, 180 Wis. 225, 193 N.W. 393 (1923); but see Wis. Stat. § 30.134 (allowing the use of exposed shore areas of navigable waters to bypass an obstruction).
[96] Wis. Stat. § 943.143; see also Wis. Stat. § 939.50(3)(h) (establishing the penalty for Class H felonies).
[97] Wis. Stat. § 943.143(1)(a)6.
[98] Wis. Stat. § 943.143(1)(b).

> which are necessary to make his or her conduct criminal and which are set forth after the word "intentionally."[99]

Importantly, a person does not need to intend to commit a crime.[100] To have the requisite intent, a person only has to know they are engaging in the actus reus, or conduct, that constitutes the crime. Here, that means entering a portion of a navigable waterway and knowing that an oil pipeline is operating beneath it.

Enbridge clearly qualifies as an energy provider under the statute. And since any property on which an oil distribution system is operated constitutes energy provider property without exception,[101] navigable waters under which an oil pipeline operates may very well qualify as energy provider property.

Below ground hazardous liquid pipelines such as Line 5 must be marked throughout the right-of-way corridor such that the pipeline's "location is accurately known", potentially creating a presumption of knowledge and fulfilling the intent element of the crime.[102] The result is that a person who is simply exercising their right to enjoy public trust uses in those portions of navigable waterways may be subject to felony prosecution unless they qualify for the exception to the crime, which requires the person to have both lawful authority to be on the property and permission from the energy provider.[103]

As established above, the public already has "lawful authority"—i.e., a state constitutional right—to enter those portions of navigable waters the proposed project will cross. However, the exception to the crime is only triggered if there is also consent from the energy provider.

While such consent would theoretically eliminate the possibility of being convicted (not necessarily prosecuted) for a felony under Act 33, it is not clear exactly how such consent would be granted and effectively communicated in perpetuity. In any event, such consent would not eliminate impacts stemming from the law. For example, fear of felony prosecution could be a significant deterrent to engaging in public trust uses in navigable waters even near oil pipelines given uncertainty over whether consent has been provided and how the law will be interpreted and implemented by local law enforcement. Such a deterrent could also reduce potential for the general public to discover and report leaks through visual inspections, which is not uncommon.[104]

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[99] Wis. Stat. § 939.23(3).
[100] Wis. Stat. § 939.23(5).
[101] Even the list of general exceptions to Wis. Stat. § 943.143 does not include persons engaged in public trust uses. *See* Wis. Stat. § 943.143(3).
[102] 49 C.F.R. § 195.410(a)(1).
[103] Wis. Stat. § 943.143(2).
[104] *See infra* § III.d.ii.

It is therefore highly likely that the proposed project will impact access to public trust resources and the full enjoyment thereof once the new segment becomes operational, and therefore have a detrimental effect on the public uses to which navigable waters are suited.

h. The Corps Should Regulate Dredging Impacts in Waterways the Proposed New Segment Does Not Cross.

The most recent Waterway Crossing Table on the Corps' project application website is underinclusive and should be updated to include waterways the proposed new pipeline segment does not cross but will nevertheless be impacted by dredging. The Public Notice indicates that the Corps is treating all waters as jurisdictional for the purposes of Section 404 permitting and of course recognizes that the Corps has regulatory authority over discharges of dredged or fill material, including temporary discharges.[105] However, the updated Waterway Crossing Table does not include all waterways where Enbridge has indicated it will engage in dredging, which will result in temporary discharges. Based on the Wetland and Waterbody Table attached to the DEIS as Appendix G, we recommend the Corps update the Waterway Crossing Table to include the following water features:

sasc012e_x	sase012e_x2	sasa020i	sasc1104e_x2	sasc1004e_x3	sasa1026e
sasc1001i	sasv001p	sasb005e	sasb003e	sasd017e	sasd018e
sasw011_x2	sasw011_x3	sasw010	sasw009_x1	sasw009_x2	sasw007
sirb009p	sirb1002e	sira006i_x1	sira005i	sira006i_x2	WDH-107_x1

Consistent with the Corps' past practice, such an update to the Waterway Crossing Table should include a corresponding extension of the public comment period to adequately consider direct and cumulative impacts.

III. NATIONAL ENVIRONMENTAL POLICY ACT.

a. Legal Background.

NEPA requires all agencies of the federal government to prepare an EIS for all "major Federal actions significantly affecting the quality of the human environment."[106] NEPA requires an evaluation of "any adverse environmental effects" of the proposed action "to the fullest extent

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[105] U.S. ARMY CORPS OF ENGINEERS, *supra* note 1, at 4, 10.
https://www.mvp.usace.army.mil/Portals/57/docs/regulatory/Enbridge/EnbridgeLine5/2020000260SP.pdf.
[106] 42 U.S.C. § 4332(2)(C).

possible."[107] This analysis must include a "hard look" at all impacts from any foreseeable impacts from any activity that the Corps' permitted action allows, including pipeline operation.[108] That "hard look" must include consideration of impacts that "occur at the same time and place"[109] as the authorized activities and reasonably foreseeable impacts like HDD frac-outs, greenhouse gas emissions,[110] fuel spills and leaks,[111] and cumulative impacts to wetlands and waterways in a linear project in a sensitive landscape.

While the CEQ revised its NEPA regulations in 2020 to remove the longstanding cumulative impacts provision, these revisions are contrary to statute, as CEQ has recently indicated. CEQ formally proposed to discard the 2020 regulation and revert to the prior, broader definition precisely because the "2020 Rule's limiting language could cause Federal agencies to omit critical categories of effects from analysis and disclosure, frustrating NEPA's core purpose and Congressional intent" in enacting NEPA.[112]

Regardless, the 2020 regulations currently in place require an analysis of environmental impacts that "are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives, including those effects that occur at the same time and place as the proposed action or alternatives and may include effects that are later in time or farther removed in distance from the proposed action or alternatives."[113] And, the Corps' regulations require consideration of cumulative effects.[114]

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[107] *Id.* (emphasis added); *Kleppe v. Sierra Club*, 427 U.S. 390, 409-10 (1976) (noting Congress's mandate that agencies use "all practicable means" to "assure consideration of the environmental impact of their actions in decisionmaking") (citations omitted).
[108] 42 U.S.C. § 4332(C); *see also* 33 C.F.R. § 320.4(a)(1) (requiring the Corps to evaluate the impacts "of the proposed activity and its intended use on the public interest" including an evaluation of "the probable impact which the proposed activity may have on the public interest").
[109] *See* 40 C.F.R. § 1508.1(g).
[110] *See, e.g.*, *Wilderness Workshop v. U.S. Bureau of Land Mgmt.,* 342 F. Supp. 3d 1145, 1167 (D. Colo. 2018) ("BLM failed, in part, to take a hard look at the severity and impacts of GHG pollution. Namely, it failed to take a hard look at the reasonably foreseeable indirect impacts of oil and gas.").
[111] *See, e.g., Standing Rock Sioux Tribe v. United States Army Corps of Engineers*, 985 F.3d 1032, 1045-49 (D.C. Cir. 2021) (the Corps' EA for the Dakota Access oil pipeline violated NEPA by failing to adequately evaluate the risks and potential impacts of oil spills); *see also Stop the Pipeline v. White*, 233 F. Supp. 2d 957, 967 (S.D. Ohio 2002) (recognizing the Corps' obligation under NEPA to analyze oil spills in issuing a Section 404 permit for an oil pipeline).
[112] National Environmental Policy Act Implementing Regulations Revisions, 86 Fed. Reg. 55,757, 55,766 (Oct, 7, 2021).
[113] 40 C.F.R. § 1508.1(g).
[114] *See* 33 C.F.R. Pt. 325, app. B ("In any case, once the scope of analysis has been defined, the NEPA analysis for that action should include direct, indirect and cumulative impacts on all Federal interests within the purview of the NEPA statute").

As the CEQ has recently acknowledged, NEPA requires consideration of impacts outside the agency's jurisdiction.[115] The Corps is also required to analyze potential environmental impacts, including the possible impacts of oil spills and greenhouse gas emissions, even where it does not directly "regulate" the underlying activity or where the activities are regulated by another agency.[116]

Relevant CEQ Guidance on consideration of GHGs is also currently under review, but until updated guidance is issued, agencies "should consider all available tools and resources in assessing GHG emissions and climate change effects of their proposed actions, including, as appropriate and relevant, the 2016 GHG Guidance."[117] The 2016 CEQ Guidance instructs agencies to consider the extent to which a proposed action, and the identified alternatives to it, would contribute to climate change through GHG emissions and to account for those impacts.[118] The scope of analysis should include any "connected actions."[119] As when considering any impacts, the Corps must also consider any other actions that have a close causal relationship to the proposed action and their GHG impacts as part of its NEPA analysis.[120] The 2016 Guidance also explains that agencies should consider reasonable measures to reduce or mitigate GHG emissions.[121] An agency should also include and analyze federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reduction or climate adaptation to make clear whether a proposed project's GHG emissions are consistent with such plans or laws."[122]

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[115] See, e.g., NEPA Implementing Regulations Revisions 86 Fed. Reg. at 55,766 ("Reasonably foreseeable environmental effects do not fall neatly within discrete agency jurisdictional or regulatory confines.").

[116] *See, e.g.*, *Standing Rock Sioux Tribe*, 985 F.3d at 1048-49*; see also* Calvert Cliffs Coordinating Comm. v. Atomic Energy Comm'n, 449 F.2d 1109, 1123 (D.C. Cir. 1971) (certifications under other laws do not satisfy NEPA); S. Fork Band Council of W. Shoshone v. U.S. Dep't of Interior, 588 F.3d 718, 726 (9th Cir. 2009) (rejecting argument that impacts analysis is not required where a facility operates pursuant to a Clean Air Act permit).

[117] Notice of Rescission, 86 Fed. Reg. 10,252, 10252 (Feb. 19, 2021) available at https://www.govinfo.gov/content/pkg/FR-2021-02-19/pdf/2021-03355.pdf.

[118] CHRISTINA GOLDFUSS, COUNCIL ON ENVIRONMENTAL QUALITY, GUIDANCE ON CONSIDERATION OF GREENHOUSE GAS EMISSIONS AND THE EFFECTS OF CLIMATE CHANGE IN NATIONAL ENVIRONMENTAL POLICY ACT REVIEWS 13 (Aug. 1, 2016) (emphasis added) available at https://ceq.doe.gov/docs/ceq-regulations-and-guidance/nepa_final_ghg_guidance.pdf.

[119] *Id.* at 9.

[120] *Id.* at 13.

[121] *Id.* at 15.

[122] *Id.* at 28.

b. The Corps' NEPA Review Must Consider Uplands and All Connected Actions.

i. <u>The Corps cannot limit its NEPA review to waterways. The "uplands" are inseparable from the water crossings and come within the Corps' "control and responsibility".</u>

In evaluating the impacts to wetland fill or other federal actions, under NEPA, the Corps must evaluate the impacts of the entire proposed project, and not just the wetland fill.[123] This means that upland impacts and landscape level impacts from the project must be considered.

Of course, in addition to the topics discussed below, the Corps' NEPA analysis must include an evaluation of all the wetland and waterway impacts set forth above.

ii. <u>The connected actions allowing Line 5 to continue to transport hazardous liquids are connected, major federal actions triggering NEPA.</u>

The issuance of a dredge and fill permit pursuant to CWA § 404 for the Line 5 reroute is, on its own, a major federal action.[124] However, the Corps must analyze the entire Line 5 pipeline, including all connected and cumulative actions as well as all cumulative impacts, in a single NEPA document.[125] Courts have allowed individual components of pipelines and other linear projects to be analyzed in a separate NEPA document only if they would have "independent utility."[126] "The justification for the rule against segmentation is obvious: it 'prevent[s] agencies from dividing one project into multiple individual actions each of which individually has an insignificant environmental impact, but which collectively have a substantial impact.'"[127]

Regardless of whether the entire Line 5 pipeline is a major federal action and all related approvals must be considered in one EIS, or whether the Corps has to consider uplands, the Corps currently has two "major federal actions" related to Line 5 before it: the proposed new segment around

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[123] *See* 33 C.F.R. Pt. 325, app. B.
[124] *Standing Rock Sioux Tribe*, 985 F.3d at 1048-49; *Stop The Pipeline v. White*, 233 F. Supp. 2d 957 (S.D. Ohio 2002) (Corps prepared NEPA analysis for individual 404 permit for an 149-mile petroleum pipeline); Hammond v. Kempthorne, 448 F. Supp. 2d 114 (D.D.C. 2006) (BLM prepared EIS for the Williams oil pipeline project); *Spiller v. Walker*, A-98-CA-255-SS, 2002 WL 1609722 (W.D. Tex. July 19, 2002) *aff'd sub nom. Spiller v. White*, 352 F.3d 235 (5th Cir. 2003) (Corps' permitting of an oil pipeline was a major federal action).
[125] *See* 40 C.F.R. §§ 1501.9(e); 1501.3(b). CEQ is proposing to further revise the NEPA regulations during a phase 2 rulemaking. As noted at the beginning of this Section, a proposed rulemaking will restore a cumulative effects analysis, consistent with the NEPA statutory text and caselaw.
[126] *Hammond*, 370 F. Supp. 2d at 244 (applying the independent utility test and holding that an entire 480-mile oil pipeline must be analyzed in a single NEPA document); *Coal. on Sensible Transp., Inc. v. Dole*, 826 F.2d 60, 69 (D.C. Cir. 1987) (applying the independent utility test to a highway project).
[127] Delaware Riverkeeper Network v. F.E.R.C., 753 F.3d 1304, 1314, (D.C. Cir. 2014) (quoting *NRDC v. Hodel*, 865 F.2d 288, 297 (D.C. Cir. 1988)); *see also Taxpayers Watchdog, Inc. v. Stanley*, 819 F.2d 294, 298-99 (D.C. Cir. 1987) (the segmentation doctrine "was developed to insure that interrelated projects the overall effect of which is environmentally significant, not be fractionalized into smaller, less significant actions.").

Bad River, and the Michigan Tunnel Project. The Corps has issued public notices for both proposals and does not dispute that they each trigger NEPA. The two proposals meet the definition of "connected actions," as both would have to go forward in order for Line 5 to continue operating for decades to come. If only one proposal goes forward, it would be virtually useless without the other also going forward. Therefore, they do not have independent utility and must be evaluated together in an EIS.

c. The Corps Must Develop an Alternatives Analysis Sufficient to Comply with NEPA.

As explained more fully in the attached memorandum from Petra Pless, the DNR's DEIS fails to provide a sufficient alternatives analysis for the proposed project.[128] The DEIS considers impacts from several variations of the proposed reroute and a flawed "no action alternative" that relies on faulty economic assumptions regarding demand for Line 5 oil.[129]

The Corps' analysis must include a "no action alternative" that considers cessation of operation of the pipeline under reasonable economic assumptions, including the appropriate relationship between supply and demand of the oil delivered via Line 5. Any alternatives analysis that includes consideration of non-pipeline transportation of oil currently moved through Line 5, such as rail or truck, must include the most reasonable scenarios, which are likely dynamic combinations of truck or rail transport and use of existing pipeline capacity. Comparison of potential impacts from each alternative analyzed, including an appropriately designed "no action alternative," is central to NEPA's purpose and the Corps must carefully analyze alternatives to the proposed project that fully account for the various scenarios and their impacts.

In addition, in its alternatives analysis, the Corps must critically evaluate the need for Line 5 given market forces. It is anticipated that the Trans Mountain Pipeline expansion (TMX) from Alberta to British Columbia will be operational by 2023.[130] If Canadian crude oil production from the Canadian tar sands region stays the same or falls, then throughput on the Enbridge Mainline System could drop by up to about 450,000 bpd, because this amount of oil would instead flow to the Pacific on TMX. While this transfer of shipments would likely not decrease crude oil flows to the Sarnia region, because it is nearly 100% dependent on Enbridge pipelines, it would likely result in reduced shipments of Canadian crude oil to the U.S. Gulf Coast, which shipments travel on Line 61. This means that total unused capacity on Enbridge Pipelines to northern Illinois could increase to over 700,000 bpd – significantly more than currently flows through Line 5. Therefore, if TMX comes online as scheduled and if Canadian crude oil production does not grow, then the need for Line 5 could disappear in 2023.

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[128] Memorandum from Petra Pless, Pless Environmental, to Rob Lee, Midwest Environmental Advocates 37-38 (Mar 13, 2022) (attached hereto).
[129] *Id.*
[130] Trans Mountain Corporation Updates Expansion Project Cost and Schedule https://www.transmountain.com/news/2022/trans-mountain-corporation-updates-expansion-project-cost-and-schedule (Feb. 18, 2022).

Finally, as discussed in the section related to the Corps' duties under the Clean Water Act, the Corps' must perform an alternatives analysis for each proposed crossing of a wetland and waterway to determine the least damaging practicable alternative for each crossing to minimize impacts to wetlands.[131] This alternatives analysis is also required under NEPA.

d. The Corps Must Analyze All Direct, Indirect, and Cumulative Impacts Associated with the Construction and Operation of Line 5 and the Identified Alternatives.

i. GHG emissions and cumulative impacts.

The Corps' alternatives analysis of the proposed project is particularly important given the significant direct, indirect, and cumulative GHG impacts associated with Line 5. To satisfy NEPA's "hard look" requirement, the Corps' alternatives analysis must include comprehensive consideration of alternatives that accurately forecast market dynamics related to Line 5 oil, and alternatives that consider the potential impacts—or lack thereof—associated with decommissioning of the pipeline.

Direct impacts from GHG emissions will be associated with the construction of the project, including clearing and maintenance of vegetation for the right of way, and operational emissions of the pipeline. Indirect impacts include the loss of sequestration potential of the various types of vegetative cover and land uses in the right of way, the manufacturing of steel and concrete for the project, and the abandonment or removal of existing segments of Line 5.

Cumulative impacts include, but are not limited to, the annualized and life-cycle GHG emissions related to the proposed project. Importantly, the GHG impacts of the proposed project are well above any established significance thresholds for analysis in a full EIS. The federal government and state of Wisconsin have policies in place to reduce GHG emissions in the coming decades.[132] The Corps must analyze the proposed project's consistency with any applicable climate policies. The impacts and considerations listed above are not exhaustive, but merely illustrative of the type of analysis the Corps is required to perform in its environmental analysis of the GHG impacts of the proposed project.

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[131] *See supra* § II.c (discussing the alternatives analysis required under the Clean Water Act).

[132] *See e.g., FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies*, https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/ (President Biden announced target for the United States to achieve a 50-52 percent reduction from 2005 levels in economy-wide net greenhouse gas pollution in 2030); Executive Order #38 "Relating to Clean Energy in Wisconsin" at https://evers.wi.gov/Documents/EO%20038%20Clean%20Energy.pdf (directing state officials to "achieve a goal of ensuring all electricity consumed within the State Wisconsin is 100 percent carbon-free by 2050[,]" and "ensure the State of Wisconsin is fulfilling the carbon reduction goals of the 2015 Paris Climate Accord."

ii. Oil spills.

The Corps must fully analyze the impacts of an oil spill from the pipeline once it is operational. We note that the DEIS fails to account for the environmental impacts of a spill. As noted, Enbridge has not submitted baseline hydrology sufficient to characterize the impacts to wetlands affected by the project. Likewise, the lack of baseline hydrology data and geomorphology means that the DEIS does not adequately account for possible impacts of a worst-case spill or any spill of product from the pipeline once it is operational.[133] The Corps' NEPA analysis must include a full fate and transport analysis of any possible spill.

The Corps must do more than use the information in DNR's DEIS. The only discussion of the impacts from an oil spill occurs in one section of the DEIS.[134] It minimizes the risk of spill to Lake Superior and ignores the possibility of a spill reaching Lake Michigan, by stating "[w]hile 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."[135] This statement ignores likely impacts.[136] In general, the spill analysis is "too general to characterize the potential damage from a spill."[137] The liquid plume dispersion modeling appears not to include time-of-travel studies to predict impacts on a river or at stream crossings or acknowledge that these risks have increased because of an increased likelihood of larger, flood magnitude flows due to climate change.[138] This is particularly problematic because the risk of a rupture is highest during storm flows and many pipeline ruptures have occurred at stream crossings during floods.[139] A proper analysis must be performed that appropriately accounts for increased flood flows and performs accurate time-of-travel studies.

In addition, without the baseline hydrological monitoring of wetlands, the Corps cannot predict impacts of an oil spill to those wetlands.[140] The Corps must reject DNR's faulty assumption that most petroleum impacts on groundwater travel no further than 1200 feet and then properly model those impacts.[141] As DNR acknowledges in the DEIS, the OILMAPLand spill modelling used to evaluate impacts to High Consequence Areas "does not account for subsurface releases."[142]

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[133] *See also* Great Lakes Indian Fish & Wildlife Commission Letter re: Adequacy of the Line 5 Reroute Draft Environmental Impact Statement (DEIS) for Release to the Public to DNR (Dec. 10, 2021), available at https://widnr.widen.net/s/pvjvdmdjpz/el5_glifwc_prelimcomments_deis_dec2021.
[134] DEIS, *supra* note 34, at 272-307.
[135] *Id*. at 272.
[136] *See* ALMENDINGER ENVIRONMENTAL MEMO., *supra* note 19, at 8.
[137] *See id*. at 4-5.
[138] *Id.*
[139] *Id.* at 6-7.
[140] *Id.* at 6-7.
[141] *Id.* at 7.
[142] *See* Enbridge response to DNR Information Request of Oct. 29, 2021 at 4 (Nov. 4, 2021), available at https://widnr.widen.net/s/bxs66fgxsb/1_l5wsr-data-request-question-responses_20211104.

The Corps must also ensure that its NEPA analysis considers the risk of pipeline leaks, including those that may not be detected by the leak-detection systems proposed by Enbridge. Here, Enbridge proposes to rely on a computational pipeline monitoring (CPM) system to detect abnormal operating conditions in the pipeline that could indicate possible releases.[143] However, a 2012 Pipeline and Hazardous Materials Safety Administration (PHMSA) study found that in 80% of incidents where a CPM system was used, it was not that system, but often visual detection that uncovered a leak.[144] Here, where a pipeline is largely underground, visual identification cannot therefore be used to detect leaks and cannot make up for deficiencies in a CPM system, including the real possibility of human error.[145] Despite this, Enbridge predicts that response time would typically be 10 minutes or less.[146] The Corps must appropriately consider the risks of leaks and spills rather than rely on Enbridge's unrealistic prediction. Based on these PHMSA reports, the Corps must evaluate the environmental effects of an undetected seep or pinhole leak that can have a significant impact on the environment—Including analyzing the possible impacts of a worst-case discharge or the maximum amount of oil that might be spilled before a leak is detected and stopped. This analysis must include impacts to areas of high consequence like drinking water supplies, ecologically sensitive areas, and waterways including trout streams and wild rice areas.[147] This evaluation must also acknowledge the specific risks of an undetected spill during winter and quantify the additional time and therefore environmental impacts based on slip and fall risks and other factors that make winter spills more difficult to respond to.

The Corps must also make this evaluation based on Enbridge's specific safety record. As discussed elsewhere and in other comments, Enbridge pipelines have had numerous spills over the years, including since the catastrophic Kalamazoo spill forced them to adopt additional protocols. The

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[143] Enbridge EIR at 58 (§ 4.8.3).

[144] U.S. DEPT. OF TRANSP., PIPELINE AND HAZARDOUS MATERIAL SAFETY ADMINISTRATION, FINAL REPORT LEAK DETECTION STUDY at 2-10 – 2-11 (Dec. 10, 2012), https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/technical-resources/pipeline/16691/leak-detection-study.pdf.

[145] *See* PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMIN., POST-HEARING DECISION CONFIRMING CORRECTIVE ACTION ORDER, BELLE FOURCHE PIPELINE CO. 5 (Mar. 24, 2017), https://primis.phmsa.dot.gov/comm/reports/enforce/documents/520165013H/520165013H_HQ%20Post%20Hearing%20Decision%20Confirming%20CAO_03242017.pdf (describing an incident where a buried pipeline leak was not detected even though the leak detection system registered an imbalance).

[146] See Enbridge's Response to DNR Requests for Information of Feb. 1, 2021 at 56 (Mar. 3, 2021), available at https://widnr.widen.net/s/dsbs8hqsm2/l5wsrp-information-response-to-wdnr-20210302.

[147] Since DNR published its DEIS, PHMSA issued a new regulation, effective Feb. 25, 2022, designating the Great Lakes and coastal beaches as "unusually sensitive areas" and extending more stringent pipeline integrity management program requirements to those areas. *See* 86 Fed. Reg. 73173, 73181 (Dec. 27, 2021) (explaining that "operators need to consider the terrain around the pipeline and natural forces inherent in the area, including tidal forces, meteorological conditions, and flood zones, when determining which pipeline segments could affect a[high consequence area]"). Anticipated, federal rulemakings will strengthen oil and gas detection requirements including minimum rupture detection standards. A list of these upcoming rulemakings can be found at https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2022-03/3.8.22%20PIPES%20Act%20Website%20Chart.pdf.

Corps must take into account Enbridge's specific safety record in evaluating environmental impacts.[148]

Finally, the spill analysis should also include the risk of a spill from Line 5 into Lake Michigan from the pipeline across the Straits of Mackinac. The new Line 5 Segment Project in Wisconsin, if approved, will allow the continued operation of Line 5 across the Straits. Therefore, the continued operation of Line 5 depends on the Corps' approval here, and the operational concerns from continued operation of Line 5 must be considered in the EIS. That consideration includes the possibility of an oil spill in Lake Michigan and all the environmental effects that flow from that spill.

iii. HDD, drilling fluid loss, and frac-outs.

The Corps' NEPA review must consider the impacts associated with HDD, and particularly those stemming from drilling fluid loss. HDD requires the injection of drilling fluid, comprised of water, bentonite clay, and often undisclosed additives, into the drill hole in order to keep the drill bit cool and lubricated.[149] The drilling fluid then pressurizes and functions to carry soil and rock cuttings from the hole back to the surface into containment pits.[150] Not all drilling fluid makes it back to the surface, however, and some geologic formations are more susceptible to drilling fluid loss than others.[151] For example, drilling fluid can escape along fractures in the overburden or through permeable layers and even reach the surface or stream channels. And when the drilling fluid pressure exceeds the strength of the surrounding geology, hydraulic fracturing, also known as a frac-out, occurs, resulting in larger volumes of drilling fluid loss up to tens of thousands of gallons.

Drilling fluid loss is often characterized as an "inadvertent release", but that is somewhat of a misnomer. Indeed, drilling fluid loss is a calculated result of the HDD process by design. Literature from the American Petroleum Institute, which develops industry standards incorporated into PHMSA pipeline safety regulations, indicates that, by employing industry best practices, drilling fluid loss cannot be prevented, only reduced, and the risk of frac-outs can only be lowered but not eliminated.[152]

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[148] EPA Region 5 demanded payment from Enbridge of over $6 million in stipulated penalties in May 2020 for several failures to comply with deadlines to repair or address safety issues including a failure to evaluate "shallow dents" in pipelines in the Lakehead Pipeline System which includes Line 5. *See* U.S. EPA letter to Steptoe & Johnson (May 8, 2020), *available* at https://www.epa.gov/sites/default/files/2020-06/documents/enbr_stipulated_penalties_demand_letter_sets_2_and_3_5.8.20.pdf.

[149] AMERICAN PETROLEUM INSTITUTE, PIPELINES: A CRUCIAL PIECE OF MODERN INFRASTRUCTURE 3, available at https://www.api.org/-/media/APIWebsite/oil-and-natural-gas/primers/Horizontal%20Directional%20Drilling%20HDD%20Operations%20White%20Paper.pdf?la=en&hash=87ECB03D2D25B28DE401D6A23DA1C74D387339A7.

[150] *Id.*

[151] *Id.* at 10.

[152] *Id.*

Another source produced by a drilling service recognizes that frac-outs are a common occurrence when engaging in HDD and that while impacts associated with an individual frac-out are typically minor, "[t]he seriousness of a frac-out depends on where it occurs. If the frac-out occurs in an environmentally or culturally sensitive area (which you are generally trying to avoid by using HDD), there is reason for concern."[153] The frequency of frac-outs is evidenced by the recent construction of Line 3 in northern Minnesota, where frac-outs occurred at 19 stream and wetland crossings and at 12 of the crossings, drilling fluid reached the waterway.[154]

When drilling fluid reaches surface waters, including wetlands, it can kill vegetation and imperil aquatic life.[155] Even though "[t]he drilling fluid itself may not be toxic . . . fine particles can smother plants and animals, particularly in an aquatic environment."[156] Frac-outs can also result in damage to infrastructure, causing nearby roads to rise and water pipelines to fail "as the frac-out washe[s] away the bedding sand."[157]

HDD activities can also result in the breach of artesian aquifers like those present in the project area. In March 2022, the Minnesota DNR announced that it had completed an investigation into three large artesian aquifer breaches during the construction of Enbridge's Line 3 project.[158] Across the three sites, Enbridge caused the discharge of more than 250 million gallons of groundwater.[159] The Minnesota DNR will assess the potential for additional aquifer breaches once the ground thaws.[160] According to the investigations, "[a]ll three aquifer punctures involved sheet piling to stabilize trenches for the pipe," where Enbridge had driven pilings into shallow aquifers.[161] As noted above, Enbridge has failed to provide the Corps with data on the locations of artesian aquifers, making similar ruptures (and impacts to the hydrology of streams and wetlands) very possible.

According to Wetland and Waterbody Crossing Table attached to DNR's DEIS as Appendix G, Enbridge proposes to cross 132 wetlands and waterways using HDD. The Corps' NEPA review must account for the inevitability of frac-outs and associated direct, secondary, and cumulative

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[153] Charles Stockton, Stockton Drilling Services, Technical Guide: Information and Advice for the Successful Planning and Execution of Horizontal Directional Drilling Works 14 (Aug. 2017), available at http://stocktondrillingservices.com/wp-content/uploads/2017/08/Stockton-HDD-ebook-4-1.pdf.
[154] ALMENDINGER ENVIRONMENTAL MEMO., *supra* note 19, at 6.
[155] *Id.*
[156] Stockton, *supra* note 150, at 14.
[157] *Id.*
[158] Minnesota DNR, Minnesota Department of Natural Resources Update on Line 3 Aquifer Breach Investigation and Enforcement (Mar. 21, 2022), *available at* https://files.dnr.state.mn.us/features/line3/dnr-update-line-3-aquifer-breach-investigation-and-enforcement-3-21-22.pdf (on file with author).
[159] *Id.*
[160] *Id.*
[161] Jennifer Bjorhus, *Enbridge Crews Punctured Three Aquifers During Line 3 Oil Pipeline Construction, DNR says*, STAR TRIBUNE (Mar. 21, 2022), available at *https://www.startribune.com/enbridge-crews-punctured-three-aquifers-during-line-3-oil-pipeline-construction-dnr-says/600158140/*.

adverse environmental impacts, especially potential impacts to sensitive resources HDD is supposed to avoid.

iv. The Corps' NEPA review must address issues related to sexual and physical violence, human trafficking, and drug trafficking including how this violence particularly affects Indigenous communities.

The Corps' NEPA review must fully address the health, social, cultural, and economic harms to Indigenous women, children, Two-Spirit people and their relatives that will result from the proposed project. Research has demonstrated a direct relationship between the influx of the predominantly male workers brought in to construct oil pipelines and increases in sexual and physical violence, human trafficking, and drug trafficking affecting Indigenous communities in general and Indigenous women, children, and Two-Spirit people in particular. These negative impacts of extractive industries and pipeline projects contribute to what the federal government understands to be "crisis" levels of gender-based violence against Indigenous women and other Native people.[162] Consistent with the Corps' obligations under 40 C.F.R. § 1501 and President Biden's recent executive order related to addressing historical and current "epidemic" levels of violence against Indigenous people,[163] the Corps must consider these serious potential consequences of the proposed project on the lives, safety and wellbeing of Native people and communities.

In information provided for the DNR's DEIS, Enbridge indicated that it would "establish a Human Trafficking Awareness and Prevention Program for the proposed [Line 5] project, similar to 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."[164] We are not aware of any information about the effectiveness of that program; however, there is anecdotal evidence that seriously calls its effectiveness into question: as the DEIS notes, four Line 3 contractors were arrested for sex trafficking last year in two separate stings.[165]

e. The Corps' NEPA Review Must Consider Intergenerational Equity.

The failure to detail the climate effects of the proposed project violates NEPA's provisions that require due consideration to the interests of younger and future generations. NEPA holds the Federal government responsible for "fulfill[ing] the social, economic, and other requirements of present and *future generations* of Americans."[166] NEPA imposes a continuing intergenerational

[162] U.S. Gen. Accounting Office, GAO-22-104045, *Missing or Murdered Indigenous Women: New Efforts Are Underway but Opportunities Exist to Improve the Federal Response* 1 (2021).
[163] Improving Public Safety and Criminal Justice for Native Americans and Addressing the Crisis of Missing or Murdered Indigenous People, Exec. Order No. 14,053, 86 Fed. Reg. 220 (Nov. 18, 2021).
[164] DEIS, *supra* note 34, at 312.
[165] *Id.*
[166] 42 U.S.C § 4331(a) (emphasis added).

responsibility to "fulfill the responsibilities of each generation as trustee of the environment for succeeding generations" so "that each person [] enjoy[s] a healthful environment."[167] Without quantifying all the foreseeable GHG emissions associated with the project and monetizing the cost of such emissions, the Corps is unable to take a "hard look" at the climate effects of a pipeline infrastructure project that would facilitate the combustion of fossil fuels, adding pressure to an already stressed atmosphere in disproportionate detriment to the younger and future generations.

To those ends, the Corps' NEPA review must duly weigh "the maintenance and enhancement of long-term productivity" against short-term uses of the human environment.[168] This balancing approach reveals whether "any irreversible and irretrievable commitments of resources" are associated with the proposed project.[169] Without accounting for climate effects—using procedures, methods, and tools generally accepted by the scientific and economic community––the Corps will be unable to rely on the EIS to take a hard look to the benefits of short-term uses and the costs associated with climate change that will impact future generations and its relationship with the human environment and natural resources.

Acting as trustee to younger and future generations and fulfilling NEPA's mandates requires the Corps to take a "hard look" at the social cost of GHGs because those emissions will inflict greater harms in the future as emissions accumulate in the atmosphere and climate and economic systems become increasingly stressed.[170] A study found that "[t]he life of every child born today will be profoundly affected by climate change. Without accelerated intervention, this new era will come to define the health of people at every stage of their lives."[171] Further, the Fourth National Climate Assessment estimates that climate change will lead to increased temperatures and precipitation that will reduce agricultural productivity, erode soils, contribute to poor air quality, and overall worsening of economic conditions in the Midwest.[172]

Pursuant to 42 U.S.C. § 4332(C)(v) and (v), the Corps' EIS must quantify the GHG emissions from construction and operation and from foreseeable upstream, mid-stream and downstream activities. Additionally, the EIS must monetize the social cost of the emissions through the Social Cost of Carbon protocol to translate the future harm inflicted into current monetary value. Under

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[167] 42 U.S.C § 4331(b)-(c).
[168] 42 U.S.C. § 4332(C)(iv).
[169] 42 U.S.C. § 4332(C)(v).
[170] U.S. Interagency Working group on Social Cost of Greenhouse Gases, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990* (Feb. 2021), tbls. ES-1, ES-2, ES-3, https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf
[171] Nick Watts et al., *The 2019 Report of The Lancet Countdown on Health and Climate Change: Ensuring That the Health of a Child Born Today is Not Defined by a Changing Climate*, LANCET (2019), available at https://doi.org/10.1016/S0140-6736(19)32596-6.
[172] The U.S. Global Change Research Program, *The Fourth National Climate Assessment, Volume II, Chapter 21: Midwest. Impacts, Risks, and Adaptation in the United States*, attached as Exhibit ELP-3 (PAE-3) (2018), https://doi.org/10.7930/NCA4.2018.CH21

NEPA's intergenerational spirit and statutory requirements, the DEIS must apply discount rates at no higher than 3%.[173] Otherwise, the Corps would rely on an inadequate cost that gives very little weight to younger and future generations' welfare contrary to NEPA.

"A vital requisite of environmental management is the development of adequate methodology for evaluating the full environmental impacts and the full costs—social, economic, and environmental—of Federal actions."[174] An inadequate EIS that does not account for climate effects and its intergenerational equity impacts fails the informational burden requisite under NEPA.[175]

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[173] Moritz Drupp, Mark Freeman, Ben Groom, and Frikk Nesje, *Discounting Disentangled: An Expert Survey on the Determinants of the Long-term Social Discount Rate*, CENTRE FOR CLIMATE CHANGE ECONOMICS AND POLICY Working Paper No. 195, Grantham RESEARCH INSTITUTE ON CLIMATE CHANGE AND THE ENVIRONMENT, Working Paper No. 172 (May 2015), available at: http://piketty.pse.ens.fr/files/DruppFreeman2015.pdf.
[174] 115 Cong. Rec. (Part 30) 40,420 (1969), section-by-section analysis of S. 1075.
[175] 42 U.S.C. § 4332(C)(v).

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MEMORANDUM

To: Midwest Environmental Advocates, Madison, WI
From: James E. Almendinger, PhD
Date: 8 March 2022
Regarding: Review of *Draft Environmental Impact Statement: Proposed Enbridge Line 5 Relocation Project*, Volume I – Draft EIS and Volume II – Appendices

Qualifications in brief: *Dr. James Almendinger earned a PhD in Ecology from the University of Minnesota in 1988 and has held positions as a post-doc at the University of Lund (Sweden), as research hydrologist at the U.S. Geological Survey, and as senior scientist and director at the St. Croix Watershed Research Station. He is currently semi-retired, serving as Adjunct Assistant Professor at the University of Minnesota in the Department of Earth and Environmental Science and in the Water Resources Science program. His research topics include groundwater hydrology, wetland hydrology, groundwater/surface-water interactions, watershed hydrology, paleoecology, and aqueous geochemistry.*

Abstract

Since 1953 Enbridge has operated Line 5 to transport petroleum products across northern Wisconsin and Michigan. A 2019 lawsuit has required that Enbridge cease operations within the reservation boundaries of the Bad River Band of Lake Superior Tribe of Chippewa Indians just east of Ashland, Wisconsin. The proposed pipeline route bypassing the reservation is about 40 miles long and crosses many streams and wetlands. A draft environmental impact statement (DEIS) has been prepared to help inform the responsible government agencies in deciding whether to grant permits for these crossings. The purpose of this memo is to review the adequacy of the DEIS in assessing the hydrologic impacts due to these crossings.

The current DEIS is incomplete or insufficient in several important issues:
• There is no plan for pre- or post-construction monitoring of streams and wetlands. Before-and-after monitoring data are required to quantify and mitigate impacts.
• Stream crossings will produce significant temporary impacts from site erosion and “frac-outs” (spills of drilling mud). These impacts can become persistent if stream banks are not properly restored.
• Wetland crossings will have persistent long-term impacts because of irreversible changes in wetland hydrology, soils, and geochemistry. Altered wetland soils can generate excess nutrients and greenhouse gases, as well as sulfate, which can increase mercury toxicity and harm wild rice. These impacts will be transported downstream because of hydrologic connectivity between wetlands and downstream waters.

• The impacts due to the spill of toxic petroleum products has been given little attention in the DEIS. At stream crossings, the DEIS failed to consider future flood flows, which are the critical conditions under which streambank erosion and catastrophic pipeline ruptures are likely to occur. The high velocities of these expected floods will rapidly transport petroleum spills downstream, likely all the way to Lake Superior, where the DEIS dismisses any significant impact.
• The DEIS dismisses oil spills in wetlands as being of limited spatial and temporal extent – and yet without more monitoring data, we cannot know the direction of oil-plume migration in the subsurface. Once an aquifer is contaminated, toxic plumes can migrate for long distances over long periods of time. The DEIS does not address this problem in a meaningful way.

In short, we find the DEIS heavily skewed toward discussing the temporary impacts due to pipeline construction, and wholly inadequate in addressing the long-term threats from pipeline construction, operation, and spills. Much more information about the aquatic resources to be impacted needs to be compiled before meaningful permit decisions can be made by the attendant government agencies.

Introduction

The importance of water to ecosystem function is unquestionable. Water is a principal vector of nutrient delivery to organisms and the recycling of waste from organisms, processes that allow ecosystems to be self-sustaining in perpetuity. Water can be thought of as the lifeblood of the ecosystems upon which all life depends, including people. We perturb the hydrologic function of ecosystems at our peril. Pipeline construction and operation are activities that threaten ecosystem hydrologic function.

Since 1953 Enbridge has operated the 30-inch Line 5 pipeline across northern Wisconsin and Michigan to transport petroleum products from sources in the northern Great Plains of Canada and the USA to refineries in Michigan, Ohio, and Ontario (WDNR and TRC 2021). Line 5 currently crosses about 12 miles of reservation lands of the Bad River Band of Lake Superior Tribe of Chippewa Indians (Bad River Band). The easements to allow operation of Line 5 on tribal lands expired in 2003, and after many years of discussion between the tribe and Enbridge, the tribe decided to deny renewal of the easements. A 2019 lawsuit requires that operation of the pipeline on the reservation cease and it be removed. Consequently, Enbridge is seeking to re-route the pipeline to the south around the boundary of the reservation. The proposed route is about 40 miles long and would require many stream and wetland crossings. The magnitude of this project (Proposed Enbridge Line 5 Relocation Project) requires an environmental impact statement to assess whether the project can be completed and operated within guidelines to minimize any environmental impact. To this end, the Wisconsin Department of Natural Resources (WDNR) and TRC Environmental Corporation (as hired by Enbridge) have created the Draft Environmental Impact Statement (DEIS) that is the subject of this memo. One purpose of the DEIS is to compile all the available information about the potential impacts of the proposed project so that the WDNR can make an informed decision about whether to issue permits to Enbridge to allow the pipeline to cross the many streams and wetlands along the proposed route.

The impacts of pipeline installation include impacts due to construction, impacts due to operation (the physical presence of the pipeline), and impacts due to spills. Construction activities can harm aquatic biota by delivering large sediment loads to streams (Betcher et al. 2019; Lévesque and Dubé 2007). The simple presence of a pipeline can permanently alter wetlands by removal of woody vegetation and alteration of soil densities and wetland hydrology (Olson and Doherty 2012; Boelter and Close 1974). And, without question, oil spills are incredibly toxic to all forms of aquatic life (Dupuis and Ucan-Marin 2015). During the operation of Line 5, over 1 million gallons of petroleum has been spilled over 29 separate events (Sierra Club 2019). We must conclude that spills will continue into the future. Pipeline construction and oil-spill impacts must further be evaluated in terms of their short-term and long-term impacts, and in terms of their cumulative impacts that not only add to existing environmental degradation but exacerbate it. For example, the climate change caused by fossil fuels carried by pipelines has created larger storm and flooding events that make pipeline failures and spills all the more likely.

Purpose and Scope

The purpose of this memo is to review this DEIS and assess whether it appropriately addresses, and avoids or mitigates, impacts to the hydrologic function of the aquatic resources that the proposed pipeline intersects. To this end, this memo examines plans in the DEIS to address hydrologic monitoring, stream crossings, wetland crossings, oil spills, and cumulative impacts.

Issues of Concern

Pre- and Post-Construction Hydrologic Monitoring and Characterization

Environmental impacts cannot be quantitatively assessed without before/after analyses, and, in some cases, identification of control sites (Lévesque and Dubé 2007). In other projects, streams have been monitored both pre- and post-construction downstream of pipeline crossings for stage, flow, temperature, specific conductance, pH, dissolved oxygen, and turbidity (USGS 2017). Turbidity is of particular importance, given the sensitivity of aquatic life to suspended solids from pipeline construction and streambank erosion. For all the stream crossings where erosion is likely to occur, as identified in the DEIS, such monitoring stations should be established and operated at least one year in advance of construction.

In trying to guard against and mitigate oil spills, one key piece of information is the direction and velocity of water flow, which will in turn influence the direction and velocity of a toxic plume resulting from a spill. In the case of streams, the direction of the flow will be obviously downstream, and its velocity should be assumed to be at large flood flows (e.g., the 500-yr 24-hr flow), because those are the conditions where pipeline failure is most likely. However, in a wetland the flow direction of a toxic plume may not be obvious, because it depends on whether the wetland discharges or recharges water relative to the adjacent groundwater system. Hence all wetlands that are crossed by the pipeline need to be assessed for (a) flow direction at the surface, through the uppermost vegetated surface layer of the wetland (sometimes called the "active layer"), and (b) seepage direction relative to the adjacent groundwater system. The seepage direction critically determines whether a toxic plume will migrate up toward the surface and flow towards a surficial outlet from the wetland (if there is one), or whether the plume migrates down and laterally into the pores of the adjacent groundwater system. Seepage direction is almost certainly unknown for most of the wetlands crossed by the proposed project and needs to be determined with an array of paired piezometers (one screened at the water table and another screened about 1.5 to 3 m below the water table).

A better characterization of wetland hydrology is also essential for avoiding major problems during pipeline construction. During the construction of Line 3 in Minnesota, a clay layer under a wetland was breached, and artesian flow created a flood of water gushing from the site, delivering large amounts of turbid water to nearby receiving waters (Bjorhus and staff 2021). Had wetland hydrology been monitored and characterized before construction, then this problem could have been avoided.

In short, both stream flow, water quality, and wetland hydrology need to be better characterized prior to pipeline construction. The DEIS fails to consider any substantive monitoring and aquatic resource characterization beyond what was available in existing data sets. Existing data sets are simply inadequate to evaluate environmental impacts, which require before/after analyses specifically for impacted sites.

Stream Crossings

Here we focus on temporary and persistent impacts at stream crossings, excluding spills. Impact from spills will be discussed in a separate section.

Temporary Impacts

The temporary impacts due to pipeline installation center around construction practices and the safeguards put in place to minimize soil erosion and incidental petroleum spills from heavy equipment. While many of these practices are well established (FERC 2013) and not uniquely limited to pipeline construction, all are imperfect. It is simply impossible to contain all erosion during construction, and the resulting suspended solids in the streams will have an impact on aquatic life (Betcher et al. 2019; Lévesque and Dubé 2007). Stream crossings during pipeline construction are especially problematic because the consequent erosion is taking place exactly where it can do the most harm, namely to aquatic life downstream of the crossing. Dewatering the trench where the pipeline will be laid will result in turbid discharge water well above allowable standards. This discharge water must be treated before being released to receiving streams.

Horizontal directional drilling (HDD) is a way to avoid surface-soil disturbance at stream crossings, but it has alternative impacts. Enbridge has identified about 26 stream crossings that are problematic enough with erosion issues that it plans to install the pipeline under the stream valleys by using HDD (WDNR and TRC 2021). During the HDD process, a slurry of bentonite clay and unknown additives are injected under pressure to keep the borehole from collapsing before the pipe can be emplaced. Unfortunately, the pressurized mud finds the path of least resistance, i.e., high permeability layers or fractures in the overburden that were either pre-existing or created by the pressurized borehole itself. The mud can escape along these fractures and reach the surface, where it spills out onto the land or into the stream channel. These “frac outs” result in large quantities of bentonite mud erupting out of ground under pressure from the borehole below. These mud flows can kill vegetation and imperil aquatic life as large pulses of suspended material are carried downstream (Betcher et al. 2019). Furthermore, the toxicity of the proprietary additives to the bentonite slurry are simply unknown and undiscussed in the DEIS (WDNR and TRC 2021). We emphasize that frac-outs will occur with high likelihood. During the construction of Enbridge Line 3 across Minnesota, 28 frac-outs occurred at 19 stream and wetland crossings. At 12 of the crossings (63%), drilling fluid reached the waterway (Watch the Line MN 2021).

Persistent Impacts

After the temporary impacts have subsided from construction, persistent impacts from pipeline stream crossings can occur from continued erosion. Such erosion can persist if streambanks have not been properly restored and armored, and if stream channel cross-sectional area and morphology have not been properly restored and appropriately sized. Unfortunately, continued erosion at pipeline stream crossings results in persistent threats to stream ecology (Castro et al. 2015). As noted earlier, erosion causing high concentrations of suspended solids can harm a wide spectrum of aquatic life along the food chain, from algae and invertebrate filter feeders to game fish (Newcombe and Macdonald 1991; Bilotta and Brazier 2008). Persistent impacts due to pipeline rupture and toxic petroleum spills are the much larger threats to streams and will be discussed in a later section.

Wetland Crossings

Here we discuss temporary and persistent impacts at wetland crossings, excluding spills, which will be discussed in a separate section.

Temporary Impacts

As with stream crossings, wetland crossings will cause temporary impacts from turbidity and frac-outs. Pipeline installation across wetlands will commonly require trench dewatering, and the disposal of such water well above turbidity standards is problematic. All such water will have to be treated before being discharged to receiving waters. If HDD is selected as the method to cross a wetland, frac-outs will kill vegetation and impact downstream waters if the bentonite slurry reaches the stream network. We recognize that such temporary impacts appear to be accepted as standard operating procedure for pipeline installation (FERC 2013). Yet these impacts are real and increase the cumulative impact on wetlands.

Persistent Impacts

Pipeline installation through wetlands can result in serious persistent impacts because of the physical and chemical characteristics of wetland soils and hydrology. Even decades after pipeline construction, wetlands may not fully recover their prior ecological function (Moreno-Mateos et al. 2012). These long-term impacts are not isolated to wetlands but propagate to downstream receiving waters because of hydrologic connectivity (USEPA 2015; Cohen et al. 2016; Rains et al. 2016; Evenson et al. 2018; Leibowitz et al. 2018).

Wetland hydrology can be significantly altered when pipelines block or dam water flow across the wetland surface or through highly-permeable subsurface layers. Boelter and Close (1974) found that subsurface drains needed to be installed below a pipeline crossing a forested wetland in order to not kill (flood) the trees on the upgradient side of the pipeline. Likewise, Canadian researchers found that pipelines blocked flow across wetlands and suggested that pipelines should be installed in a direction co-linear with existing flows (Volik et al. 2020; Elmes et al. 2022). Even if the pipeline itself does not block flow directly, the adjacent access road has compressed wetland sediments, causing increased bulk density and reduced hydraulic conductivity that persists over time and likewise can dam lateral flow through the wetland (Olson and Doherty 2012; McCarter et al. 2020). The impact of roads in general across the landscape, especially through wetlands, are well known (Forman and Alexander 1998; Webster et al. 2015), and the access road adjacent to the proposed pipeline can be a similar barrier to flow.

The impacts of these hydrologic perturbations to wetland ecological function are significant in at least four ways. First, the impacts can change the dominant vegetation, commonly promoting woody growth on the drier downgradient side of the pipeline and flooding out tree cover on the upgradient side. When the vegetation canopy changes, then so do the sub-canopy layers. Second, desiccation and decomposition of organic soils generate (a) nutrients that cause eutrophication (Bragazza et al. 2008; Smith, Joye, and Howarth 2006), (b) sulfates that stimulate production of methylmercury (Coleman Wasik et al. 2015) and harm wild rice (A. Myrbo et al. 2017) in the wetland and downstream receiving waters, and (c) greenhouse gases (carbon dioxide and methane) that contribute to climate change (Fenner and Freeman 2011). Third, these impacts are wide-spread, impacting large areas of wetlands, well beyond the pipeline right-of-way – such is the nature of flooding in very flat landscapes. And fourth, these impacts are persistent, lasting for decades after pipeline construction (Olson and Doherty 2012). In short, the hydrologic impacts to wetlands caused by pipeline emplacement can permanently change the biology and geochemistry of wetlands and downstream receiving waters over very large areas.

These hydrologic impacts might be minimized by making sure that the pipeline is buried deeply enough so that it does not block lateral flow through the more permeable layers of wetland sediment, particularly the uppermost "active layer" that conveys shallow flow. While the two-layer model of peatland hydrology has been challenged as being too simple (Morris et al. 2011), there is no doubt that much flow occurs in the near-surface of wetlands through the standing layer of vegetation (Holden et al. 2008). However, if the pipeline trench is cut too deeply, then there is the risk of breaching a confining layer of low hydraulic conductivity, either underlying the wetland or in the form of low-permeability wetland sediments themselves. Once such a layer is breached, it is likely impossible to completely contain the upwelling groundwater flow, which creates another source of flooding in the wetland and the need to now manage a new or larger outlet stream from the wetland. As noted earlier, this very issue arose during the construction of Enbridge Line 3 in Minnesota, where the breaching of a clay layer under a wetland released large artesian flows.

Even the temporary dewatering of the pipeline trench through a wetland can have persistent impacts. In particular, dewatering reduces pore pressures in the adjacent sediments, causing sediment consolidation, which is largely irreversible (McCarter et al. 2020). The desiccation of organic soils adjacent to the trench can also mobilize nutrients, sulfate, and carbon dioxide as well, to the degree that decomposition of these soils proceeds during the period of trench dewatering. As noted above, consolidation of wetland soils has a persistent impact on wetland vegetation and hydrological function.

Petroleum Spills from Pipelines

Petroleum spills are the greatest long-term, catastrophic threat to our natural resources that can result from pipeline installation and operation. Spills are not only incredibly toxic (Dupuis and Ucan-Marin 2015) – they are also likely to occur. Based on data from 2001-2011, KAI (2012) concluded "[t]he 'average' pipeline therefore has a 57% probability of experiencing a major leak … in a ten-year period."

Yet, despite the likelihood of a toxic spill, the topic was given a generalized, boilerplate treatment in the DEIS (Section 7 in WDNR and TRC 2021). The information given in Section 7 is interesting enough but too general to characterize the potential damage from a spill. The WDNR and TRC (2021) cite Volume II in Appendix C of the DEIS for how spills will be treated, but the spills discussed there are mostly spills of oil and fuel from construction equipment, not from a catastrophic pipeline failure. They recognize the threat of bank erosion in exposing and rupturing pipelines but do not explain how they will address this problem. They discuss spill-response protocols from private, state, and federal agencies, and note that spill notification must take place within one hour. We are grateful that these protocols are in place, but even they may be too limited and too late to prevent damage from a major spill, especially on a flooding river.

Particularly disappointing was the discussion of their "liquid plume dispersion modeling" (Section 7.7 in WDNR and TRC 2021). The parameterization assumptions were not explained, and while the positions along the line (every 100 m) were noted on the figures, the sizes of modeled spills were not shown. Surely a plume could be depicted as a polygon showing a directly contaminated area. It is unclear whether the model depicts oil pooling on the land surface, or three-dimensional plumes entering the porous media surrounding the pipeline. They recognize that spills can travel downstream, but apparently did no time-of-travel studies or modeling to predict the speed and extent of a spill into a river. They acknowledge that spills could reach Lake Superior, but conclude that Lake Superior is so large that spills would be diluted into insignificance. We could not disagree more: no matter how large Lake Superior is, a toxic oil spill will still sully localized areas and degrade sensitive habitat.

The threat of pipeline rupture at stream crossings is particularly acute. Stream crossings are places where even natural bank erosion can expose a pipeline to weather and mechanical stresses from streamflow and the loss of supporting sediment. The threat becomes exponentially magnified during large storm flows, when pipelines can actually float up and be subjected to extraordinary mechanical stresses (Li et al. 2017). Consequently, many pipeline ruptures occur at stream crossings during floods, and these spills tend to be very large and catastrophic (Castro et al. 2015). As climate changes and precipitation patterns shift, flow volumes, flood magnitude, and flood frequency are all likely to increase (Wuebbles and Hayhoe 2004; Yang et al. 2019), greatly increasing the chance of channel erosion leading to pipeline exposure and rupture. As flows increase, bank erosion will increase channel cross-sectional area in order to convey the larger flows at existing gradients (Schottler et al. 2014). Enbridge's stream crossing plans must allow for a 10-20% increase in bank erosion from these larger flows due to climate change.

Further, because pipeline failures are most likely to occur under flood flows, Enbridge must account for likely maximum floods under future climate and estimate travel-times under those much larger flood velocities. The DEIS indicates that calculations of flow velocities will be based on current mean annual flows (WDNR and TRC 2021, p. 271). These flow velocities are entirely inadequate because not only are they *not* flood flows, they are not based on expected flood flows under a wetter future climate. At the very least we suggest that the 500-year 24-hour event be determined for each stream crossing. We suggest that under these conditions, catastrophic pipeline failure is all too probable. We further suggest that in these high-velocity floodwaters, petroleum products will reach Lake Superior and its lake-shore sloughs and wild rice beds well before spill-control measures can be implemented, despite the well-meaning spill protocols that are currently in place within the bureaucracies of local, state, and federal agencies.

Pipeline spills in wetlands and uplands are less time-critical than in stream channels, but also less predictable. Without wetland monitoring of hydrologic function, we cannot predict the direction of plume migration following a spill. As noted in the Monitoring and Characterization section above, we need to know basic wetland hydrology to be able to predict the direction of plume migration. Is the wetland a groundwater discharge feature, where groundwater is flowing into the wetland and eventually flows toward a downgradient outlet stream or wetland margin? What is the direction of shallow-water flow through the uppermost layer of the wetland? Or, is the wetland a groundwater recharge feature, where shallow water percolates downward or laterally toward the underlying or adjacent aquifer units, respectively? In this case, the toxic petroleum plume becomes a permanent part of the groundwater flow system, gradually migrating downgradient. The contention in the DEIS (WDNR and TRC 2021, p. 278) that most petroleum impacts on groundwater travel no further than 1,200 feet is not realistic. These plumes are entirely persistent and will migrate in the direction of groundwater flow for decades to centuries, just as groundwater commonly does. They are neither spatially static nor short-term.

Cumulative Impacts

Cumulative impacts are those that occur in concert with other, prior-established impacts due to human activities. These other impacts have altered the air, water, land, and biota in ways that have pushed them away from their natural equilibrated and integrated states. Nature has been changed in ways that make it less resilient. Will pipeline installation and operation add to these existing impacts to such a degree that nature is pushed beyond a tipping point, where essential ecological functions are lost? We may not be able to answer this last question before it is too late, but we can definitively say that Line 5 will cumulatively add to the existing impacts.

The most obvious existing impact along the proposed pipeline route is from land-use change that has replaced natural vegetation with agricultural and urban lands that are interconnected by a network of roads. These changes have greatly increased the occurrence and mobility of sediment (soil erosion), nutrients, and toxins in the environment, especially as nonpoint-source pollution that is difficult to control (Duda 1993). Not only are such pollutants generated at elevated quantities in human-altered landscapes, they are conveyed with engineered efficiency into our waterways via a dense network of wetland and road ditches (Webster et al. 2015).

For the Bad River reservation, we already have a metric by which to measure cumulative impacts. This metric is to examine the relative change over time as recorded in lake sediments. Each year the lake bed accumulates a thin layer of sediment, and changes in this sediment quantity and chemistry over time (deep sediment is older than shallow sediment) thereby gives a record of changes in the lake's catchment. Sediment cores were collected from six lakes in the Bad River reservation lands in 2012 and 2014, and these cores indicated that sediment accumulation rates (as a broad measure of landscape-scale soil erosion) increased by 50% to 150% since the late 1800s, that is, about the time that logging, agriculture, and settlement by EuroAmericans became well established (Amy Myrbo, Almendinger, and Ladwig 2016). Urbanization and especially agriculture generates soil erosion well above background levels, and ditch networks transport the eroded material to the lakes. The road network also contributed lead (Pb) to the lakes from the use of leaded gasoline, creating levels many times above background and peaking approximately in the 1970s to 1980s.

Pipelines are linear infrastructure features fundamentally similar to roads, and in fact *are* roads to the extent that the access road adjacent to the pipeline is maintained. Hence pipelines will increase the cumulative environmental impact as much as a typical road. However, the difference is that the Line 5 pipeline carries a very toxic load, and hence it is adding a new and significant threat in large quantities that previously did not exist along the proposed route. Will the pipeline contribute toxic petroleum products to the environment, pollutants that are heretofore totally absent from the natural environment of northern Wisconsin -- except from spills? The impact from an oil spill is not just an incremental addition to a cumulative total; it adds a giant threat of a long-term toxic stain on the environment from which recovery is uncertain.

Finally we note that the pipeline will support the continued used of fossil fuels and their cumulative impact on the climate. This cumulative impact creates a positive feedback loop, whereby all the possible impacts from the pipeline must be considered in light of the climate change that petroleum usage has caused. The changes in climate translate into changes in watershed hydrology. Stream and wetland hydrologic function are changing in ways that are not easily predicted, and yet they are the very factors that we need to know in order to model and mitigate the impacts of pipeline installation, operation, and spills.

Summary

A principal purpose of the DEIS for re-routing Enbridge Line 5 is to compile all relevant information needed to assess the potential impacts to aquatic resources, such that the Wisconsin Department of Natural Resources and U.S. Army Corps of Engineers can make informed decisions about whether to issue permits for the required stream and wetland crossings along the proposed route. We find the treatment of potential impacts and threats in the DEIS insufficient with regard to several topics:

• There is no plan for pre- or post-construction monitoring of streams and wetlands. Without such before-and-after data, impacts cannot be quantitatively measured and properly mitigated. Without monitoring to demonstrate impacts, these impacts can be denied.

• Stream crossings will produce significant temporary impacts from site erosion and "frac-outs" (spills of drilling mud), which can morph into persistent impacts.

• Wetland crossings will have similar temporary impacts, but will additionally create persistent impacts because of irreversible changes in wetland hydrology, soils, and geochemistry. Altered wetland soils can generate excess nutrients and greenhouse gases, as well as sulfate, which can increase mercury toxicity and harm wild rice. These impacts will be transported downstream because of hydrologic connectivity between wetlands and downstream waters.

• The impacts due to the spill of toxic petroleum products have been given little attention in the DEIS. At stream crossings, the DEIS failed to consider future flood flows, which are the critical conditions under which streambank erosion and catastrophic pipeline ruptures are likely to occur. The high velocities of these expected floods will rapidly transport petroleum spills downstream, likely all the way to Lake Superior, where the DEIS dismisses any significant impact.
• The DEIS dismisses oil spills in wetlands as being of limited spatial and temporal extent – and yet this cannot be known unless the hydrologic function of the wetland has been determined. Without more monitoring data, we cannot know the direction of oil-plume migration in the subsurface. Once in the porous media of aquifers, toxic plumes can migrate for long distances over long periods of time. The DEIS does not address this problem in a meaningful way.

In short, we find the DEIS heavily skewed toward discussing the temporary impacts due to pipeline construction, and wholly inadequate in addressing the long-term threats from pipeline construction, operation, and spills. Much more information about the aquatic resources to be impacted needs to be compiled before meaningful permit decisions can be made by the attendant government agencies.

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Qualifications

JAMES EDWARD ALMENDINGER

Address
Almendinger Environmental LLC
416 Churchill St W
Stillwater, MN 55082
Cell: 651-468-6524
Email: almen001@umn.edu

Education

1988. Ph.D., Ecology. University of Minnesota, Minneapolis, MN 55455
(Dissertation: "Lake and groundwater paleohydrology: a groundwater model to explain past lake levels in west-central Minnesota")

1978. B.A., Botany. Ohio Wesleyan University, Delaware, OH 43015
(Valedictorian; Summa Cum Laude; Phi Beta Kappa; Slocum Prize for most outstanding science student)

Positions

2000- Adjunct Associate Professor, Univ. of Minn.: Water Resources Science Program; Dept. of Earth Sciences; and Dept. of Fisheries, Wildlife and Conservation Biology
2017-20 Director, St. Croix Watershed Research Station, Science Museum of Minnesota
1995-2017 Senior Scientist, St. Croix Watershed Research Station, Science Museum of Minnesota
1990-95. Hydrologist, U.S. Geological Survey, Mounds View, MN.
1989-90. Fellow, American-Scandinavian Foundation, Univ. of Lund, Sweden.
1981-89. Research Assistant/Associate, Univ. of Minnesota.
1978-81. NSF Predoctoral Fellow, Univ. of Minnesota.

Graduate and Postdoctoral Advisors

Doctoral Committee: E.J. Cushing (advisor), H.E. Wright, Jr., O.D.L. Strack, H.-O. Pfannkuch, M.L. Heinselman
Postdoctoral Advisors: B. Berglund, S. Björck, G. Digerfeldt, D.R. Engstrom

Research Interests

General:
Watershed hydrology models; land-use and small stream hydrology; Quaternary paleoecology; groundwater/surface-water interactions; wetland hydrology.

Current projects:
(1) Modeling land-use impacts on streams, lower St. Croix basin, MN & WI
(2) Watershed-scale erosion in agricultural western Minnesota

Professional Memberships

American Ass'n for the Advancement of Science
American Geophysical Union
American Quaternary Association
Society of Wetland Scientists
American Water Resources Association
Geological Society of America
Minnesota Ground Water Association

almendinger environmental

Students & Postgraduate Advisees
Dietz, R. (PhD committee, Univ. of Minn. -- current)
Green, M.B. (PhD committee, Univ. of Minn., now at Univ. of New Hampshire)
Murphy, M.S. (MS advisor, Univ. of Minn., now near Univ. of Minn.-Duluth)
Panek, V. (MS committee, Univ. of West Virginia, now at CH2M Hill, OR)
Strommer, A. (MS committee, Univ. of Minn., now at Pope County, MN)
Ulrich, J.S. (PhD committee, Univ. of Minn. -- current)
Zapp-Granley, M. (MS advisor, Univ. of Minn., now at Univ. of Minn.-Duluth)

Relevant Employment and Experience

2000- **Adjunct Associate Professor, Univ. of Minnesota**
- Water Resources Science Program; Dept. of Earth and Environmental Sciences

1995-2020 **Senior Scientist (1995-2017) & Director (2017-2020)**, **St. Croix Watershed Research Station**, **Science Museum of Minnesota**
- Hydrology:
  - Groundwater, Watersheds, Wetlands, Surface-Water/Groundwater Interactions
- Paleohydrology
  - Lakes, Groundwater

1990-95. **Hydrologist, U.S. Geological Survey**, Mounds View, MN.
- Surface-water/groundwater interactions
- Wetland hydrology
- Rainfall-runoff relations

1989-90. **Fellow, American-Scandinavian Foundation, Univ. of Lund, Sweden**.
- Past lake/groundwater interactions and past climate in southern Sweden
- Groundwater hydrology of a raised bog, south-central Sweden
- Taught graduate course "Lake-level change: mechanisms and paleoclimatic reconstruction"

1987-89. **Research Associate, Univ. of Minnesota.**
- Early lake ontogeny in Glacier Bay, Alaska; lake/groundwater interactions

1981-88. **Research Assistant, Univ. of Minnesota.**
- Ph.D. dissertation research and writing: lake and groundwater paleohydrology
- Geochemical investigation of Aquifer Thermal Energy Storage

1981-82. **Teaching Assistant, Univ. of Minnesota.**
- TA for various biology and ecology courses; began lake-level investigations

1980-83. **Peatland Ecology, Univ. of Minnesota**
- Vegetation of northern Minnesota peatlands
- Sampling and surveying of peatlands in the Canadian maritime provinces

1978-81. **NSF Predoctoral Fellow, Univ. of Minnesota.**

I. Papers

Yang, Q., X. Zhang, **J.E. Almendinger**, M. Huang, G. Leng, Y. Zhou, K. Zhao, G.R. Asrar, X. Li, and J. Qiu. 2019. Improving the SWAT forest module for enhancing water resource projections: A case study in the St. Croix River Basin. Hydrological Processes 33:864–875. doi:10.1002/hyp.13370.

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Almendinger, J.E., and D.R. Engstrom. (in prep) Post-glacial evolution of geomorphic surfaces, climate, and vegetation in the upper Mississippi region leading to cultural expansion at the Red Wing locality. Chapter 4 in Shirmer, R. C. and C. A. Dobbs, eds., Mounds, Villages, and Feasts: Archaeological Investigations at Red Wing, Minnesota. Institute for Minnesota Archaeology.

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Almendinger, J.E. 2020. Load Reductions of Nonpoint-Source Pollutants for Selected Subwatersheds of the Kinnickinnic River Under Different Agricultural Best-Management Scenarios. St. Croix Watershed Researach Station, Science Museum of Minnesota, Marine on St. Croix, MN. 4 pp.

Almendinger, J.E. 2020. Maps of Nonpoint-Source Pollutant Reductions in the Kinnickinnic River Watershed Under Different Agricultural Best-Management Scenarios. St. Croix Watershed Researach Station, Science Museum of Minnesota, Marine on St. Croix, MN. 9 pp.

Ulrich, J.S., **J.E. Almendinger**, and S.M. Kloiber. 2019. Minnesota Wetland Inventory: Wetland Functional Assessment and Final Report & Guidance Handbook. Minnesota Department of Natural Resources, St. Paul, Minnesota. 43 pp.

Almendinger, J.E. 2019. Construction and Calibration of a Computer Model of the Madison Lake Watershed. SCWRS Fact Sheet 2019-01, St. Croix Watershed Research Station, Marine on St. Croix, MN. 4 pp.

Fleming, E., **J. Almendinger**, J. Anderson, T. Brehm, J. Koncur, R. Oehlenschlager, J. Ulrich, and A. Wintheiser. 2019. An Archaeological Survey of Wadena County. Dept. of Anthropology and St. Croix Watershed Research Station, Science Museum of Minnesota, St. Paul, MN. 316 p.

Fleming, E., **J. Almendinger**, J. Anderson, T. Brehm, J. Koncur, and J. Ulrich. 2018. An Archaeological Survey of Dakota County. Dept. of Anthropology and St. Croix Watershed Research Station, Science Museum of Minnesota, St. Paul, MN, 330 pp.

Almendinger, J.E. 2017. Construction and calibration of a computer model of the Kinnickinnic River Watershed. St. Croix Watershed Research Station Fact Sheet, 4 pp. Project report to Univ. of Wisconsin-River Falls and U.S. Department of Agriculture.

Haack, J., and **J.E. Almendinger**. 2016. St. Croix Watershed: Cropland Practices for Reducing Phosphorus Loss. Fact sheet for Wisconsin Department of Natural Resources, Univ. of Wisconsin Extension, and Environmental Resources Center, 4 pp.

Almendinger, J.E. 2016. Applying a SWAT Model of the St. Croix River Basin to Estimate Phosphorus and Sediment Load Reductions due to Agricultural Best Management Practices. Report to the St. Croix Basin Water Resources Planning Team. St. Croix Watershed Research Station, Science Museum of Minnesota, Marine on St. Croix, MN, 36 pp.

Almendinger, J.E., D. Deb, M. Ahmadi, X. Zhang, and R. Srinivasan. 2014. Constructing a SWAT model of the St. Croix River basin, eastern Minnesota and western Wisconsin. Project report to the National Park Service. St. Croix Watershed Research Station. Report to the National Park Service, Centennial Challenge Cost Share Program, 83 pp.

Almendinger, J.E., and J. Ulrich. 2012. Applying a SWAT model of the Sunrise River watershed, eastern Minnesota, to predict water-quality impacts from projected land-use change. Project report to the Minnesota Pollution Control Agency. St. Croix Watershed Research Station. (plus four Fact Sheets summarizing components of this report)

Almendinger, J.E., and J. Ulrich. 2010. Constructing a SWAT model of the Sunrise River watershed, eastern Minnesota. Project report to the National Park Service and Minnesota Pollution Control Agency. St. Croix Watershed Research Station, 63 pp.

Almendinger, J.E. 2008. Modeled phosphorus exports from the Willow River watershed. St. Croix Watershed Research Station Fact Sheet, 4 pp.

Almendinger, J.E., and M.S. Murphy. 2007. Constructing a SWAT model of the Willow River watershed, western Wisconsin. Project report to the Legislative Commission on Minnesota Resources, the Wisconsin Department of Natural Resources, and the National Park Service. St. Croix Watershed Research Station, 84 pp.

Almendinger, J.E., and M.S. Murphy. 2005. Land-use change and agricultural practices in the Willow River watershed, western Wisconsin, 1992-2004. Project report to the Wisconsin Department of Natural Resources. St. Croix Watershed Research Station, 39 pp.

Almendinger, J.E. 2003. Watershed hydrology of Valley Creek and Browns Creek; Trout streams influenced by agriculture and urbanization in eastern Washington County, Minnesota, 1998-99. Final project report to the Metropolitan Council Environmental Services, Twin Cities Water Quality Initiative (TCQI) Program. St. Croix Watershed Research Station, 80 pp.

Pitt, D.G., **J.E. Almendinger**, R. Bell, and S. Roos. 2003. An examination of the relationship between watershed structure and water quality in the Valley Creek and Browns Creek watersheds. Final project report to the Metropolitan Council Environmental Services, Twin Cities Water Quality Initiative (TCQI) Program. St. Croix Watershed Research Station, 69 pp.

Engstrom, D.R., and **J.E. Almendinger**. 2002. Sediment and nutrient loading to Lake Pepin. St. Croix Watershed Research Station Fact Sheet, 1 p.

Zapp, M.J., and **J.E. Almendinger**. 2001. Nutrient dynamics and water quality of Valley Creek, a high-quality trout stream in southeastern Washington County. Final project report to the Valley Branch Watershed District and the Board of Water and Soil Resources. St. Croix Watershed Research Station, 29 pp.

Engstrom, D.R., and **J.E. Almendinger**. 2000. Historical changes in sediment and phosphorus loading to the Upper Mississippi River: mass-balance reconstructions from the sediments of Lake Pepin. Final research report prepared for the Metropolitan Council Environmental Services. St. Croix Watershed Research Station, 48 pp.

Almendinger, J.E., D.G. Pitt, B.N. Wilson, E.M. Jahnke, S.P. Schottler, K.E. Thommes, D.C. Whited, and S.E. Grubb. 1999. Monitoring and Modeling Valley Creek Watershed. Final project report to the Legislative Commission on Minnesota Resources (compendium of six individual sub-project reports). St. Croix Watershed Research Station, ca. 200+ pp.

Hoyer, M.C., S.J. Eisenreich, **J.E. Almendinger,** J.A. Perlinger, R.T. Miller, J.L. Lauer, and M. Walton. 1991. University of Minnesota Aquifer Thermal Energy Storage (ATES) Project Report on the First Long-Term Cycle. Minnesota Geological Survey, University of Minnesota, St. Paul, MN, for Battelle Pacific Northwest Laboratory, Richland, WA. Report PNL-7817, UC-202, 61 pp., plus appendices.

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III. Ph.D. dissertation

Almendinger, J.E. 1988. Lake and groundwater paleohydrology: a groundwater model to explain past lake levels in west-central Minnesota. Minneapolis, University of Minnesota, Dept. of Ecology and Behavioral Biology. Ph.D. dissertation, 123 p.

Memorandum

From: Petra Pless, Pless Environmental

To: Rob Lee, Midwest Environmental Advocates

Date: March 12, 2022.

Subject: Review of Draft Environmental Impact Statement for Enbridge's Line 5 Wisconsin Replacement Project

Dear Mr. Lee,

Please find attached my comments on the Draft EIS for Enbridge's Line 5 Replacement Project. As requested, my comments focus on greenhouse gas emissions and the social cost of carbon.

Also attached are a number of Excel spreadsheets (pdf format) to support calculations found in the text. Most references are provided as a hyperlink. Please let me know should you have any trouble accessing the cited documents and I will provide you with the originals.

Please let me know if you have any questions.

Best regards,
Petra Pless

Table of Contents

I. The Draft EIS Fails to Fulfil the Requirements of the Wisconsin Environmental Protection Act

Environmental analysis and review under the Wisconsin Environmental Protection Act ("WEPA") must assure that the department decisionmakers, other decisionmakers, and the interested public have adequate information to be able to fully consider the short- and long-term effects of department policies, plans, programs, and actions on the quality of the human environment. Wis. Admin. Code NR 150.01(b). The Draft EIS for the Project falls far short of this mandate. (Note: the terms "effects," "impacts," and "consequences" are used interchangeably.[1])

The Draft EIS seems to be hastily put together and pays lip service only to analyses of the Project's environmental impacts. Much of the document consists of background information which is not adequately put into context with the environmental impacts that were purportedly analyzed. Importantly, the Draft EIS's perfunctory discussions fail to provide adequate information to support its conclusions regarding the significance of the Project's environmental impacts. As a result, many of the document's findings regarding the Project's environmental effects are conclusory and speculative. What's more, the Draft EIS fails to provide all required analyses. Specifically, it fails to provide an executive summary a summary of adverse environmental effects which cannot be avoided, and a cumulative impacts analysis.

Further, the Draft EIS is poorly put together with many sections lifted verbatim from prior documents (*e.g.*, the EIS for the Enbridge Sandpiper Pipeline and Line 3 Replacement Projects[2]) without properly editing the copied sections to incorporate project-specific information.[3] Overall, the document's incomplete and hodgepodge presentation (replete with substantially duplicative information;[4] internally contradictory information;[5] numerous grammatical errors, typographical mistakes, and

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[1] Wis. Admin. Code NR 150.03(9). (""Environmental effect," "effect," "environmental impact," "impact," "effect on the environment," or "environmental consequence" means a direct, indirect, secondary, or cumulative change to the quality of the human environment.")

[2] DNR, Final EIS for the Enbridge Sandpiper Pipeline and Line 3 Replacement Projects ("hereafter "Sandpiper Final EIS"), August 2016; available at: https://dnr.wisconsin.gov/topic/EIA/Archive.html.

[3] *See* Comment I.B.

[4] For example, Draft EIS chapter *2.6.16.2 Pipeline Decommissioning*: the entire paragraph on p. 47 (last paragraph), beginning with "According to Enbridge, …." is duplicated with minor changes on p. 49 (first full paragraph).

[5] *See* Comment I.C regarding construction schedule and migratory bird nesting season; acreage of forest land affected by Project; and emissions of CO_2 per ton-mile for pipelines.

formatting issues;[6] arithmetic errors and incorrect units of measurement;[7] undefined terms;[8] obsolete references;[9] lack of adequate data (including reliance on third-hand

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[6] For example, Draft EIS, p. 61 (The following alternatives to this proposal were considered for detailed: [sic]"); Draft EIS, p. 147: "… multiple pigs are place between…;" Draft EIS p. 348: "Enbviro0nmental Justice;" Draft EIS, p. 223, Section 6.14.10.1.3, discussing impacts on the White River Breaks State Natural Area: "Neither indirect, long-term nor cumulative impacts to the White River Boreal Forest SNR would be anticipated." and Draft EIS, p. 336: the reference "Thorne, Colin (1982)" appears out of alphabetical order between "Code of Federal Regulations" and "Department of Natural Resources. (DNR). 1999."

[7] Draft EIS, p. 327: the correct units of measurement for annual crude oil transportation and annual carbon dioxide ("CO_2") emissions in equations are "million tons CO_2/year" and "tons CO_2/year," not "million ton CO_2" and "ton CO_2," as shown in the Draft EIS.

Draft EIS, Table 6.3-1 Potential VOC, HAP, and GHG Releases, p. 147: presents "GHG" emissions in tons/year; however, review of the underlying information by Enbridge shows that these estimates are instead in metric tons carbon dioxide equivalent ("CO_2e") per year.

Draft EIS, p. 327: calculation of annual CO_2 emissions by each mode of transportation improperly rounds the calculated weight of crude oil transported to three significant digits (29.6 M tons or million tons) in the middle of the calculation, instead of rounding the result.

[8] For example, Draft EIS, p. 22, "drag reducing agent," and pp. 147 and 148: "frac tanks."

[9] For example: The Draft EIS, chapter *11. Sources Cited* references *USEIA. 2020c. Frequently Asked Questions. How much oil is consumed in the United States? Accessed December 31, 2020.* This reference is not found in the text.

information[10]); and non-sequitur statements)[11] and inadequate or omitted analyses[12] fails to fulfil the public review requirements of WEPA. Some examples follow in the comments below.

We recommend that DNR prepare a revised Draft EIS that adequately addresses these issues and provides a considered analysis of the Project's impacts on the environment.

I.A Confusing Organization and Failure to Provide Essential Information

While there is no specific format required for an EIS, WEPA requires a format that substantially follows the guidelines issued by the U.S. Council on Environmental Quality ("CEQ") under 42 USC 4331 for implementing the National Environmental Policy Act ("NEPA"). Wis. Admin. Code NR 150.30(1)(e).

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[10] For example, the Draft EIS, p. 327, relies on CO_2 emission factors (in tons CO_2/million ton-miles) for trucks, trains and barges from a website maintained by the Central Ohio River Business Association (reference not provided in chapter *11. Sources Cited*), which in turn relies on information from "ACBL." Presumably, this refers to the American Commercial Barge Line, an inland barge transportation company moving grain, dry bulk, and liquid commodities; however, ACBL's website no longer shows the referenced information. The emission factors relied upon by the Draft EIS (**19.3**, **26.9**, and **71.6** tons CO_2/ton-mile for barges, rail, and truck, respectively) appear to originate with a 2009 study by the National Waterways Foundation, a self-described "center for research and learning where industry leaders and thinkers can address public policy issues related to America's inland waterways system." (*See* Texas A&M Transportation Institute and Center for Ports and Waterways, A Modal Comparison of Domestic Freight Transportation Effects on the General Public, 2001-2019, prepared for National Waterways Foundation, Amended March 2009, p. 36; available at: http://www.nationalwaterwaysfoundation.org/study/public%20study.pdf. *For a summary see*: National Waterways Foundation, Advantages of Inland Barge Transportation: A Smaller Carbon Footprint, 2009; available at: https://www.americanwaterways.com/sites/default/files/legacy/tti/tti_study_greenhouse_gas_insert.pdf).

Note: The National Waterways Foundation recently revised these estimates to **15.1**, **21.6**, and **140.7** tons CO_2/ton-mile for barges, rail, and truck, respectively. (*See* Texas A&M Transportation Institute and Center for Ports and Waterways, A Modal Comparison of Domestic Freight Transportation Effects on the General Public, 2001-2019, prepared for National Waterways Foundation, January 2022; available at: http://www.nationalwaterwaysfoundation.org/study/TTI%202022%20FINAL%20Report%202001-2019%20(1).pdf. *For a summary see*: National Waterways Foundation, Fuel Efficient and Reliable; available at: http://www.nationalwaterwaysfoundation.org/study/NWF%202022NewStudyInserts_FINAL.pdf.)

[11] For example, Draft EIS, p. 147. ("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 VOC, GHG, and hazardous air pollutant (HAP) emissions from valves, pumps, and connectors.")

[12] *See* Comments I.A.3, I.G, and II.

The CEQ's guidelines recommend that agencies use "a format for environmental impact statements that will encourage good analysis and clear presentation of the alternatives including the proposed action" and, unless the agency determines that there is a more effective format for communication, use the following standard format for preparation of environmental impact statements:

1. Cover
2. Summary
3. Table of contents
4. Purpose of and need for action
5. Alternatives including the proposed action
6. Affected environment and environmental consequences
7. Submitted alternatives, information, and analyses
8. List of preparers
9. Appendices (if any)[13]

As discussed below, the Draft EIS fails to include all required information and fails to adequately discuss environmental consequences, including the direct, indirect, secondary, and cumulative environmental effects and their significance. Importantly, the Draft EIS omits several standard chapters that are crucial and required for providing the public with an adequate review document.

I.A.1 Failure to Provide an Executive Summary

Unlike any environmental review document we have reviewed in the past, the Draft EIS fails to include an executive summary that adequately and accurately summarizes the EIS (including a brief description of the project major conclusions, areas of disputed issues, and issues to be resolved) that would provide and highlight the main findings of its analyses. Instead, the reviewer must read the entire Draft EIS to understand the consequences of the Project. An executive summary (as well as a chapter with conclusions) was provided with the environmental impact report for the Project, published in August 2020 ("August 2020 EIR"),[14] but was omitted in the Draft EIS.

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[13] Council on Environmental Quality, National Environmental Policy Act Implementing Regulations, 40 CFR Parts 1500–1508, 2021; available at: https://ceq.doe.gov/docs/laws-regulations/nepa-implementing-regulations-desk-reference-2021.pdf.

[14] Enbridge, Line 5 Wisconsin Segment Relocation Project, Wisconsin Department of Natural Resources, Environmental Impact Report, Revised August 2020, pp. 1-3 and 122-129.

I.A.2 Failure to Provide a Summary of Adverse Environmental Effects Which Cannot Be Avoided

Further, the Draft EIS also fails to provide a "summary of adverse environmental effects which cannot be avoided," as required by Wis. Admin. Code NR § 150.30(2)(g)(2)m, which is typically provided as a summary table.[15]

I.A.3 Failure to Provide Cumulative Impacts Analyses

State regulations explicitly require DNR to evaluate "the probable positive and negative direct, secondary and cumulative effects of the proposed project … on the human environment." Wis. Admin. Code NR § 150.30(2)(g). Cumulative effects means "compounding effects resulting from repeated or other proximal actions, activities or projects." Wis. Admin. Code NR § 150.03(4).

The Draft EIS characterizes the following five types of environmental effects for the scope of analyses: direct, indirect, temporary, long-term, and cumulative impacts.[16] The Draft EIS defines cumulative effects as "the overall impact on the environment resulting from the incremental impact of an action, when added to other past, present or reasonably foreseeable actions, regardless of who undertakes them."[17] The Draft EIS defines the geographic scope it allegedly considered for its cumulative impact analyses as ranging from "rights-of-way and staging areas for the direct impacts of pipeline construction to regional climate zones for the indirect effects and cumulative impact of greenhouse gas emissions resulting from system alternatives and no-action."[18] (Note: climate change is not solely a regional effect and must be discussed in a global context as well.) Yet, the Draft EIS fails to include corresponding cumulative impacts analyses for any of the environmental impact areas.

Cumulative impacts cannot be assessed in a vacuum but rather must assess the "compounding effects resulting from repeated or other proximal actions, activities or projects." Wis. Admin. Code NR § 150(3)(4). This requires identification of other actions, activities, and projects in the region (or beyond, depending on the type of project and scope of analysis) including, at a minimum, their location; a project description; their status (*e.g.*, construction status, first date of startup); the distance to the proposed project; and the resources affected by these actions (*e.g.*, air quality, climate change,

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[15] *See*, for example, Sandpiper Final EIS, Volume I, Table ES-1, and U.S. Department of State, Final Supplemental EIS for the Keystone XL Project, December 2019 (hereafter "2019 Keystone XL Final SEIS"), Volume I, Table S-3; available at: https://2017-2021.state.gov/releases-keystone-xl-pipeline/index.html.

[16] Draft EIS, p. 71.

[17] Draft EIS, p. 71.

[18] Draft EIS, p. 71.

noise, etc.). While the Draft EIS recognizes that the environmental consequences of a project must be assessed in context with "past, present, or reasonably foreseeable future actions,"[19] it fails to even include a listing, let alone a description, of proximal actions, activities or projects.

Curiously, the August 2020 EIR included a chapter on secondary and cumulative impacts (Chapter 7).[20] The document listed other major projects in the region, including past, present, and future projects (Chapter 7.2), as shown in the below excerpt:

7.2.1 Past Projects

- Ashland-Ironwood Transmission Line Relocation
- Ashland County Solar Garden
- Saxon Harbor Dredging

7.2.2 Present Projects

- WIS 13 Corridor Project: Morse Road to Caguya Road
- WIS 13 Corridor Project: Caguya Road to Jefferson Avenue
- WIS 13 Corridor Project: Soo Line Railroad Bridge
- WIS 13 Corridor Project: Morse Road to Jefferson Avenue
- Trail System Expansion
- Broadband Initiative Project

7.2.3 Future Projects

- Saxon Harbor Campground
- Ashland Ore Dock Redevelopment

(Note: For purposes of assessing cumulative impacts with respect to greenhouse gas emissions and climate change, this list is not sufficiently comprehensive as it does not list past and proposed improvements to Enbridge's Line 5 and associated facilities elsewhere (*e.g.*, Line 5 Straits of Mackinac replacement project before the Michigan Public Services Commission ("MI PSC")[21] and ongoing improvements to Line 5,

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[19] Draft EIS, p. 71.

[20] Enbridge, Line 5 Wisconsin Segment Relocation Project, Wisconsin Department of Natural Resources Environmental Impact Report, Revised August 2020, Chapter 7, Secondary and Cumulative Impacts, pp. 115-122, and Attachment J Cumulative Impacts Projects.

[21] MI PSC, Case U-20763 (In the Matter of Enbridge Energy, Limited Partnership, Application for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief); available at: https://mi-psc.force.com/s/case/500t000000UHxxLAAT/application-for-the-authority-to-replace-and-relocate-the-

including pump station upgrades.[22] Further, the applicable regulatory provision in Wis. Admin. Code NR § 150(3)(4) does not limit such analysis to "major" projects.). Yet, rather than providing an updated list of actions, activities, and projects and a detailed discussion of their cumulative impacts, the Draft EIS simply eliminated the entire chapter. Instead, for most impact areas, the Draft EIS provides only conclusory statements regarding cumulative impacts associated with the Project and its alternatives without any supporting analyses. For example:

- The incremental release of greenhouse gasses from the construction and maintenance of the route would not result in measurable direct, indirect long-term or cumulative impacts on the atmospheric concentration of greenhouse gases."[23]
- Similarly, there are no cumulative impacts to public health and safety from rock blasting from the proposed route or the alternative routes.[24]
- Cumulative impacts on bedrock from blasting in any of the routes are not anticipated.[25]
- Neither the Copper Falls or Miller Creek Formations are anticipated to have significant direct, indirect, long term or cumulative impacts from construction of the proposed route or any of the alternative routes.[26]
- Neither indirect, long-term nor cumulative impacts are anticipated to the Penokee Hills from any of the alternative routes.[27]

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segment-of-line-5-crossing-the-straits-of-mackinac-into-a-tunnel-beneath-the-straits-of-mackinac-if-approval-is-required-pursuant-to-1929-pa-16-mcl-4831-et-seq-and-rule-447-of-the-michigan-publ.

[22] Enbridge, Enbridge Completes $20-Million Mackinaw City Pump Station Upgrade, July 15, 2016; available at: https://www.enbridge.com/Stories/2016/July/Mackinaw-City-Michigan-pump-station-upgrade.aspx. (On July 15, 2016, we completed this upgrade in Mackinaw City, on the south side of Michigan's Straits of Mackinac, after nearly six years of planning, design and construction involving more than 250 workers. This $20-million upgrade—one in a series of station upgrades along our Line 5 pipeline route through Michigan—involved the installation of the newest and most advanced piping, valves, traps and instrumentation… Our Line 5 pump station on the north side of the Straits of Mackinac, in St. Ignace, underwent a nearly identical upgrade in 2011. Numerous other Line 5 pump stations in Michigan received similar upgrades in 2012 and 2013, with numerous new remote operated valves, additional pressure transmitters, and pump rebuilds.")

[23] Draft EIS, p. 148.

[24] Draft EIS, p. 151.

[25] Draft EIS, p. 166.

[26] Draft EIS, p. 167.

[27] Draft EIS, p. 168.

- Indirect impacts, long-term impacts, and cumulative impacts to geological materials or the biological environment are not anticipated from directional drilling methods.[28]
- Neither long term nor cumulative impacts to the Copper Falls Aquifer are anticipated from the proposed route or the three alternative routes.[29]
- Long term and cumulative impacts to the Superior Sandstone Aquifer are not anticipated from the proposed route or the three alternative routes.[30]
- Neither long term nor cumulative impacts to Fractured Crystalline Aquifer are anticipated from the proposed route or the three alternative routes.[31]
- Neither long-term nor cumulative impacts to municipal supply wells are anticipated.[32]
- Neither long-term nor cumulative impacts to wells are anticipated.[33]
- Neither long-term nor cumulative impacts to agricultural lands are anticipated to result from any of the alternatives.[34]
- At present, large-scale losses of these habitat types are not planned and the proposed route would not have significant cumulative impacts on habitat loss in the Superior Coastal Plain.
- At present, large-scale losses of these habitat types are not planned and the proposed route would not have significant cumulative impacts on habitat loss in the North Central Forest.[35]
- Pipeline construction and operations in agricultural areas would not have long term or cumulative impacts.
- Neither indirect, long-term nor cumulative impacts to the White River Boreal Forest SNR would be anticipated.[36]

This approach ignores the entire purpose of a cumulative impacts analysis in that cumulative impacts "can result from individually minor, but collectively significant

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[28] Draft EIS, p. 169.

[29] Draft EIS, p. 170.

[30] *Ibid*.

[31] Draft EIS, p. 171.

[32] Draft EIS, p. 174.

[33] Draft EIS, pp. 174 and 175.

[34] Draft EIS, p. 208.

[35] Draft EIS, p. 209.

[36] Draft EIS, p. 223.

actions, taking place over a given period," as recognized by DNR elsewhere.[37] As such, even if greenhouse gas emissions from the Project were minor (which they are not, *see* Comment II.D), they may still be cumulatively significant.

I.A.4 Failure to Provide Supporting Documentation

The Draft EIS also fails to include background materials prepared in connection with the EIS. These include a number of studies that were provided with the August 2020 EIR for the Project, including: *Attachment B Unanticipated Discoveries Plan*; *Attachment C Route Alternative Maps*; *Attachment F Invasive Species List; Attachment G Land Cover Data*; *Attachment G-1 Steep Slopes Maps*; *EIR Attachment J Cumulative Impacts Projects*; *Attachment L Water Bridging Drawings*; and *Attachment N Stream Restoration Typicals*.

In addition, the Draft EIS fails to provide supporting documentation for its estimates of air pollutants and greenhouse gas emissions presented in chapter *6.3 Air Quality*, Table 6.3-1 Potential VOC, HAP, and GHG Releases.[38]

I.A.5 Failure to Require Implementation of Mitigation Measures to Reduce the Project's Potential Adverse Environmental Impacts

Wis. Admin. Code NR 150.30(2)(e) also requires that an EIS contain a description of proposed preventive and mitigating measures for the alternatives it analyzes. Here, the Draft EIS fails to unambiguously require the implementation of the preventive and mitigating measures it describes.

For example, the Draft EIS presents a lengthy discussion of best management practices ("BMPs") established by DNR to limit the introduction and spread of invasive species but does not require that Enbridge uses them.[39] DNR's BMPs are not incorporated into either Enbridge's Environmental Protection Plan[40] or Draft Agricultural Plan.[41]

Further, the Draft EIS discusses actions that could be taken to reduce impacts during abandonment but fails to require that Enbridge implement these measures:

> As described for in place pipeline abandonment, a specialized third-party consultant could test liquid materials removed from the pipe. Materials removed

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[37] Sandpiper EIS, *op. cit.,* pp. ES-15 and 7-1.

[38] Draft EIS, p. 147.

[39] Draft EIS, p. 225.

[40] *See* Draft EIS, Appx. C.

[41] *See* Draft EIS, Appx. D.

from the pipeline could be transported to an approved, licensed disposal facility."[42]

I.A.6 Inadequate Project Description

The Draft EIS fails to provide key aspects for the Project which are essential to assess associated impacts.

a) Project Lifetime

The Draft EIS fails to disclose the anticipated lifetime of the Project (or, for that matter, the remaining lifetime of other sections of Line 5).[43] This information is essential, for example, to calculate greenhouse gas emissions from biomass carbon sequestration over the service life of the Project (*see* Comment II.D.3).

The lifetime of a pipeline is difficult to pin down because it is dependent on two factors: the pipeline's physical life and its economic life. Enbridge assumes that the physical life of its pipelines would be "indefinite" under the company's "comprehensive program of maintenance and refurbishment."[44] However, there is considerable uncertainty when trying to determine the economic life of a pipeline because it depends on multiple factors including future crude oil supply capability, changes in demand, and actions aiming at decarbonization, as well as the outcome of legal actions seeking closure of individual pipelines. Due to these uncertainties, Enbridge in 2021 petitioned the Federal Energy Regulatory Commission ("FERC") to assume a December 31, 2040, truncation date (less than 18 years from now) for depreciation of the Lakehead System (*i.e.*, Enbridge's U.S. mainline, which includes Line 5[45]). Enbridge determined this

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[42] Draft EIS, p. 50.

[43] Draft EIS, p. 56, mentions operational life only in the context of operation and maintenance procedures ("The integrity of a pipeline over its operational lifetime depends on how well protected it is against threats (e.g., corrosion) that can lead to defects in the pipeline over time.")

[44] Minnesota Department of Commerce, Energy Environmental Review and Analysis, Final Environmental Impact Statement, Line 3 Project, Docket Nos. PPL-15-137/CN-14-916, August 17, 2017 (hereafter "Line 3 Final EIS"), p. 2-7; project docket available at: https://mn.gov/commerce/energyfacilities/line3/. ("The Applicant anticipates that the physical life of the proposed Line 3 pipeline (i.e., the number of years that the pipeline would be capable of transporting crude oil) would be indefinite given appropriate construction, maintenance, and integrity systems. The economic life of the Project (i.e., the number of years that continued operation of the Project would be feasible) is anticipated to be no less than 30 years.") and p. 5-3 ("The life of the project is assumed to be 30 years for the purposes of this EIS.").

[45] Enbridge's Lakehead System is the U.S. portion of its mainline and consists of Lines 1, 2B, 3, 4, 6, 5, 14, 61, 62, 64, 67, and 78. *See* Enbridge, The Mainline Pipeline System; available at: https://www.enbridge.com/~/media/Enb/Documents/Factsheets/FS_ENB_Mainline_system.pdf?la=en.

economic life the Lakehead System despite current supply forecasts supporting the conclusion that adequate crude oil supply would be available to support, at a minimum, a 20-year economic life. While Enbridge notes that physical assets may remain in service beyond this truncation date, it is nonetheless an indicator that the company is aware that the pipeline transportation business is on a downward trajectory.[46]

In its EIS for Enbridge's Line 3 replacement, the Minnesota Department of Commerce assumed a 30-year life for purposes of assessing impacts.[47] We assume the same in our calculations of greenhouse gas emissions associated with the Project.

b) *Emission Sources for Construction and Abandonment*

Construction of the new 41.2-mile pipeline and abandonment of the existing 20-mile section of Line 5 would require extensive mobilization of vehicles and construction equipment, including, for example; construction worker vehicles, all-terrain vehicles, graders, dozers, loaders, forklifts, trackhoes, backhoes, sidebooms, padding machines, trenchers, bending machines, horizontal directional drilling ("HDD") and boring machines, delivery/haul-away trucks, dump/fill import trucks stringing trucks, fuel trucks, water trucks for fugitive dust suppression, hydrotest water trucks, welding trucks, circulating mud pumps, air compressors, welders, cranes, flatbed tractor-trailers utilized to transport construction equipment, and generators. Information about the number, horsepower, hours of operation per day, load factor, miles-travelled, gallons of fuel consumed, etc. for these vehicles and equipment is necessary to estimate construction emissions for the Project. This information is routinely used to estimate construction emissions in other environmental review documents, including for pipeline projects,[48] but was not provided in the Draft EIS.

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[46] Michael Hrynchyshyn, Enbridge, Letter to Kimberly Bose, FERC, Oil Pipeline Filing, May 21, 2021; available at: https://d3n8a8pro7vhmx.cloudfront.net/oilandwaterdontmix/pages/26/attachments/original/1638974675/Enbridge_depreciaton_study.pdf?1638974675.

[47] Line 3 Final EIS, *op. cit.*, p. 2-7 ("The Applicant anticipates that the physical life of the proposed Line 3 pipeline (*i.e.*, the number of years that the pipeline would be capable of transporting crude oil) would be indefinite given appropriate construction, maintenance, and integrity systems. The economic life of the Project (*i.e.*, the number of years that continued operation of the Project would be feasible) is anticipated to be no less than 30 years.") and p. 5-3, Footnote a to Table 5.1-1 ("The life of the project is assumed to be 30 years for the purposes of this EIS.").

[48] *See*, for example, Santa Barbara County, Plains Pipeline, LP, Line 901-903 Pipeline Replacement Project (*see* 2017 Application Submittal, Attachment C.3 Air Quality Report and Attachment C.12, and 2020 Updated Documents, Attachment C.12); available at: https://cosantabarbara.app.box.com/s/t6d9jjoy80dy132ecn61qekjtf53yu5k.

c) *Emission Sources for Maintenance*

Maintenance of the pipeline would require fixed-wing aircraft or helicopter flying along the pipeline for inspection,[49] trucks delivering materials (*e.g.*, drag reducing agent), vacuum trucks, and other vehicles utilized during pigging and other maintenance events, and construction equipment, as well as flatbed tractor-trailers utilized to transport construction equipment for onsite repairs. Combustion emissions associated with these maintenance vehicles and equipment would increase because of the increased length of the new pipeline. Information about the number, horsepower, hours of operation per day, load factor, miles-travelled, gallons of fuel consumed, etc. for these vehicles and equipment is necessary to estimate operational emissions for the Project. Such information is routinely used in other environmental review documents to estimate maintenance emissions, including for pipeline projects,[50] but was not provided in the Draft EIS.

d) *Drag Reducing Agent Injection System*

According to the DEIS, the proposed Project also includes "minor modifications" to the existing Ino Pump Station in Bayfield County, including replacement of the existing drag reducing agent ("DRA") injection system with a new system including tanks for drag reducing agent storage, tank mixers, transfer pumps and accompanying appurtenances.[51] The Draft EIS does not provide information why the existing DRA injection system needs to be replaced nor does it provide any technical specifications or other descriptive information.

Drag reducing agents, or flow improvers, are injected into pipeline fluids, typically right after pump stations, to reduce frictional pressure loss (drag) due to turbulence (or non-laminar flow). This provides benefits to pipeline operators by providing additional pipeline throughput, the ability to operate in reduced pressure-drop conditions, or a combination of these effects.[52] According to one manufacturer of DRAs, their use can

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[49] *See* Draft EIS, p. 22 ("Following construction, Enbridge would maintain the permanent 50-foot-wide ROW clear of woody vegetation to conduct aerial inspections and facilitate access for maintenance."), p. 218 ("During operation, pipeline monitoring would include low-level aerial over-flight and ground-based Inspections…"), and p. 264 ("Aerial patrols are conducted at varying intervals.").

[50] *See*, for example, Santa Barbara County, Plains Pipeline, LP, Line 901-903 Pipeline Replacement Project (*see* 2017 Application Submittal, , Attachment C.12, and 2020 Updated Documents, Attachment C.12); available at: https://cosantabarbara.app.box.com/s/t6d9jjoy80dy132ecn61qekjtf53yu5k; and 2019 Keystone XL Final SEIS, *op. cit*.

[51] Draft EIS, p. 22.

[52] LiquidPower Specialty Products Inc., About DRA and How It Works; available at: https://www.liquidpower.com/what-is-dra/about-dra-and-how-it-works/.

double the throughput of pipelines.[53] DRA injection is particularly effective in lighter crudes.[54]

Review of the dockets before the DNR and the U.S. Army Corps of Engineers shows that Enbridge initially proposed the installation of a new 20-foot by 8-foot DRA injection skid but later changed the description to replacing the existing DRA injection skid with a 40-foot by 8-foot equipment skid.[55] Either way, it appears that the size (and presumably capacity) compared to the existing DRA injection skid would increase.

This new DRA injection system could be needed to overcome the increased hydraulic head at the Ino Pump Station due to the longer pipeline (replacement of 20-mile segment with 41.2 miles of pipe) or it could be installed for capacity recovery. For example, among other actions, Enbridge cited the installation of new DRA skids and associated appurtenances as one of the components for safe removal of network bottlenecks of the Mainline System, leading to capacity recovery of 25,000 bpd on Line 4:

> Line 4 capacity recovery by adding new DRA skids, trimming pump impellers and modifying motors at multiple pump stations along Line 4 in Canada and the US. ISD Q4 2019.[56]

We recommend that DNR discuss the new DRS injection skid in more detail and provide associated emission estimates in a revised Draft EIS.

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[53] LiquidPower Specialty Products Inc., DRA Benefits; available at: https://www.liquidpower.com/what-is-dra/dra-benefits/.

[54] Housley Carr, RBN Energy, LLC, Kind of A Drag – Boosting Crude and Products Pipeline Capacity with Drag Reducing Agents, January 18, 2017; available at: https://www.liquidpower.com/wp-content/uploads/2017/07/Kind-Of-A-Drag-Boosting-Crude-And-Products-Pipeline-Capacity-With-Drag-Reducing-Agents.pdf.

[55] *See*, for example, Enbridge, Line 5 Wisconsin Segment Relocation Project, Ashland, Bayfield, Douglas, and Iron Counties, Wisconsin, Water Resources Application for Project Permits, Supplemental Information, Revised August 2020, track changes version, p. 10 ("These modifications will include replacement of the existing drag reducing agent injection system (DRA Injection skid) with a new 40-foot by 8-foot DRA Injection skid ~~installation of a new 20-foot by 8-foot~~ skid containing two new drag reducing agent storage tanks, tank mixers, and associated appurtenances.").

[56] MI PUC, Enbridge Energy Response to Honor the Earth Information Request, Docket No. PL9/CN-14-916, Response to Request # 16 (Update of Mainline System Planned Capacity Increases to 2020); available at: https://efiling.web.commerce.state.mn.us/security/login.do?method=showLogin.

I.A.7 Organizational Issues

An EIS may be organized in several ways. Some of the more common variations are:

- A combined "Affected Environment" and "Environmental Consequences" discussion.
- Separate "Affected Environment" and "Environmental Consequences" sections.
- Display effects on an alternative-by-alternative basis, analyzing each affected resource or feature under one alternative before turning to the next alternative and its effects.
- Describe one affected resource, or a group of similar resources, followed by a comparison of the impacts of each alternative upon it on an alternative-by-alternative basis.

While all of these approaches, or different combinations of them, are acceptable, generally, combining the chapters on "Affected Environment" and "Environmental Consequences" reduces redundancy and is considered by some to be easier for the reader.[57] Further, most often, subchapters on impact areas (*e.g.*, air quality, biological resources, traffic and transportation, etc.) are presented in alphabetical order, particularly when a large number of such impact areas are analyzed. Here, the Draft EIS presents 21 impact areas in non-alphabetical order that does not follow any discernible logic.

a) Inconsistent Presentation of Impact Areas

Here, the DNR chose to separate the description of the affected environment (chapter *5 Current Conditions*) from the assessments of environmental consequence for the Project (chapter *6 Effects of the Proposed Project and Route Alternatives*) and the no-action and system alternatives (chapter *9 Effects of No Action and System Alternatives*). (Note, contrary to the heading, environmental effects associated with the three route alternatives are <u>not</u> addressed in chapter 6 *Effects of the Proposed Project and Route Alternatives*, because they were dismissed in chapter 3 Route Alternatives.) In addition, the Draft EIS separates out the discussion of pipeline spills into a freestanding chapter (*7 Risk and Potential Effects of Pipeline Spills*).

Further, the organization of chapter *9 Effects of No Action and System Alternatives* does not follow the same outline as chapters 5 and 6, which cover 21 impact areas, but rather addresses only five impact areas (*9.2 Traffic and Infrastructure*, *9.3 Risk and Potential Effects of Spills*, *9.4 Air Quality and Greenhouse Gas Emissions*, *9.5 Climate Change*, and

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[57] Bureau of Reclamation, Reclamation's NEPA Handbook, Managing Water in the West, February 2012, pp. 8-2 and 8-3; available at: https://www.usbr.gov/nepa/docs/NEPA_Handbook2012.pdf, accessed February 3, 2022.

9.6 Socio-economics). The Draft EIS does not disclose why the other 16 impact areas were not addressed for the No Action and System Alternatives.

Review of this disjointed presentation is complicated by the fact that the chapters on environmental impact areas are provided in non-alphabetical order, have inconsistent headings (*e.g.*, chapters *5.2 Transportation*, *6.2 Transportation – Road Congestion* and *9.2 Traffic and Infrastructure*), and for the three system alternatives addressing alternative means of transportation (rail, truck, ship/barge) are lumped together into one chapter (*9.4 Air Quality and Greenhouse Gases*). This disorganized presentation has the reviewer constantly flipping back and forth between chapters trying to make out the meaning of it all.

What's more, the Draft EIS fails to discuss impacts associated with the Project and its alternatives in the correct chapters. For example, for the rail alternative, the Draft EIS discusses impacts on air quality in the chapter on transportation,[58] while the chapter on air quality and greenhouse gases only establishes the number of daily trucks that would be required but does not discuss the associated impacts on air quality at all.[59]

In addition, the Draft EIS provides estimated emissions of carbon dioxide ("CO_2") from pipeline transportation of crude oil in chapter *9 No Action and System Alternatives*[60] under the subheading *9.4.2.3 Ships/Barges* but fails to incorporate this estimate or discuss impacts from pipeline transportation in chapter *6 Effects of the Proposed Project and Route Alternatives.* (Note: Chapter *9 Effects of No Action and System Alternatives*, begins with subchapter *9.1 Overview and Explanation*. This subchapter only addresses the No Action Alternatives but does not address system alternatives.[61])

In sum, the disjointed organization of and incomplete discussion presented by the Draft EIS unnecessarily complicates review. Several examples are discussed in more detail below.

b) Improper Sequence of Headings for Decommissioning (Abandonment or Removal) of Pipeline

Decommissioning of the existing section of Line 5 within the Reservation can be accomplished by either abandoning the pipeline in place, excavating and removing it,

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[58] *See* chapter 9.2 Traffic and Infrastructure, 9.2.2.2 Rails: "Environmental impacts associated with railroads include increased air emissions associated with burning of fossil fuels."

[59] *See* chapter *9.4 Air Quality and Greenhouse Gases*, subchapter *9.4.2.2 Rail*.

[60] Draft EIS, p. 327.

[61] Draft EIS, p. 319.

or a combination of both abandonment-in-place and removal based on site-specific requirements. The Draft EIS summarizes information for these activities under the following heading and subheadings:

2.6.16 Abandonment of Existing pipe
2.6.16.1 Pipeline Decommissioning
2.6.16.2 Pipeline Removal[62]

Obviously, the heading and subheadings are not in the correct order, as abandonment is one of the two options for decommissioning, not the other way round. What's more, the information presented in these sections does not follow a logical flow either: for example, information that is relevant for pipeline abandonment is only found in a later chapter on pipeline removal.[63]

c) Inconsistent Organization and Failure to Adequately Discuss Impacts Hamper Review of Project Impacts with Respect to Air Quality and Greenhouse Gas Emissions

The Draft EIS presents discussions of the environmental effects due to emissions of greenhouse gases from construction and operation of the "Project and Route Alternatives" in three chapters: *6.3 Air Quality*, *6.4 Greenhouse Gas Emissions*, and *6.5 Regional Climate*. (Note that chapter *6.5 Regional Climate* discusses atmospheric concentrations of greenhouse gases rather than a discussion of regional effects, as claimed by the Draft EIS elsewhere.[64]) Environmental effects due to emissions of greenhouse gases from construction and operation of the "No Action and System Alternatives" are discussed in chapters *9.4 Air Quality and Greenhouse Gas Emissions* and *9.5 Climate Change*. This fractured presentation, which does not even follow the same organizational structure, makes it difficult for the public to understand and compare the differences and severity of effects between the Project and the various route and system

[62] Draft EIS, pp. 47-49.

[63] Draft EIS, chapter 2.6.16.2 Pipeline Removal, p. 49 ("Contaminants that might be released from pipelines include substances produced in the hydrocarbon stream and deposited on the walls of the pipeline; treatment chemicals; the line pipe and associated facilities; pipeline coatings and their degradation products; and historical leaks and spills of product that were not cleaned to current standards (NEB 1996).") and p. 50 ("The removal of hazardous materials in a pipeline ready for abandonment can be carried out with a cleaning pig. 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.")

[64] Draft EIS, p. 74. ("The scope of analysis for the draft EIS included Wisconsin's climate, both as a potential end-point of environmental effects (*i.e.*, climate change) and as a contributing factor in determining other environmental effects, such as stormwater runoff and impacts on climate-sensitive species.")

alternatives considered. This problem is further exacerbated by the absence of a summary table comparing the environmental effects of the Project and considered alternatives.

What's more, while the Draft EIS identifies three potential route alternatives (RA-01, RA-02, RA-03),[65] their impacts with respect to greenhouse gas emissions and climate change (or air quality), are not mentioned once in the chapters they are allegedly analyzed in (*6.3 Air Quality*, *6.4 Greenhouse Gas Emissions*). Thus, reviewers are left in the dark about their impacts, left to draw conclusions on their own how these route alternatives compared to the Project. Only in chapter *6.5 Regional Climate* does the Draft EIS vaguely mention once that alternative routes "could" result in an incremental increase of greenhouse gas emissions.[66] Yet, the document fails to disclose the severity of these incremental increases compared to those of the Project because it does not provide any quantitative analysis, or even a qualitative discussion.

I.A.8 Failure to Analyze Reasonable Alternatives

Wis. Admin. Code NR 150.30(2)(e) requires that an EIS contain a list of reasonable alternatives to the proposed project, particularly those that might avoid all or some of the adverse environmental effects of the project.

a) System Alternatives

The Draft EIS describes considers three system alternatives for the Project: a) switch to other existing pipelines; b) construct a new pipeline; and c) alternative modes of transport via either trucks, rail cars, or ships/barges.[67]

The Draft EIS assesses potential impacts associated with the three alternative modes of transportation assuming the entire capacity of Line 5 (540,000 bbl/day) would be transported via one of these modes.[68] This assumption is not reasonable and unlikely to occur. Instead, a more likely outcome of a shutdown of Line 5 would be an increase in crude oil shipments on other, existing pipelines (*e.g.*, Line 78) and a smaller increase in alternative transportation modes, particularly rail. In addition, shutdown of Line 5 would likely result in increasing replacement of propane fuel in Wisconsin and

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[65] Draft EIS, Section 3.2 Route Alternatives, pp. 62-66.

[66] Draft EIS, p. 148. ("There could be an incremental increase if additional pumping stations were required for the alternative routes.")

[67] Draft EIS, p. 61.

[68] Draft EIS, p. 327.

Michigan with alternatives for heating and cooking (*e.g.*, electric heat pumps[69]). DNR should analyze this scenario – a combination of transport via and rail and reduced demand of propane – as a reasonable alternative.

b) No Action Alternative(s)

Instead of providing a stable and finite definition of the No Action Alternative, the Draft EIS describes two scenarios: 1) continued operation of Line 5 within the Bad River Reservation and 2) decommissioning Line 5. Which scenario would occur under the No Action Alternative, the Draft EIS maintains, depends on the outcome of the lawsuit by the Bad River Band of Lake Superior Chippewa to remove Line 5 from the Bad River Reservation as if DNR did not have a choice in permitting the Project.

Further, rather than analyzing shutdown of Line 5 as a reasonable No Action Alternative, the Draft EIS brushes off any in-depth analysis. We recommend that DNR prepare a revised Draft EIS that properly assesses the environmental impacts of the shutdown of Line 5 as the No Action Alternative.

I.B Failure to Edit Language Copied from Other Documents

The Draft EIS states that "air emissions typically would be localized, intermittent, and short term. *These temporary impacts would occur twice if the pipelines are not constructed concurrently.*"[70] The latter statement is nonsensical as the Project would include construction of only one pipeline. It appears, that this sentence (indeed the entire paragraph) was copied verbatim from the Sandpiper EIS.

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[69] *See* Direct Testimony and Rebuttal Testimony of Dr. Elizabeth A. Stanton, on Behalf of the Environmental Law & Policy Center, The Michigan Climate Action Network, and the Bay Mills Indian Community, September 14, 2021 and December 14, 2021, MI PSC Case No. U-20763 (In the Matter of Enbridge Energy, Limited Partnership, Application for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service, Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief); available at: https://mi-psc.force.com/s/case/500t000000UHxxLAAT/application-for-the-authority-to-replace-and-relocate-the-segment-of-line-5-crossing-the-straits-of-mackinac-into-a-tunnel-beneath-the-straits-of-mackinac-if-approval-is-required-pursuant-to-1929-pa-16-mcl-4831-et-seq-and-rule-447-of-the-michigan-publ.

[70] Draft EIS, p. 147, *emphasis* added.

Reference to more than one pipeline is not a one-time occurrence: throughout the text, the Draft EIS repeatedly refers to "pipelines" or "projects" when it intends to refer to the Project,[71,72] presumably in sections that were copied from the Sandpiper EIS.

I.C Internal Inconsistencies

The Draft EIS contains a number of inconsistencies and contradictions, including:

- The Draft EIS anticipates that construction would occur over a 9-month period beginning on February 7, 2022, with an in-service date for the replacement pipeline of September 1, 2022. Elsewhere, the Draft EIS states that "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, from March 5 to July 31.[73] These two statements are incompatible. Specifically, the proposed construction schedule for the Project indicates that utility sweeps and right-of-way clearing would occur through April 20, which falls squarely within the migratory bird migration and nesting season. Further, rock blasting would also occur during this season, from March 1 through May 13. Therefore, any conclusions regarding

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[71] For example, Draft EIS, p. 21 ("An AC mitigation system would also be installed, which is a grounding system to protect pipelines…"), p. 28 ("External cathodic protection systems would be installed to inhibit corrosion during the operating life of the pipelines."), p. 30 ("… facilitate the installation of the pipelines."), p. 39 ("Clearing would be limited to the extent needed for access and construction of the pipelines" and "… to prevent excessive bending of the pipelines."), p. 41 ("Pipelines in areas of shallow bedrock would be protected…"), p. 46 ("After the pipelines have been installed and tested…"), p. 55 ("… installation of the pipelines."), p. 59 ("… growth of woody vegetation over the pipelines."), p. 148 (… due to the short amount of time it would take to construct the pipelines."), p. 180 ("The proposed route of the pipelines…"), p. 221 ("… construction and operation of the pipelines…," and "pipelines would be installed"), p. 256 ("… crude oil releases from the pipelines…"), and p. 259 ("Hydrostatic testing of the pipelines…").

[72] For example, Draft EIS, p. 39 ("… in accordance with the Projects' permits), p. 40 ("…as specified in the Projects' plans, commitments, or permits" and "along the proposed Projects' route"), p. 51 ("… construction methods, BMPs, spill prevention, and other measures that would be used in construction of the Projects."), p. 59 ("… impacts on Managed Forest Law lands would occur from construction of the Projects…"), p. 105 ("… overall environmental review of the proposed Projects," "… consultation under Section 7 of the ESA is required for these Projects," and "… Section 7 consultation for these Projects."), p. 147 ("Construction of the proposed projects is not expected to significantly affect local or regional air quality," "No long-term emissions would result from operations associated with the proposed Projects…," and "operation of the proposed projects"), p. 180 ("There are no natural lakes found in the area crossed by the proposed projects."), and p. 240 ("…affected by the Projects' construction…," "discovered along the Projects' route,…," "…avoid Projects-related impacts,…," "… construction of the Projects,…"), p. 329 ("Especially when the projects crosses or is near waterways.").

[73] *See* Draft EIS, Table 6.17.2.1-2 Anticipated Enbridge Construction Schedule, pp. 229-230.

construction impacts on biological resources (chapter *6.1.4 Wildlife, Fish, Plants, and Natural Communities*) are not supported.

- The Draft EIS states three times that construction of the Project would temporarily impact **354.7** acres of forest land cover (based on a standard 120-foot-wide corridor along the proposed route).[74] However, based on the Draft EIS, Table 3.2.3-1, the affected forest land would be **357.7** acres.

- The Draft EIS alternately refers to the length of new pipeline as "approximately 41 miles,"[75] "41.1 miles,"[76] "approximately 41.1 miles,"[77] and ""41.2 miles,"[78] sometimes using different mileage within the same paragraph.

- The Draft EIS calculates a CO_2 emission factor for pipeline transport of crude oil based on the following assumption: "… pipelines are estimated to have 70% less emissions than train [sic], equaling **8.07** tons of CO_2 per million ton-miles."[79] Yet, Draft EIS's equation for calculating annual CO_2 emissions associated with pipeline transport relies on **10.5** tons CO_2/million ton-mile without an explanation of this discrepancy.[80] (Note: for these emission factors, the Draft EIS relies on third-hand information from a website maintained by the Central Ohio River Business Association rather than citing from the original study.[81])

I.D Inadequate Description of Environmental Setting for Air Quality

The Draft EIS claims that Section 5, Current Conditions, "describes the environment present within proposed route and route alternatives."[82] However, with respect to air quality, the provided information is entirely inadequate to describe the environmental setting, *i.e.*, "a description of the human environment that will likely be affected by the proposed project and alternatives to the proposed project." Wis. Admin. Code NR § 150.30(2)(f).

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[74] Draft EIS, pp. 146, 206, and 210.

[75] Draft EIS, pp. 2 and 20.

[76] Draft EIS, p. 63 and Table 3.2.3-1.

[77] Draft EIS, pp. i and 61,

[78] Draft EIS, pp. 1 and 2.

[79] Draft EIS, p. 327.

[80] *Ibid*.

[81] *See* Footnote 10.

[82] Draft EIS, p. 76.

Specifically, the Draft EIS provides a summary of national ambient air quality standards ("NAAQS") and the status of their adoption into the Wisconsin administrative code. However, the Draft EIS fails to put these standards into context by providing a list of monitored ambient air quality concentrations and a discussion of the current attainment status of the region as the current environmental setting (or baseline). Curiously, this information was included in the August 2020 EIR Yet, instead of updating this information for the December 2021 publication date, the Draft EIS simply eliminated the entire discussion. This is not acceptable.

Without describing existing background ambient air quality concentrations and attainment status of the area where the Project would be constructed, any conclusions regarding potential exceedances of the NAAQS due to Project emissions are conclusory and unsupported. For example, if short-term background ambient air quality concentrations in an area were already close to the NAAQS, construction emissions need not be large result in an exceedance.

I.E Reliance on Outdated Information and Failure to Put Information in Context

Review of the sources cited (Draft EIS, Section 11) shows that some of the associated websites were last accessed in 2020 or the early months of 2021, almost a year before release of the Draft EIS in mid-December 2021. Many of the sources cited have been superseded by newer reports, rendering the information presented in the Draft EIR outdated or obsolete (*sources cited in italics*):

- *USEIA. 2019. U.S. Crude Oil and Natural Gas Proved Reserves, Year-end 2018. Accessed October 2020.*
  In Section 1.3.3, Demand for Oil and Gas Products, the Draft EIS discusses oil and natural gas prices and proved reserves based on the 2018 Year-end Report published by the U.S. Energy Information Administration ("EIA"). This report is released annually, and the update, the Year-end 2019 Report, was released on January 11, 2011, 11 months before the Draft EIS was released for public review on December 16, 2021.[83] (Where the 2018 report discussed another year of stronger oil and natural prices leading to 12% increase of proved reserves in the U.S, the 2019 report discusses a decline in oil and natural gas prices interrupting the trend of rising proved reserves, which remained effectively the same.)

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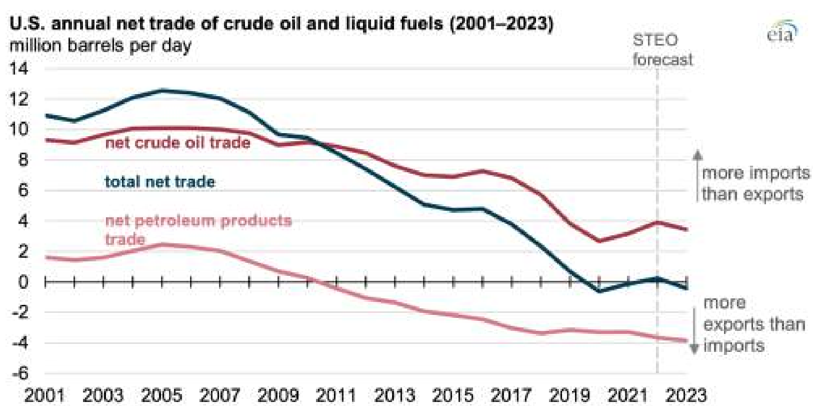
[83] EIA, U.S. Crude Oil and Natural Gas Proved Reserves, Year-end 2019; available at: https://www.eia.gov/naturalgas/crudeoilreserves/archive/2019/.

- *USEIA. 2020a. Frequently Asked Questions: How much petroleum does the United States import and export? Accessed October 2020.*
  In Section 1.3.3, Demand for Oil and Gas Products, the Draft EIS provides a discussion of U.S. *imports* of petroleum (crude oil, hydrocarbon gas liquids, refined petroleum products such as gasoline and diesel fuel, and biofuels) for the reporting year 2019. It is unclear what the reviewer is supposed to take away from this information with respect to the Project. Further, the Draft EIS fails to discuss contemporaneous U.S. *exports* of petroleum to provide the reviewer with the bigger picture of whether the U.S. is a net importer or exporter of petroleum.

  What's more, the Draft EIS's discussion relies on outdated information for reporting year 2019. Updated data for the reporting year 2020 were published by the U.S. Energy Information Administration ("EIA") several months before the Draft EIS was released and show that the U.S. became a net petroleum exporter for the first time in reporting year 2020.[84]

- Further, a more meaningful discussion than a summary of imports and exports for a specific reporting year, be it 2019, 2020, or 2021, would have a discussion of the trajectory of U.S. imports and exports of petroleum and crude oil over the past decade or more, which has been towards net export, as illustrated by the graph below.



From: Green Car Congress, EIA expects US petroleum trade to shift toward net imports during 2022; https://www.greencarcongress.com/2022/02/20220220-eia.html

[84] EIA, How Much Petroleum Does the United States Import and Export? Updated September 20, 2021; available at: https://www.eia.gov/tools/faqs/faq.php?id=727&t=6&%3A%7E%3Atext=The%20top%20five%20source%20countries%20of%20U.S.%20gross%2Cand%20net%20imports%2C%202019%20million%20barrels%20per%20day, accessed February 22, 2022.

As shown, while the EIA expects a minor reversal of the net trade trend in 2022, the forecast for 2023 follows the general trajectory towards the U.S. becoming a net exporter of petroleum products (dark blue line).

- *USEIA. 2020b. Short Term Energy Outlook. October 2020. Accessed October 2020.* In Section 1.3.3.1, Current Demand for Oil and Gas Products, the Draft EIS discusses the EIA's forecast of global petroleum and liquid fuels consumption for 2020 based on the agency's October 2020 report.[85] Again, information in this section again needs to be put in context with the Project, otherwise it is meaningless to the reviewer.

  Further, EIA's forecast reports are released monthly and the Draft EIS should have updated this section to reflect the agency's more recent forecasts but did not. Monthly reports available before release of the Draft EIS are dated December 7, 2021, November 9, 2021, October 13, 2021, and September 8, 2021.

- *Y Charts. Michigan Residential Propane Price. Accessed December 31, 2020.* In Section 9.4.1.2 Consumers (indirect emissions), the Draft EIS states: "During the last 5 years propane prices in Michigan have varied from $1.56 to $2.25 per gallon."[86] The Draft EIS provides no support for this statement. However, *Section 11 Sources Cited*, refers to a summary of Michigan residential propane prices prepared by Y Charts (based on EIA data), last accessed December 31, 2020. This information is updated weekly by Y Charts and should have been updated with the Draft EIS but was not. Review of these data shows that Michigan's five-year residential propane prices through

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[85] Draft EIS, p. 7:

> The USEIA forecasted that global petroleum consumption and liquid fuels will average 92.8 million bpd for all of 2020, down by 8.6 million bpd from 2019. Global consumption was anticipated to increase by 6.3 million bpd in 2021 (USEIA 2020b).
>
> Due to the global pandemic, the 2020 petroleum market did not align with the predictions from previous years. USEIA reported that the October Short-Term Energy Outlook (STEO) has heightened levels of uncertainty related to impacts from COVID-19 on petroleum demand and supply. Reduced economic activity consequent to the pandemic caused changes in 2020 energy demand and supply patterns. The USEIA expects that on an annual average basis the U.S. crude oil production will fall from 12.2 million bpd in 2019 to 11.5 million bpd in 2020 and to 11.1 million bpd in 2021 (USEIA 2020b).
>
> Despite expected projected inventory draws in the coming months, USEIA expects high inventory levels and surplus crude oil production capacity will limit upward pressure on oil prices (USEIA 2020b).

[86] Draft EIS, p. 325.

October 2021 ranged from $1.565 to $2.486 per gallon, being consistently above $2.40 starting October 11, 2021.[87]

I.F Failure to Provide Sources of Information

WEPA requires that an EIS provide sources of information or verbiage. Wis. Admin. Code NR 150.30(2)(i).

I.F.1 Inadequate Support of Emission Calculations

The Draft EIS presents estimates of fugitive volatile organic compounds ("VOC"), hazardous air pollutants ("HAP"), and greenhouse gases ("GHG") emissions from "operations of valves, pumps, and connectors" in Table 6.3-1. The Draft EIS discloses that these emission estimates were prepared by Enbridge but fails to provide any support, *i.e.*, a description of the underlying assumptions and calculations. This information is typically provided in a technical report as an appendix. (*See* also Comment I.G.)[88] It is unclear whether the agency independently reviewed these calculations. Given that the Draft EIS incorrectly refers to these emission estimates as long-term operational emissions,[89] this seems unlikely.

I.F.2 Reliance on Unsupported Assumptions for Residual Left in Pipe After Pipeline Abandonment

Enbridge proposes to decommission the existing section of Line 5 between the interconnect points (approximately 20 miles, crossing the Bad River Reservation in Ashland and Iron Counties) by abandoning the line in place as follows: the existing pipeline would be disconnected from operating facilities, purged of all combustibles, the ends of sections remaining in place sealed and rendered inactive.[90] The Draft EIS

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[87] YCharts, Michigan Residential Propane Price; available at: https://ycharts.com/indicators/michigan_residential_propane_price, accessed February 18, 2022.

[88] Draft EIS, p. 147. ("Enbridge estimates…")

[89] Draft EIS, p. 147. ("No long-term emissions would result from operations associated with the proposed projects, except for fugitive VOC, GHG, and hazardous air pollutant (HAP) emissions from valves, pumps, and connectors. The additional components from the longer pipeline would result in additional long-term VOC, GHG, and HAP emissions increases from the valves, pumps, connectors, and other fugitive piping components… See table below for breakdown of estimates.") Review of the docket shows that Enbridge instead calculated these fugitive emissions as combined emissions from commissioning, decommissioning, and operational activities *See*, Enbridge, Responses #1 and #2 to DNR Follow-up Regarding Enbridge's September 16, 2021 Response to DNR September 1, 2021 Data Request Question #15.

[90] Draft EIS, p. 47.

recognizes that leaks of hazardous materials from the pipeline may occur after it is abandoned in place.[91]

The Draft EIS discusses residuals left in the pipeline after pipe cleaning for decommissioning, citing to a 1996, a quarter of a century-old, report by the National Energy Board (Canada):

> … 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. As described for in place pipeline abandonment, a specialized third-party consultant could test liquid materials removed from the pipe. Materials removed from the pipeline could be transported to an approved, licensed disposal facility.[92]

(Note: DNR should require that liquid materials from pipeline abandonment be tested and transported to an approved licensed disposal facility rather than leaving the decision up to Enbridge *viz*. "could.") However, studies have shown that significant quantities of contaminants may be left behind in abandoned pipelines as a result of poor pigging and chemical cleaning practices. These remaining residuals (products left inside the pipeline) can cause future issues by directly contaminating the soil when the integrity of the abandoned line is compromised or by creating an environment within the abandoned pipeline that is conducive to internal corrosion (*e.g.*, under deposit corrosion and/or microbiologically influenced corrosion).[93]

The Draft EIS further discusses pipeline decommissioning and abandonment in place of Line 5 based on information provided by Enbridge, stating that cleaning procedures would be repeated until a residue thickness of less than the "currently acceptable limit" of 12 ounces per 36 miles of 30-inch diameter pipe would remain (**0.33 oz/mile**[94]).[95] The Draft EIS provides no reference to "currently acceptable" or any demonstration that this level of residual in the pipe has been achieved in practice.

In fact, it appears that these estimated residuals are so far theoretical and calculation-based only and have not been demonstrated in practice. Specifically, a report by the

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[91] Draft EIS, p. 48.

[92] Draft EIS, p. 50.

[93] Tamer Crosby, Desiree Joe, Amanda Prefontaine and, Haralampos Tsaprailis, Alberta Innovates - Technology Futures, Cleaning of Pipelines for Abandonment, Final Report, September 2015, prepared for PTAC, (hereafter "2015 PTAC report") p. 12; available at: https://www.ptac.org/wp-content/uploads/2016/08/Final-Report-17.pdf.

[94] (12 oz)/(36 miles)= 0.33 oz/mile.

[95] Draft EIS, pp. 47 and 49.

Petroleum Technology Alliance of Canada ("PTAC") from 2015 indicates that Enbridge calculated the volume of products left inside the pipe for decommissioning of the existing 34-inch Line 3 (Alberta, Canada, to Superior, WI). These calculations were based on a proposed cleaning program using a number of water stages (assuming a mixing efficiency between 80% and 90%). Based on these assumptions, Enbridge calculated the residual at less than 7.2 mL/km (**0.39 oz/mile**) of pipeline, corresponding to removing 99.988 % of the residual product from the pipeline. (It appears that the residual cited in the Draft EIS (0.33 oz/mile) was scaled from the estimate for Line 3 based on the inner diameter of the respective pipes.)

At present, the overall effectiveness of Enbridge's proposed cleaning procedures is unclear and has yet to be validated and the potential quantities and properties of the remaining contaminants within an abandoned pipeline are not fully known, as summarized by the 2015 PTAC report: [96]

> Enbridge decommissioning of Line 3 provides a great opportunity to case study major pipeline abandonment/decommissioning project. Third party witnessing of the process and the approach and lessons learned from this project could be used as a foundation for an industry best practice. For instance, to validate the Enbridge calculations that indicate a residual of less than 7.2 mL/km of oil after cleaning using water stages, among other aspects of their cleaning program.[97]

Enbridge's existing Line 3 pipeline will be decommissioned once the Line 3 replacement pipeline becomes operational.[98] At present, the 337-mile Minnesota portion of the replacement project is still under construction (construction began December 2020)[99] and, thus, the existing Line 3 pipeline remains in operation. In other words, Enbridge's estimates are so far theoretical calculations that have not been validated in practice.

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[96] Tamer Crosby, Desiree Joe, Amanda Prefontaine and, Haralampos Tsaprailis, Alberta Innovates - Technology Futures, Cleaning of Pipelines for Abandonment, Final Report, September 2015, prepared for PTAC, p. 12; available at: https://www.ptac.org/wp-content/uploads/2016/08/Final-Report-17.pdf.

[97] 2015 PTAC Report, p. 68.

[98] Enbridge, Line 3 Deactivation; available at: https://www.enbridge.com/projects-and-infrastructure/public-awareness/minnesota-projects/line-3-deactivation.

[99] Enbridge, Line 3 Replacement Project (U.S.); available at: https://www.enbridge.com/projects-and-infrastructure/public-awareness/minnesota-projects.

I.F.3 References

The Draft EIS fails to provide adequate references, for example:

- In *Section 1.3.3.2.1, Alternative Energy*, the Draft EIS discusses the U.S. EIA's forecast for U.S. electricity consumption including shares from renewable energy citing to "USEIA 2020." This source is not found in *Section 11, Sources Cited*.

- Outdated and no longer functioning weblink: Enbridge 2020f; University of Alberta 2016; U.S. Department of Agriculture 2017a; and

- Source cited not available to the public: Capital Policy Analytics, September 2021.

I.G Failure to Adequately Quantify Emissions and Failure to Establish Criteria or Thresholds to Determine the Significance of Air Pollutant and Greenhouse Gas Emissions

As discussed below, the Draft EIS fails to adequately estimate emissions of air pollutants and greenhouse gases and fails to present any criteria or quantitative thresholds to assess their significance and to determine the severity of impacts. In the absence of such metrics, any conclusions with respect to emissions of air pollutants and greenhouse gases are speculative and unsupported. Further, the public is deprived of understanding how the agency arrived at its conclusions regarding the significance of impacts.

I.G.1 Failure to Adequately Quantify Emissions

The Draft EIS recognizes that construction and operation of the Project would result in emissions of air pollutants, including hazardous air pollutants, and greenhouse gases.[100]

a) Construction

The document briefly acknowledges different emission sources during construction, including: fugitive dust; combustion emissions from gasoline and diesel-powered construction equipment, trucks, and other mobile sources; open burning of cleared materials including trees; and fugitive emissions from temporary fuel storage tanks and refueling emissions.[101] The Draft EIS concludes – without providing a quantitative analysis – that construction of the Project is not expected to significantly affect local or regional air quality.[102]

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[100] Draft EIS, pp. 146-147.

[101] Draft EIS, p. 147.

[102] *Ibid*.

b) *Operations*

Further, during the operational phase of the Project, pipeline monitoring would include low-level aerial over-flight and ground-based inspections[103] as well as maintenance activities (*e.g.*, removal of brush and trees to prohibit growth of woody vegetation over the pipeline along the permanent right-of-way).[104] The Draft EIS provides no estimates of greenhouse gas (or criteria air pollutant) emissions for these activities.

Operation of the Project would also result in fugitive emissions from pipeline pigging, storage tanks, and from valves, pumps, connectors, and other fugitive piping components. The Draft EIS only provides estimates of fugitive emissions – including volatile organic compounds ("VOCs"), hazardous air pollutants ("HAPs"), and greenhouse gases from valves, pumps, connectors, and other components for Project operations.[105] (Note: Review of the underlying information, which was provided by Enbridge in response to a data request by DNR, shows that these emission estimates are not only for Project operations but are total emissions from Project operations and commissioning and decommissioning).[106] These emission estimates are incomplete and by far underestimate Project emissions because they a) address only a comparatively minor source of emissions (*see* Comment II.D for greenhouse gas emissions, which equally applicable to air pollutant and HAP emissions) and b) fail to quantify emissions of other air pollutants including particulate matter equal to or smaller than 10 micrometers and 2.5 micrometers ("PM10" and "PM2.5," respectively), which result from fuel combustion and fugitive dust, and nitrogen oxides ("NOx") from fuel combustion. Further, it is unclear what DNR thinks this information provides, as the Draft EIS fails to put these emissions in context.

I.G.1 Criteria and Thresholds for Impacts on Air Quality

For air quality, environmental review documents most often use the following thresholds to determine whether of air pollutant emissions would have significant adverse effects on air quality:

- An exceedance of a NAAQS in an attainment area;

[103] Draft EIS, pp. 22, 59, 60, 200, 218, 260, and 264.

[104] Draft EIS, p. 22.

[105] Draft EIS, p. 147.

[106] Enbridge, September 1, 2021 Wisconsin Department of Natural Resources Data Request Response Follow-up, DNR Data Request Question: Follow-up question regarding Enbridge's September 16, 2021 response to DNR September 1, 2021 Data Request Question #15: Enbridge Response #2. ("Potential VOC, HAP and GHG emissions from the temporary pipeline commissioning and decommissioning activities and the permanent mainline isolation valve sites are summarized in Table A.")

- A specified incremental increase (in micrograms per cubic meter ("μg/m^3")) in nonattainment areas; and/or
- An increase in pollutants over an established quantitative threshold in pounds per day ("lb/day") and/or tons per year ("ton/year").

Here, the Draft EIS simply concludes that "[c]onstruction of the proposed projects [sic] is not expected to significantly affect local or regional air quality.[107] Similarly, for operational emissions, the Draft EIS states that "[t]here are no ambient air quality standards or increments for VOC, GHG or HAP emissions although there are ozone standards for which VOC is a precursor and state requirements for HAPs." Regardless," the Draft EIS concludes, "operation of the proposed projects [sic] would not cause or contribute to a violation of any federal, state, or local air quality standards."[108] (It is unclear what "state, or local air quality standards" DNR refers to, as the agency did not identify any such standards.[109]) Without information about existing ambient concentrations of air pollutants in the area and without modeling incremental ambient concentrations resulting from Project emissions or comparing emissions to an established quantitative threshold, the agency has no basis for these conclusions.

I.G.2 Quantitative Thresholds for Greenhouse Gas Emissions

The Draft EIS also presents emission estimates for greenhouse gases ("GHG") associated with fugitive emissions from fugitive piping components (*e.g.*, valves, pumps, and connectors) from Project operations.[110] Again, these emission estimates are incomplete because they a) address only a comparatively minor source of emissions (*see* Comment II.D). The Draft EIS states that "[t]here are currently no federal regulations or guidelines for maximum GHG emissions (although such regulations could be developed in the future)."[111] However, the lack of federally recommended thresholds for greenhouse gas emissions does not excuse DNR from providing a reasoned analysis of significance, which the agency could accomplish by establishing their own quantitative thresholds or relying on thresholds established by other agencies. For a discussion how the agency could go about deriving such quantitative thresholds, *see* Comment II.A.

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[107] Draft EIS, p. 147.

[108] *Ibid*.

[109] Draft EIS, pp. 76-78.

[110] Draft EIS, p. 147.

[111] Draft EIS, p. 148.

I.H Preliminary Blasting Plan Constitutes Improper Deferral of Analysis

The Draft EIS evaluates noise impacts and impacts on biological resources associated with blasting activities during construction of the Project based on a preliminary Blasting Plan.[112] This plan only identifies general blasting procedures and does not contain any site-specific information such as the locations and type and quantities of explosives that would be used, or their timing.[113] This information would be developed by blasting contractor(s) and submitted to Enbridge prior to any blasting activities.[114] However, environmental impacts, such as noise impacts on humans and animals as well as impacts on air quality, cannot be evaluated in a vacuum based on a preliminary plan that does not include site-specific information. Relying on such a preliminary plan constitutes improper deferral of analysis, including the failure to identify potential ways of mitigating project impacts.

II. The Draft EIS Fails to Provide a Reasoned Analysis of the Significance of Greenhouse Gas Emissions Associated with the Project

As discussed below, the assessments for greenhouse gas emissions and impacts on climate change provided by the Draft EIS for the Project and its alternatives are substantially deficient. Specifically, the Draft EIS only provides estimates of fugitive emissions of greenhouse gases (from valves, flanges, pumps, etc.) associated with commissioning and operation of the new 41.2-mile pipeline segment and de-commissioning of the existing 20-mile pipeline segment (estimated at less than 50 tons of carbon dioxide equivalent emissions per year ("tons CO_2e/year")[115]), which are comparatively minor. (*See* Comment II.D.) However, the Draft EIS fails to quantify a) greenhouse gas emissions from construction and operation of the Project and b) from reasonably foreseeable upstream, mid-stream and downstream activities, which are several orders of magnitude higher than those presented in the Draft EIS. (We quantify these emissions in Comments II.D.1 through II.D.8.) Consequently, the Draft EIS's conclusions regarding the impacts resulting from Project-related greenhouse gas emissions are not supported.

II.A Quantitative Thresholds for Greenhouse Gas Emissions

As mentioned in Comment I.G.2, the lack of federally recommended thresholds for greenhouse gas emissions does not excuse DNR from providing a reasoned analysis of

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112 Draft EIS, Appx. E, Enbridge Draft Blasting Plan.

113 Draft EIS, p. 15, Section 2.6.8 – Blasting and Section 6.6.2 – Bedrock Blasting Effects, and Appx. E, Enbridge Draft Blasting Plan.

114 Draft EIS, Appx. E, Enbridge Draft Blasting Plan, p. 5.

115 Draft EIS, Table 6.3-1 Potential VOC, HAP, and GHG Releases, p. 147.

significance, which the agency could accomplish by establishing their own quantitative thresholds.

For example, DNR could look at its own record. DNR established and maintains the state's voluntary emission reduction registry pursuant to Wis. Admin. Code § NR 437. This registry accommodates the registration of carbon sequestration from the creation or preservation of carbon reserves and the avoided emissions resulting from energy efficiency measures and from the use of renewable energy sources. For purposes of the registry, DNR set a quantitative threshold level for greenhouse gas emissions at 25 tons per year of CO_2 equivalent ("CO_2e"). Wis. Admin. Code NR § 437.03. While this threshold was not established for purposes of WEPA review, DNR recognizes with this threshold that incremental reductions of 25 tons CO_2e/year or more can contribute to addressing the global climate crisis. It would be insincere to recognize the significance of greenhouse gas reductions at 25 tons CO_2/year for individual projects but claim to be unable to assess the significance of Project emissions for lack of a quantitative threshold.

Further, the DNR could have looked to agencies in other states for quantitative thresholds established to determine significance during environmental review. For example, the California Air Resources Board, air districts, and counties in California have established quantitative significance thresholds for construction and operation of industrial and stationary source projects on the order of 1,000 to 10,000 metric tons of CO_2e/year.[116,117] These thresholds are used to determine the significance of greenhouse gas emissions during construction and operation of pipelines under the California Environmental Quality Act ("CEQA"), which is modeled after (but more stringent than) NEPA.[118] These thresholds apply to both direct (*e.g.*, combustion emissions) and indirect emissions (*e.g.*, electricity consumption) from constructing and operating a project. (Note: These thresholds do <u>not</u> apply to upstream emissions (*e.g.*, embodied CO_2 emissions associated with steel or concrete production) or mid/downstream emissions (*e.g.*, refining of crude oils and subsequent combustion of fuels).)

DNR could have also looked to reporting thresholds for greenhouse gas emissions reporting programs, which vary between 4,545 metric tons CO_2e/year (5,000 tons CO_2e/year[119]) and 25,000 metric tons CO_2e/year.[120]

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[116] 1 metric ton = 1.1023 U.S. short tons.

[117] *See* attached Table A-1.

[118] *See*, for example, County of Santa Barbara, Plains Replacement Project, Attachment C.3 Air Quality Technical Report; available at: http://www.countyofsb.org/plndev/projects/energy/Plains.sbc.

[119] (5,000 tons CO_2e/year) / (1.1 ton/metric ton) = 4.545 metric tons CO_2e/year.

[120] *See* attached Table A-1.

To put these quantitative thresholds in context, we estimate that construction of the new pipeline, abandonment of the existing segment of Line 5, open burning associated with land clearing, and the loss of carbon sequestration about 3,000 metric tons CO_2e/year. (For detailed discussions and calculations, *see* Comments II.D.3.a through II.D.3.c) This estimate is well within the range of the above discussed significance thresholds, which indicates that the Project may result in significant adverse impacts on the environment. Because this estimate does not include a number of sources of greenhouse gas emissions during construction and abandonment (*e.g.*, indirect emissions from electricity usage and fugitive emissions from fuel tanks and refueling) and during operation of the Project (*e.g.*, indirect emissions from electricity usage, combustion emissions from maintenance vehicles and aircraft), total Project-related emissions would be closer to the higher end of the above-discussed thresholds.

Further, February 17, 2002, the Federal Environmental Energy Commission ("FERC") released an updated policy to guide natural gas project certifications (pipelines and export terminals).[121] For both new and pending natural gas projects under its jurisdiction, FERC will presume that estimated greenhouse gas emissions of 100,000 metric tons CO_2e/year would have a significant impact on the environment. (This threshold aligns with the Obama-era standard for stationary sources (*e.g.*, refineries and power plants) established by the U.S. Environmental Protection Agency ("EPA") known as the "Tailoring" Rule.") In contrast to the above discussed thresholds, which considered direct and/or indirect emissions from a project's construction and operation, the FERC guidance additionally addresses reasonably foreseeable upstream and downstream emissions for projects under the Natural Gas Act ("NGA"). Specifically, the Commission will:

> Consider direct emissions of a project to be reasonably foreseeable;
>
> Not consider the upstream and downstream emissions associated with NGA section 3 export facility projects;
>
> Consider on a case-specific basis whether downstream emissions are a reasonably foreseeable effect of an NGA section 7 interstate project; and
>
> Consider on a case-specific basis whether upstream emissions are a reasonably foreseeable effect of an NGA section 7 project.

(For purposes of analysis, a natural gas pipeline under NGA section 7 before FERC is the equivalent of the Line 5 replacement project before DNR.) For purposes of calculating emissions, FERC will apply the 100% utilization rate or "full burn" to reflect

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[121] FERC, News Releases, FERC Updates Policies to Guide Natural Gas Project Certifications, February 17, 2022; available at: https://www.ferc.gov/news-events/news/ferc-updates-policies-guide-natural-gas-project-certifications.

the project's maximum potential amount of GHG emissions. (Projects that would emit more than the designated threshold could still be approved if the benefits are found to outweigh the costs.) In addition, the 100,000 metric tons per year threshold will serve as the metric for triggering the development of an Environmental Impact Statement ("EIS") — as opposed to a less-rigorous environmental assessment ("EA"). [122]

Here, the reasonably foreseeable effects of permitting the Project to go forward are the downstream emissions associated with combustion of products manufactured from the transported products. We estimate these downstream emissions at about 29 million metric tons CO_2e/year based on a 100% utilization rate of Line 5 (540,000 bbl/day and assuming 100% crude oil to reflect the maximum potential amount of greenhouse gas emissions).[123] (*See* Comment II.D.7.c.) Reasonably foreseeable effects also include upstream emissions (*e.g.*, drilling, production, venting, flaring, fugitive emissions, transport to refinery, etc.) and midstream emissions (heat, electricity, and steam), which we estimate at about 4.2 and 0.9 million metric tons CO_2e/year, respectively.[124] (*See* Comment II.D.7.c.) Upstream, midstream, and downstream emissions, individually and in aggregate, are far above FERC's significance threshold of 10,000 metric tons CO_2e/year, indicating significant impacts on the environment. (Our emission estimates are primarily based on the Oil-Climate-Index, a web-based tool developed in conjunction with Stanford University and the University of Calgary that integrates three open-source lifecycle assessment models to systematically estimate the total greenhouse gas emissions embodied in a barrel of oil.[125] *See* Comment II.D.7.b.)

II.B Baseline for Assessing Significance of Greenhouse Gas Emissions

The DNR argues that the Project would only reroute an existing section of Line around the Bad River Reservation and would not result in an increase of pipeline capacity or utilization; therefore, the agency argues that downstream uses and emissions would not change:

> The scope of this Project only includes the replacement of existing pipeline segments and not an increase in pipeline capacity or utilization for Line 5. The Project does not provide natural gas liquids or crude oil to new markets or to new users for which additional downstream GHG contributions should be

[122] FERC, Staff Presentation, Consideration of Greenhouse Gas Emissions in Natural Gas Infrastructure Project Reviews, February 17, 2022; available at: https://www.ferc.gov/news-events/news/staff-presentation-consideration-greenhouse-gas-emissions-natural-gas.

[123] *See* attached Table A-2.

[124] *See* attached Table A-2.

[125] Deborah Gordon, Adam Brandt, Joule Bergerson, and Jonathan Koomey, Carnegie, Oil-Climate Index, created 2015 and updated 2016; available at: http://oci.carnegieendowment.org/; http://oci.carnegieendowment.org/ - models; and http://oci.carnegieendowment.org/ - termsofuse.

> estimated. The downstream uses of the natural gas liquids or crude oil are not anticipated to change because of the Project. The direct and reasonably foreseeable environmental impacts regarding GHGs for the Project would not be significant based upon the minimal direct contributions and the lack of new indirect contributions.[126]

However, this argument is too simplistic in that it only considers continued use of Line 5 as the baseline and fails to assess the Project in the context of DNR's decision, *i.e.*, whether to grant the permit to Enbridge for rerouting Line 5 or not.

For purposes of NEPA analysis, two common methods for establishing baseline conditions are to use either the "Affected Environment" or the "No Action alternative" as the baseline against which a project's impacts are compared:

- "Affected Environment" is a description of the environment as it exists today (at the time the EIS is prepared). The Affected Environment is essentially a snapshot in time, but also can include descriptions of ongoing trends.
- The "No Action alternative" involves an analysis of predicted impacts into the future in the event there is no approval of the project. Any impacts predicted under the No Action alternative are typically compared to, but should not be confused with, the Affected Environment.[127]

Comparing the predicted effects of the Proposed Action alternative to the predicted effects of the No Action alternative is the most common approach for selecting baseline conditions for NEPA analysis. (Because WEPA is modeled after NEPA, it should follow this common approach.) Comparing predicted effects solely to the Affected Environment—the approach taken by the Draft EIS—often does not allow one to take into account trends in the environment—such as population growth or climatic trends—or ongoing management actions that would take place regardless of a proposed project.[128]

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[126] Draft EIS, p. 148.

[127] *See*, for example, U.S. Department of Agriculture, Forest Service, Resolution Copper Project and Land Exchange Environmental Impact Statement, Process Memorandum to File Selection of Appropriate Baseline Conditions for NEPA Analysis, April 11, 2018; available at: https://www.resolutionmineeis.us/sites/default/files/references/garrett-swca-baseline-conditions-2018.pdf.

[128] *Ibid*.

II.C Incremental Greenhouse Gas Emissions from the Project Compared to Shutdown of Line 5 (No Action Alternative)

The Draft EIS denies that shutdown of Line 5 would affect the regional (and global) supply of petroleum products:

> … the no action alternative would not have an impact on the demand for petroleum from the existing markets in Wisconsin, Michigan, Ohio, Ontario, Pennsylvania, and Montreal. The extraction and refining of crude oil would occur regardless of whether the proposed route is constructed and operated since there are other ways for crude oil to reach markets. Greenhouse gases generated during the process of oil and gas extraction would continue as long as demand for petroleum products remains undiminished.[129]

Contrary to the Draft EIS's claim, it is well understood that the existence or non-existence of a major crude oil pipeline impacts both the production (supply) and consumption (demand) of crude oil. For example, a recent study concluded:

> Agencies have irrationally assumed that if a particular fossil fuel project is not completed, another project will provide the same type of energy from elsewhere at identical cost, resulting in identical GHG emissions. Thus, agencies routinely assert that the project will not increase emissions without evidentiary support. But this "perfect substitution" assumption is contrary to basic principles of supply and demand, and federal courts have rejected agency analysis on this basis.[130]

In parallel proceedings before the Michigan Public Service Commission for construction of a tunnel through the Straits of Mackinac,[131] economic expert Peter Erickson (senior scientist and director of Climate Policy Program at Stockholm Environment Institute, a U.S. 501(c)(3) organization affiliated with Tufts University) lays out the impacts of shutting down Line 5 on global supply and demand of crude oil. Considering the constraints on existing pipeline capacity for moving crude oils from the Bakken Formation[132] and the Athabasca tar (oil) sands deposits in Alberta, Canada, he estimates that shifting crude oil transportation from Line 5 (at present 450 bbl/day) to transportation by rail would result in stranding (not developing production) about

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[129] Draft EIS, p. 325.

[130] Jayni F. Hein and Natalie Jacewicz, Implementing NEPA in the Age of Climate Change, Michigan Journal of Environmental and Administrative Law, Vol. 10:1, Fall 2020, p. 7, internal citations omitted; available at: https://policyintegrity.org/files/publications/Hein-Jacewicz_NEPA_Climate_Change_08_17_2020.pdf.

[131] MI PSC, Line 5 in Michigan; available at: https://www.michigan.gov/line5/0,9833,7-413-99654_101065---,00.html.

[132] The Bakken Formation is located geologically within the Greater Williston Basin in Montana, North Dakota, Saskatchewan and Manitoba

290,000 bbl/day of crude oil in these formations because of the substantial cost premium of rail transportation ($6/bbl). (He further explains that this estimate of stranded crude oil may be considerably higher because constrained rail takeaway capacity would likely result in an even higher cost premium.) This, in turn, would result in an increase in global oil prices (~$0.29/barrel), which would prompt a net, incremental decrease in global annual oil consumption of about 150,000 bbl/day.[133] (Calculated based on the market elasticity of supply and demand of 0.6 and -0.3, respectively.) Thus, compared to the No Action Alternative (shutdown of Line 5), building the proposed tunnel project, which would allow continued operation of Line 5 through the Straits of Mackinac, corresponds to incremental crude oil transportation of about 150,000 bbl/day.[134]

The same market dynamic analyzed for Line 5 at the Straits of Mackinac applies to the Project and, thus, emission estimates must take into account emissions associated with an incremental supply of 150,000 bbl/day. We estimate the equivalent greenhouse gas emissions from producing that oil, transporting, refining, and burning fuel products at about 29 million metric tons CO_2e/year. (*See* Comment II.D.7.c.) This estimate is far above the recently adopted threshold for natural gas pipelines by FERC of 100,000 tons CO_2e/year and indicates that the Project would have significant implications with respect to climate change.

We recommend that DNR prepare a revised Draft EIS that fully analyzes and discloses the potential impacts of the Project and the No Action Alternative (shutdown of Line 5) on oil production and consumption as an indirect effect of the agency's decision.

II.D Estimates of Greenhouse Gas Emissions Associated with the Project

The following sections provide our estimates of greenhouse gas emissions associated with Project construction (including abandonment of the existing section of Line 5) and the life cycle of the pipeline. We do not claim that these emission estimates are comprehensive or accurate. Rather, these estimates are intended to illustrate the

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[133] Erickson's unrounded estimate is 148,185 bbl/day.

[134] Revised Direct Testimony of Peter A. Erickson on Behalf of the Environmental Law and Policy Center and the Michigan Climate Action Network, Case No. U-20763 (In the Matter of Enbridge Energy, Limited Partnership application for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief), January 18, 2022; available at: https://mi-psc.force.com/s/case/500t000000UHxxLAAT/application-for-the-authority-to-replace-and-relocate-the-segment-of-line-5-crossing-the-straits-of-mackinac-into-a-tunnel-beneath-the-straits-of-mackinac-if-approval-is-required-pursuant-to-1929-pa-16-mcl-4831-et-seq-and-rule-447-of-the-michigan-publ.

magnitude of greenhouse gas emissions associated with the Project. DNR should prepare their own emission estimates based on project-specific information and accepted methodologies and data.

II.D.1 Timing

The Draft EIR states that Project construction would begin in February 2023 and the new pipeline would be placed in service in August 2023. Abandonment of the exiting segment of Line 5 would occur through November 2022[135]). Presumably, Enbridge would follow the same 9-month construction schedule once all permits are approved. For purpose of our calculations below, we assume that the Project clears environmental review in 2022, all construction would occur in 2023 and operation would begin in 2024.

II.D.1 Construction of New Pipeline Section

As discussed in Comment I.G.1.a, the Draft EIS fails to provide any information for emission sources during construction of the Project that would allow calculating greenhouse gas (and air pollutant) emissions. Information available for other pipeline construction projects indicate that combustion greenhouse gas emissions from construction equipment and mobile sources range from 276 to 482 (with an average of 381) metric tons CO_2e per mile of pipeline construction ("metric tons CO_2e/mile"). The most similar terrain to the Project area is Enbridge's Line 3 in Minnesota, for which construction-related greenhouse gas emissions were estimated at 482 metric tons CO_2e/mile. Based on these data, greenhouse gas emissions from construction of the 41.2-mile new pipeline segment can be estimated at about 15,700 (average emission factor) to about 19,800 (Line 3 emission factor) metric tons of CO_2.[136] These estimates do not include indirect greenhouse gas emissions from electricity supplied to construction camps or associated with vegetation clearing. Emissions from vegetation clearing, including burning, are discussed in Comment II.D.3.a). These emission estimates also do not include embodied carbon dioxide emissions from manufacture of steel and cement used for Project construction, which are discussed in Comments II.D.4 and II.D.5.

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[135] Draft EIS, p. 8. ("Enbridge proposes to begin construction of the Project in February 2022, provided all necessary permits and approvals are obtained by then. Enbridge anticipates the pipeline replacement segment to be connected to the existing Line 5 and to be placed in-service in the third quarter of 2022. Site restoration efforts would continue to be done by Enbridge until Project areas have been restored in accordance with permit conditions and/or landowner agreements. Construction activities would occur over a period of approximately nine months.)

[136] *See* attached Table A-3.

II.D.2 Abandonment or Removal of Existing Pipeline Segments

Abandonment or removal of the existing 20-mile pipeline segment would also require construction equipment and mobile sources. Again, the Draft EIS contains no information about equipment used.

Data from another pipeline project indicate greenhouse gas emissions from abandonment and removal at 10 and 16 metric tons CO_2e/mile, respectively. Based on these emission factors, abandonment or removal of existing pipeline segments would result in 426 and 654 metric tons of CO_2e/mile.[137] Assuming only construction and abandonment (but no removal) of the existing 20-mile pipeline segment as a lower bound estimate, associated greenhouse gas emissions can be estimated at about 16,100 (average emission factor) or 20,300 (Line 3 emission factor) metric tons of CO_2.[138]

DNR should estimate greenhouse gas emissions based on Project-specific construction equipment and mobile sources in a revised Draft EIS. In addition, the revised Draft EIS should quantify carbon emissions associated with the manufacture and use of concrete used to plug abandoned pipeline segments.

II.D.3 Vegetation Clearing and Permanent Loss of Carbon Sequestration

Pipeline construction requires vegetation clearing, which results in the release of stored (sequestered) carbon from trees and other vegetation (through burning and decomposition). In addition, the cleared land along the pipeline corridor, where the forest is allowed to regrow, would have a considerably lower carbon stock for many years, if not decades. Further, maintenance of the pipeline right-of-way would prevent woody vegetation from re-growing,[139] resulting in a permanent loss of carbon sequestration.

The Draft EIS acknowledges that burning of cleared vegetation would release greenhouse gases, including carbon dioxide ("CO_2"),[140] but does not quantify greenhouse gases from vegetation clearing. Instead, the Draft EIS simply states hat construction of the Project "would result in a *temporary* incremental *local* increase in greenhouse gases from… removal of vegetation from the construction corridor" and

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137 *See* attached Table A-3.

138 *See* attached Table A-3.

139 Draft EIS, p. 59. ("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 pipelines for safety and pipeline integrity issues.")

140 Draft EIS, p. 146.

concludes that "[t]he incremental release of greenhouse gasses from the construction and maintenance of the route would not result in *measurable* direct, indirect long-term or cumulative impacts on the atmospheric concentration of greenhouse gases."[141] This conclusion is not supported by any evidence and improperly trivializes Project greenhouse gas emissions. Further, as discussed below, the Draft EIS's conclusion is incorrect.

First, it is irrelevant that the release of greenhouse gases during construction would be "temporary." Because greenhouse gases stay in the atmosphere for tens to thousands of years after being released, their warming effects on the climate persist over a long time, affecting both present and future generations.[142] The lifetime of CO_2 in the atmosphere ranges from centuries to millennia.[143]) (No single lifetime can be given for CO_2 , the range because it moves throughout the earth system at different rates: some will be absorbed very quickly but a substantial fraction (20-35%) will remain in the atmosphere for thousands of years. This is mostly due to the rapid growth and cumulative magnitude of the disturbances to Earth's carbon cycle by the geologic extraction and burning of fossil carbon.[144])

Second, equally irrelevant is the designation of greenhouse gases as "local." Once released, long-lived greenhouse gases, such as CO_2, become part of the global atmosphere where they build up.

Third, the Draft EIS recognizes that large areas of the land (both forest and wetlands) cleared for Project construction would be permanently impacted within the maintenance corridor, thus negating the alternative interpretation of what the document could have meant by "temporary" impact: According to the Draft EIS, construction of the Project would temporarily impact 357.7 acres of forest land cover[145] and the permanent right-of-way along the pipeline route would be about 50 feet

[141] Draft EIS, p. 148, *emphasis* added.

[142] *See*, for example, EPA, Climate Change Indicators: Greenhouse Gases; available at: https://www.epa.gov/climate-indicators/greenhouse-gases.

[143] David Archer, Michael Eby, Victor Brovkin, Andy Ridgwell, Long Cao, Uwe Mikolajewicz, Ken Caldeira, Katsumi Matsumoto, Guy Munhoven, Alvaro Montenegro, and Kathy Tokos, Atmospheric Lifetime of Fossil-fuel Carbon Dioxide, Annual Reviews of Earth and Planetary Science, Vol. 37, 2009; available at: https://orbi.uliege.be/bitstream/2268/12933/1/Archer-etal-Preprint.pdf.

[144] Wikipedia, IPCC List of Greenhouse Gases, Footnote A to Combined Summary from IPCC Assessment Reports (TAR, AR4, AR5, AR6); available at: https://en.wikipedia.org/wiki/IPCC_list_of_greenhouse_gases#cite_note-15.

[145] Draft EIS, Table 3.2.3-1, pp. 65-66: (coniferous forests: 56.5 acres) + (broad-leaved deciduous forest: 297.7 acres) + (mixed deciduous/coniferous forest: 3.5 acres) = 357.7 acres.

wide.[146] Thus, the permanently affected forested land cover along the pipeline right-of-way can be calculated at 147.9 acres[147] (based on a standard 120-foot-wide corridor along the proposed route[148]).[149]

Further, construction of the Project would temporarily impact 101 acres of wetlands[150] and permanently convert 34 acres of wetlands.[151] In addition, the Project would affect 84.1 acres of agricultural land.[152] Finally, the Project would impact land cover along the 32 miles of access routes to the mainline block valves;[153] however, the Draft EIS does not provide sufficient information to estimate the respective acreage for each type of permanently affected land cover along these access routes (*e.g.*, width and length).

Fourth, the Draft EIS's notion that incremental release of greenhouse gases from construction and maintenance of the route would not result in *measurable* impacts ignores the cumulative nature of greenhouse gas emissions on global climate change from individually minor, but collectively significant actions, taking place over a given period.

Established methodologies and data sources exist to quantify greenhouse gas emissions associated with land clearing and land use changes. Such estimates are typically provided in environmental review documents, including those for pipelines,[154] and must be provided here.

a) Forested Land

Forest carbon sequestration has two major components to consider: 1) the carbon stock, *i.e.*, the amount of carbon currently stored in a forest (biomass, dead wood, forest floor,

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[146] Draft EIS, p. 206.

[147] (354.7 acres) × (50 feet/120 feet) = 147.9 acres.

[148] Draft EIS, pp. 146, 206, and 210.

[149] Note: the Draft EIS, p. 146 and 243, cite to a total of 354.7 acres of forested land, which is inconsistent with the sum of forested land provided in Draft EIS, Table 3.2.3-1, p. 65.

[150] Draft EIS, Table 3.2.3-1, p. 65.

[151] Draft EIS, Table 6.11.3-1, p. 203.

[152] Draft EIS, Table 3.2.3-1, pp. 65-66.

[153] Draft EIS, p. 24 ("Off-ROW access roads would total approximately 32 miles…") and p. 76 ("The proposed access route would be constructed through grasslands, forests, wetlands, agricultural lands, forests, and some developed areas.").

[154] *See*, for example, the following documents which estimated CO_2e emissions from open burning of biomass: 2019 Keystone XL Final SEIS, *op. cit.*, Table 4.10-1, p. 4-78; Line 3 Final EIS, *op. cit.*, Table 5.2.7-7, p. 5-443.

and soil) and 2) the average annual change (rate) in carbon stock, which allows estimating expected carbon sequestration in the future if the forested land is left undisturbed.

The biomass removed from affected forest lands for construction of the Project would be either chipped or burned,[155] resulting in an immediate or near-term[156] release of sequestered carbon stock into the atmosphere. The average carbon density in aboveground live biomass in forests in northern Wisconsin (Ecoregion 212) has been estimated at 65.3 metric tons of carbon per hectare ("metric tons C/hectare").[157] Thus, the estimated removal of 357.7 acres of live biomass from forest land during construction would result in the release of about 34,700 metric tons CO_2 into the atmosphere.[158]

In addition, standing forests in the Northeastern Lake States currently have a positive sequestration rate, meaning on an annual basis, they sequester more CO_2 through photosynthesis than they release through decomposition and heterotrophic respiration;[159] thus, clearing of standing forests would result in a loss of future carbon sequestration until the forest has regrown. Wisconsin's forests at present are a carbon sink with an annual average change in aboveground carbon stock estimated at 0.46 metric tons carbon per hectare per year ("metric tons C/ha/year").[160] Thus, the aboveground sequestration loss from 357.7 acres of forest land can be estimated at about 895 metric tons CO_2/year and about 26,900 metric tons CO_2 over the lifetime of

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[155] Draft EIS, p. 146. The Draft EIS states that the burning of mature trees (with a minimum diameter at breast height of 6 inches) would not be allowed. Instead, mature trees must instead be sold or chipped in place. Given the location of the reroute, it is unlikely that a considerable volume of trees would be sold.

[156] Because of their small size, wood chips decompose much faster than whole logs.

[157] Richard Birdsey, Yude Pan, Maria Janowiak, Susan Stewart, Sarah Hines, Linda Parker, Stith Gower, Jeremy Lichstein, Kevin McCullough, Fangmin Zhang, Jing Chen, David Mladenoff, Craig Wayson, and Chris Swanston, USDA, Forest Service, Northern Research Station, Past and Prospective Carbon Stocks in Forests of Northern Wisconsin, A Report from the Chequamegon-Nicolet National Forest Climate Change Response Framework, General Technical Report NRS-127, January 2014, Table 3; available at: https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs127.pdf.

[158] (65.3 metric tons C/hectare) / (2.47105 acres/hectare) × (357.7 acres) × (3.667 g CO_2/g C) = 34,659 metric tons CO_2.

[159] Heterotrophic respiration refers to the carbon lost by organisms in ecosystems other than the plants, the primary producers, themselves.

[160] Coeli M. Hoover and James E. Smith, Current Aboveground Live Tree Carbon Stocks and Annual Net Change in Forests of Conterminous United States, Carbon Balance Manager (2021) 16:17, Supplemental Table S2, Carbon Accumulation Rates (Live Aboveground Tree Carbon Only) by State and Vegetation Class (tC/ha/y); available at: https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-021-00179-2.

the Project (30 years[161]).[162] (Note: this estimate is based on an average sequestration rate for Wisconsin's forests and can vary greatly between affected forest types. A detailed calculation is beyond the scope of these comments but should be provided in a revised Draft EIS.)

While eventually regrowth would occur within the cleared construction corridor outside of the 50-foot-wide permanent right-of-way (206.8 acres[163]), carbon sequestration is a very slow process after land clearing. In fact, the rate of carbon sequestration following clearcuts is zero or negative for about a decade. Following a clearcut, the forest acts as a CO_2 source due to relatively smaller CO_2 uptake from net primary production (photosynthesis) and a relative increase in CO_2 emissions from soils and forest litter due to enhanced heterotrophic respiration and decomposition.

Studies of boreal forest ecosystems, such as those affected by the Project,[164] have shown that clearcuts convert boreal forest ecosystems from net carbon sinks to net carbon sources for up to three decades during forest regrowth.[165] In other words, the land within the cleared construction corridor allowed to regrow is unlikely build up any appreciable carbon stock within the first 30 years after construction, *i.e.*, over the assumed lifetime of the Project. The same, or worse, can be assumed for the right-of-way along the abandoned existing Line 5, which would be allowed to regrow after almost 70 years of being maintained. (Maintenance involves removing brush and trees to prohibit the growth of woody vegetation over the pipeline.[166]) For purposes of this report, we therefore assume that both zones, the cleared construction zone along the right-of-way of the Project as well as the right-of-way along the abandoned Line 5 allowed to reforest, would be carbon neutral, *i.e.*, neither a carbon sink nor a carbon source for the next 30 years.

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[161] (0.46 metric tons C/hectare) / (2.47105 acres/hectare) × (357.7 acres) × (3.667 g CO_2/g C) = 895.2 metric tons CO_2/year.

[162] (895.2 metric tons CO_2/year) × 30 years = 26,857 metric tons CO_2.

[163] (357.7 acres forest land impacted by construction) – (147.9 acres permanently removed) = 203.8 acres forest land temporarily impacted by construction.

[164] DNR, Boreal Forest, Detailed Community Description from Ecological Landscapes of Wisconsin, last revised June 16, 2021; available at: https://dnr.wi.gov/topic/EndangeredResources/Communities.asp?mode=detail&Code=CTFOR040WI

[165] National Resources Defense Council, White Paper, Accounting for Carbon Dioxide Emissions from Clearcut Logging in the Canadian Boreal Forest; available at: https://www.nrdc.org/sites/default/files/accounting-emissions-clearcut-canadian-boreal-wp.pdf.

[166] Draft EIS, p. 59.

Table 1 summarizes the above discussed CO_2 emissions resulting from the removal of biomass from forest land cover and the associated loss of carbon sequestration for the Project and provides annualized CO_2 emissions over the lifetime of the Project.

Table 1: Carbon balance from removal of biomass from forest land cover and associated loss of carbon sequestration for Project[a]

	Over Project lifetime (metric tons CO_2)	Annualized (metric tons CO_2/year)
Removal of live biomass (burning, decomposition after chipping) (150-foot wide construction corridor along 41.2 miles)	34,659	1,155
Loss of carbon sequestration over 30 years (150-foot wide construction corridor along 41.2 miles)	26,857	895
Regrowth of temporarily impacted forest land over 30 years (outside of 50-foot wide right-of way along 41.2 miles pipeline)	0	0
Regrowth along right-of way of abandoned pipeline over 30 years (50-foot wide right-of-way along 20 miles)	0	0
Total[b]	**61,517**	**2,051**

a For calculations *see* attached Table A-4

b Values may not add up due to rounding

b) *Wetlands*

One of the numerous services and benefits Wisconsin wetlands provide is their ability to sequester (or store) carbon dioxide from the atmosphere through photosynthesis. Wetlands benefit from relatively slow rates of plant decomposition that occurs in oxygen-poor and cold environments of wetland soils. As a result, wetlands can sequester large amounts of carbon. (Nearly a quarter of all fossil fuel emissions of carbon dioxide end up in ecosystems like wetlands via carbon sequestration.) The biggest risk to this wetland service is the long-term effect of continued wetland drainage and a warming climate. Drained wetlands emit large amounts of carbon on initial conversions and then continue to act as a source of carbon dioxide to the atmosphere for some time afterward until new vegetation can be established and take root.[167] While the Project does not propose large-scale drainage of wetlands, it would permanently convert 34 acres of wetlands.[168] The Draft EIS fails to quantify the associated loss of carbon sequestration.

According to the Draft EIS, temporarily disturbed wetland areas would be reseeded (except for actively cultivated land, standing water wetlands, and/or other standing

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[167] Wisconsin Wetlands Association, How Can Wetlands Provide Resilience Against Climate Change? May 24, 2018; available at: https://www.wisconsinwetlands.org/updates/how-can-wetlands-provide-resilience-against-climate-change/.

[168] Draft EIS, Table 3.2.3-1, p. 65.

water areas) and specialized seed mixes would be used in non-standing water wetlands. In addition, Enbridge would provide wetland mitigation to account for permanent wetland fill, permanent conversion of wetland type and temporal loss of wetland function.[169] However, as summarized in a report by DNR, restoration has been shown to rarely result in fully functioning wetlands and soil carbon levels were significantly lower in restored wetlands.[170] Thus, the temporary disturbance of wetland areas (101 acres[171]) would likely result in a conversion of the wetlands from carbon sinks to carbon sources at least for some time. DNR should quantify this sequestration loss in a revised Draft EIS.

c) Agricultural Lands

The Project would also affect 84.1 acres of agricultural land.[172] We recommend that DNR quantify the sequestration loss from permanently disturbed agricultural land along the right-of-way in a revised Draft EIS.

II.D.4 Steel Manufacture

The Project would require installation of 41.2 miles of steel pipeline. Manufacture of steel is carbon-intensive, *i.e.*, it releases substantial emissions of CO_2.

We calculate emissions of CO_2 associated with the manufacture of steel required for the length of the new pipeline section (4.2) miles based on the amount of steel required and published emission factors for steel manufacture:

- The quantity of steel required for the Project can be calculated based on the length of the new pipeline section (41.2 miles), the outside diameter (30 inches), the wall thickness (0.500 to 0.075 inches), and the weight per unit length based on specifications published by the American Petroleum Institute ("API").[173] The Project would require a total weight of 18,065 tons (16,388 metric tons) of steel.[174]

[169] Draft EIS, p. 56.

[170] Melissa Gibson, Sally Gallagher Jarosz, DNR, Long-term Trends in Mitigation and Wetland Restoration: Ecological Condition and Soil Organic Carbon, March 2021; available at: https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=270446211.

[171] Draft EIS, p. 76. ("The proposed access route would be constructed through grasslands, forests, wetlands, agricultural lands, forests, and some developed areas.")

[172] Draft EIS, Table 3.2.3-1, pp. 65-66.

[173] American Petroleum Institute, API 5L: Specification for Line Pipe, 2004; available at: https://global.ihs.com/api_spec_5l.cfm.

[174] *See* attached Table A-5.

- Emission factors for steel manufacture vary dependent on the origin of the steel with the steel produced globally being more than twice as high as steel produced in the U.S.[175] However, the U.S. has a substantial deficit in steel products and currently is the world's largest steel importer. About 20% of U.S. steel imports are pipe and tube products, with about 17% coming from South Korea, followed by Canada at 17%. Among the top six U.S. steel producers, only one, United States Steel Corp., produces tubular products (*i.e.*, seamless or welded pipe and tube products used most commonly in construction and the energy sector).[176] Because the Draft EIS does not provide information on the origin of the steel that would be used for the pipeline, we assume CO_2 emission factors for manufacture of a ton of steel averaged for global steel production and U.S steel production.

- Based on these assumptions, the emissions associated with steel production for the Project's 41.2-mile new pipeline section can be estimated at about 24,000 tons CO_2.[177]

II.D.5 Concrete Manufacture

Construction of the new pipeline section would also require concrete (*e.g.*, for mainline valve pads, drag reducing injection system pads, continuous concrete coatings in areas of shallow bedrock[178]). Further, abandonment of the existing pipeline would require concrete for plugging pipeline sections to prevent subsidence and corrosion.[179]

Concrete has a very large carbon footprint resulting from fuel use-related combustion emissions and from calcination of the raw materials (mostly limestone and clay), which releases CO_2. Combustion for firing the raw materials accounts for about 40% and the calcination process of the raw materials for about 60% of CO_2 emissions. Manufacturing one cubic yard of concrete (about 3,900 pounds) results in greenhouse gas emissions of

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[175] Ali Hasanbeigi and Cecilia Springer, How Clean Is the U.S. Steel Industry? An International Benchmarking of Energy and CO_2 Intensities. San Francisco CA: Global Efficiency Intelligence, 2019; available at: https://static1.squarespace.com/static/5877e86f9de4bb8bce72105c/t/60c136b38eeef914f9cf4b95/1623275195911/How+Clean+is+the+U.S.+Steel+Industry.pdf.

[176] U.S. Department of Commerce, International Trade Administration, Global Steel Trade Monitor, Steel Imports Report: United States, May 2020; available at: https://legacy.trade.gov/steel/countries/pdfs/imports-us.pdf.

[177] *See* attached Table A-5.

[178] Draft EIS, p. 41.

[179] Draft EIS, p. 48.

about 400 pounds of CO_2.[180,181] We are unable to estimate greenhouse gas emissions associated with concrete used for the Project because the Draft EIS does not provide any information on the quantity of concrete that would be required.

We recommend that DNR provide an estimate of greenhouse gas emissions based on Project-specific information regarding the amount of concrete required for construction and abandonment in a revised EIS.

II.D.6 Indirect Emissions from Electricity Generation

State regulations require that an EIS analyze secondary (or indirect) effects. "Secondary effects" means reasonably foreseeable indirect effects caused by an action or project 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. Wis. Admin. Code NR § 150.03(24). Indirect effects associated with the Project that are reasonably foreseeable include emissions associated with the generation of electricity that would be consumed by the pump stations.

The Draft EIS recognizes that electricity is required to run pump stations and mainline block valves, which results in indirect emissions from electricity generation. [182,183] The Draft EIS further claims that Enbridge considered both direct as well as reasonably foreseeable indirect greenhouse gas emissions from the Project.[184] Yet, the Draft EIS fails to estimate these indirect greenhouse gas emissions, claiming that emissions due to operations would not be significant since the Project does not require the installation of additional pumping stations.[185]

However, the Project would replace approximately 20 miles of the existing Line 5 with 41.2 miles of new pipeline routed around the Bad River Reservation,[186] which would

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[180] *See*, for example, Portland Cement Association, Carbon Footprint, 0020-11-105; available at: https://www.cement.org/docs/default-source/th-paving-pdfs/sustainability/carbon-foot-print.pdf.

[181] Keegan Ramsden, Princeton University, Cement and Concrete: The Environmental Impact, November 3, 2020; available at: https://psci.princeton.edu/tips/2020/11/3/cement-and-concrete-the-environmental-impact.

[182] Draft EIS, p. 147 ("For pipeline operations, electricity would be used to power the system's pumping stations and other infrastructure.")

[183] Draft EIS, p. 65. ("Even though the pump station may not be a significant source of air emission, the electricity required to run the new pump station can contribute to an increase in indirect air emissions.")

[184] Draft EIS, p. 148.

[185] Draft EIS, p. 148.

[186] Draft EIS, p. 1.

increase the length of pipeline between the existing Ino and Saxon Pump Stations from about 40 miles[187] to about 60 miles, a 50 percent increase. This increase in pipeline length would increase the hydraulic head at the Ino Pump Station and, thus, the electrical load on the pump(s). The Project would also include replacement of the existing drag reducing agent injection system with a new, presumably larger, system.[188] The Draft EIS does not discuss whether this new DRA injection system would be sufficient so electricity consumption would not increase at the Ino Pump Station. Any increase in electricity consumption and associated indirect emissions must be accounted for.

(Note: Enbridge provided data for electricity consumption to operate Line 5 facilities and pump stations for the year 2019 at 356,865 Megawatt-hours ("MWh") for an annual average throughput of 419,000 bbl/day.[189] Enbridge estimated associated greenhouse gas emissions based on EPA's eGrid database subregions at 207,311 metric tons CO_2e/year.[190] Scaled to full capacity of Line 5 (540,000 bbl/day), greenhouse gas emissions can be estimated at 267,179 metric tons CO_2e/year.)

II.D.7 Lifecycle Greenhouse Gas Emissions

The Draft EIS does not adequately discuss or quantify the lifecycle emissions associated with the Project, *i.e.*, the entire supply chain from upstream extraction to midstream refining to downstream end use.[191]

a) Court Decisions Regarding Life Cycle Greenhouse Gas Emissions

Case law is clear that environmental review documents must disclose greenhouse gas ("GHG") emissions and climate change impacts associated with permitting major pipeline projects. Important decisions were summarized by the Standing Rock Sioux

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[187] Estimated with Google Earth based on Draft EIS, Figure 1.1.1-1 Project Overview Map.

[188] *See* Comment I.A.6.d.

[189] MI PSC, Case U-20673, In Re Enbridge Energy, Limited Partnership, Application for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief, Rebuttal Testimony Jeffrey Bennett, December 14, 2021, Exhibit A-26, Existing Line 5 Operational Electrical Consumption; available at: https://mi-psc.force.com/s/global-search/bennett%20U-20763.

[190] *Ibid*.

[191] Deborah Gordon, Adam Brandt, Joule Bergerson, and Jonathan Koomey, Carnegie, Oil-Climate Index, created 2015 and updated 2016; available at: http://oci.carnegieendowment.org/; http://oci.carnegieendowment.org/ - models; and http://oci.carnegieendowment.org/ - termsofuse.

Tribe in their comments on the July 2021 Draft EIS for the Dakota Access Pipeline ("DAPL"):

> As noted previously, a key underlying premise of the EIS is that the decision to permit the pipeline will have no impact on the amount of oil that is produced or transported. No analytical support is offered for this premise nor does it appear to be valid. To the contrary, it appears well understood that the existence or non-existence of a major crude oil pipeline impacts both the production and consumption of oil. And the law is clear that such impacts must be disclosed in an EIS. *See. e,g., WildEarth Guardians v. Zinke, 368 F.Supp.4d 41 (D.D.C. 2019)* (agency must disclose downstream GHG emissions from oil and gas production since "the entire purpose" of leasing is to generate oil and gas for consumption); *Western Org. of Resource Councils v. U.S. Bureau of Land Mgmt.*, 2018 WL 1475470 (D. Mont. 2018) ("NEPA requires BLM to consider in the EIS the environmental consequences of the downstream combustion of the goal, oil and gas resources potentially open to development under" their permitting decision).
>
> Courts have consistently rejected agency arguments, under NEPA and other statutes, that infrastructure or production decisions will have no impacts on markets or GHG emissions because some other source will substitute in the exact same amounts. *WildEarth Guardians v. U.S. Bureau of Land Mgmt.*, 870 F.3d 1222, 1234 (10th Cir. 2017) (rejecting as unsupported agency argument that other coal will "substitute" for coal if federal mine is not constructed); *Mid-States Coalition for Progress v. STB*, 345 F.3d 520 (9th Cir. 2003) (agency must consider impact of rail construction on coal consumption it was designed to serve). Just recently, a federal appeals court rejected an EIS for a pipeline that omitted GHG emissions from the "downstream" use of the oil. *Center for Biological Diversity v. Bernhardt, 982 F.3d 723* (9th Cir. 2020).
>
> An agency, must at a minimum, "estimate the amount of… carbon emissions that [a] pipeline will make possible." *Sierra Club v. FERC*, 867 F.3d 1357 (D.C. Cir. 2017). The project's purpose is to transport crude oil, and the purpose of crude oil is primarily to burn it. *Id*. Those emissions are consequently reasonably foreseeable and must be disclosed in a NEPA analysis. *Id*. An agency may not circumvent this disclosure just because other oil supplies may be used in its stead. *Birckhead v. FERC*, 925 F.3d 510 (D.C. Cir. 2019).[192]

b) Methodology to Calculate Crude Oil Life Cycle Emissions

A number of protocols and models exist to estimate the upstream, midstream, and downstream greenhouse gas emissions from fossil fuel extraction, processing, transport, and usage. The Carnegie Endowment for International Peace ("Carnegie"), in

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[192] Mike Faith, Standing Rock Sioux Tribe, Letter to Col. Mark R. Himes, U.S. Army Corps of Engineers, Re: Cooperating Agency Standing Rock Sioux Tribe's Comments on the July DEIS, September 22, 2021; available at: https://earthjustice.org/sites/default/files/files/srst-ca-comment-2021-07-deis.pdf.

conjunction with Stanford University and the University of Calgary, has developed a user-friendly web-based integrated tool, the so-called Oil-Climate Index ("OCI") calculator, that aggregates three open-source lifecycle assessment models to systematically estimate the total greenhouse gas emissions embodied in an entire barrel of oil, *i.e.*, produced throughout the entire supply chain from upstream extraction to midstream refining to downstream end use.[193]

The OCI calculator relies on high-quality data to make these emissions estimates suitable for estimating project emissions for purposes of compliance with NEPA, state environmental review laws, or permitting under the federal Clean Air Act. Moreover, essentially all of the scientific information necessary to make a well-reasoned, estimate of upstream and downstream greenhouse gas emissions is already available and does not require agencies to create any new scientific model.

The definitions in the OCI calculator are as follows: *upstream* includes drilling, production, processing, venting, flaring, and fugitive emissions, miscellaneous, and offsite emissions; *midstream* includes refining-related emissions from heat, electricity, steam, hydrogen (via steam methane reformer), and catalyst regeneration (fluid catalytic cracking);[194] and *downstream* includes combustion emissions from gasoline, jet fuel, diesel, fuel oil, petcoke, residual fuels, and liquefied petroleum gas ("LPG").[195]

Models Aggregated into OCI Calculator

The three open-source models aggregated into the OCI calculator covering upstream, midstream, and downstream greenhouse gas emissions are:

> **Upstream: OPGEE** (Oil Production Greenhouse Gas Emissions Estimator), hosted by Stanford University and in use by a number of agencies including the California Air Resources Board ("CARB"),[196] is an engineering-based life cycle assessment tool for the measurement of greenhouse gas emissions from the production, processing, and transport of crude petroleum. The system boundary of OPGEE extends from initial exploration to the refinery entrance gate. OPGEE is built for maximum transparency, using public data sources where possible and being implemented in a user-accessible Microsoft Excel format, which is

[193] Deborah Gordon, Adam Brandt, Joule Bergerson, and Jonathan Koomey, Carnegie, Oil-Climate Index, created 2015 and updated 2016; available at: http://oci.carnegieendowment.org/; http://oci.carnegieendowment.org/ - models; and http://oci.carnegieendowment.org/ - termsofuse.

[194] In contrast to the OCI calculator, the Draft EIS treats refining emissions as downstream.

[195] *Ibid*.

[196] CARB, LCFS [Low Carbon Fuel Standards] Crude Oil Life Cycle Assessment; available at: https://ww2.arb.ca.gov/resources/documents/lcfs-crude-oil-life-cycle-assessment.

> available for download free of charge from the university's Environmental Assessment & Optimization Group website.[197] The OCI web tool incorporates OPGEE version 1.1.[198]
>
> **Midstream: PRELIM** (Petroleum Refinery Life-Cycle Inventory Model), hosted by the University of Calgary, is a is a mass- and energy-based process unit-level tool for the estimation of energy use and greenhouse gas emissions associated with processing a variety of crude oils within a range of configurations in a refinery. The PRELIM model was built using Microsoft Excel to ensure transparency and maximum accessibility and is available for download free of charge from the university's Life Cycle Analysis of Oil Sands Technologies research group website. PRELIM aims to inform policy analysis by providing a transparent model including data, assumptions, and detailed results.[199] The OCI web tool relies on PRELIM version 1.1.[200]
>
> **Downstream: OPEM** (Oil Products Emissions Module), developed by researchers from Carnegie and Stanford University, is an open-source, Microsoft Excel-based model available for download free of charge. The model estimates downstream life-cycle greenhouse gas emissions, including petroleum product transport from the refinery outlet through petroleum product consumption. The model uses data related to distances petroleum products travel to market, the mode of transport and transport fuel used, and the vehicle and fuel emissions factors from the Argonne National Laboratory's GREET (Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation) Model. End-use emissions from the combustion of petroleum products are calculated using USEPA emissions factors.[201] (Note that USEPA emissions factors assume near-complete fuel combustion in the calculation of published emissions factors and thus may result in a best-case (lowest emissions) estimate.) The OCI calculator uses OPEM version 1.1.[202]

The current version of the OCI calculator, Phase 2, is available for 75 crude oils from all over the world and outputs are standardized by converting them into the same functional units, or metrics, so emission results can be summed, including per barrel of crude oil. This ensures that the OCI calculator provides a fully comparable and comprehensive estimate of the lifecycle greenhouse emissions per barrel of global

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[197] *See* Stanford University, OPGEE: The Oil Production Greenhouse Gas Emissions Estimator; available at: https://eao.stanford.edu/research-areas/opgee.

[198] OCI, *op. cit.*

[199] University of Calgary, PRELIM: The Petroleum Refinery Life Cycle Inventory Model; available at: https://www.ucalgary.ca/lcaost/prelim.

[200] OCI, *op. cit*.

[201] Carnegie, OPEM; available at: http://oci.carnegieendowment.org/assets/resources/opem1.1.xlsx.

[202] OCI, *op. cit*.

oils.[203] The OCI calculator uses GWP values that include climate–carbon feedbacks from the IPCC's 5th Assessment Report (GWP methane: 34 and GWP nitrous oxide: 298[204]).

Crude Oils Transported by Line 5 in OCI Calculator

Line 5 is used to transport unconventional light crude and NGLs extracted and processed from the "oil sands" (or "tar sands") of northern Alberta Canada, and the shale oil of the Bakken Formation of North Dakota, Montana, and Saskatchewan Canada.[205] We ran the OCI calculator for these crude oils (Bakken and Canada Athabasca FC-HC SCO[206]) accepting all default values. The OCI calculator provides lifecycle greenhouse gas emissions in units of kilograms CO_2e per barrel of crude oil ("kg CO_2e/bbl").[207]

c) *Project Lifecycle Emissions*

Based on the default emission factors from the OCI calculator, we calculated combined Project-specific emission factors (upstream, downstream, midstream), assuming that Line 5 would carry 73% Bakken crude oil (based on 90% production not flaring methane and 10% flaring methane) and 27% Canada Athabasca FC-HC SCO crude oil (based on crude oil flow into Sarnia of reported by the Canadian government). We estimated combined emission factors associated with production and processing (refining) at 77 kilograms CO_2 per barrel ("kg CO_2/bbl"). Based on the same assumptions, we estimated midstream and downstream emissions at 17 kg CO_2/bbl and 450 kg CO_2/bbl,

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[203] *Ibid*.

[204] OCI, *op. cit.* ("OCI GHG emissions estimates are based on equivalent GHG emissions for carbon dioxide, methane, and nitrous oxide, combining these into one result using different global warming potentials (GWPs) that compare the other GHGs to carbon dioxide. For Phase 2, we used data reported by the IPCC. The IPCC's 2013 assessment report (AR5) states that the one-hundred-year GWP including climate feedback loops for carbon dioxide (CO_2) is referenced at 1. The GWP for methane (CH_4) is 34 times greater than CO_2, and for nitrous oxide (N_2O), it is 298 times greater than CO_2.")

[205] Draft EIS, p. 5.

[206] From the OCI Calculator: Canada Athabasca FC-HC SCO is the only light synthetic crude oil from Northern Alberta listed in the OCI database: an extra-heavy, high-sulfur bitumen mined from the Athabasca oil sands in Canada's Alberta Province that is upgraded into a light, sweet synthetic crude oil (SCO) before transport to the refinery. Upgrading this oil requires a fluid coker (FC) unit and a hydroconversion (HC) system. Athabasca FC-HC SCO generates more greenhouse emissions in the upgrading process but fewer emissions in refining and end use compared to other SCOs, owing to its lighter, upgraded gravity.

[207] *See* OCI, Total Estimated GHG Emissions and Production Volumes for 75 OCI Test Oils; available at: https://oci.carnegieendowment.org/#total-emissions.

respectively. The combined lifecycle emission factor associated with crude oils transported by Line 5 can thus be estimated at 545 kg CO_2/bbl.[208]

However, not all extracted fossil fuels, including those transported by Line 5, are ultimately combusted. Review of data from the U.S. Energy Information Administration ("EIA") shows that less than 6% of the heat content contained in fossil fuels (coal, natural gas, and petroleum products) is used for non-combustion purposes, *i.e.*, sequestered in products such as lubricants, petrochemical feedstocks (for manufacture of chemicals, synthetic rubber, and a variety of plastics), asphalt, and road oil, etc. Less than 83% of this non-combustion-related use is attributable to petroleum products.[209] Further, based on 2018 data, an estimated 15.8 percent of all plastic in the U.S. was incinerated, releasing more greenhouse gases.[210] What's more, new research suggests that plastic materials in the environment do not permanently sequester carbon but rather, as they degrade, release greenhouse gases, including methane (which is 28 to 34 times more potent than CO_2 over a 100 year period[211]).[212]

Nonetheless, for our calculations of life-cycle greenhouse gas emissions below, we conservatively assume that Line 5 would operate at full capacity (540,000 bbl/day), carrying only crude oil, and that about 5% of that throughput would be sequestered for non-combustion use.[213] (Note: the Draft EIS makes the same assumption that Line 5

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[208] *See* attached Table A-2.

[209] *See* EIA, Monthly Energy Review, DOE/EIA-0035(2022/2), February 2022, Table 1.11b, Heat Content of Non-Combustion Use of Fossil Fuels, p. 221, February 2022; available at: https://www.eia.gov/totalenergy/data/monthly/pdf/sec1_25.pdf.

[210] EPA, Facts and Figures about Materials, Waste and Recycling, Plastics: Material-Specific Data; available at: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/plastics-material-specific-data.

[211] *See*, Wikipedia, Global Warming Potential, for methane based on the Intergovernmental Panel on Climate Change Fifth Assessment Report ("AR5"); available at: https://en.wikipedia.org/wiki/Global_warming_potential#cite_note-ar5-5. Original citations: G. Myhre, D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)], 2013, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA; available at: https://archive.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf.

[212] Sarah-Jeanne Royer, Sara Ferrón, Samuel T. Wilson, and David M. Karl, Production of Methane and Ethylene from Plastic in the Environment, August 1, 2018; available at: PLoS ONE 13(8):e0200574; available at: https://doi.org/10.1371/journal.pone.0200574.

[213] $(0.85) \times (0.56) = 0.48$.

would only carry crude oil in its calculations of CO_2 emissions associated with system alternatives.[214]).

II.D.8 Summary of Annualized Project Greenhouse Gas Emissions

Table 2 summarizes the above-discussed estimates of greenhouse gas emissions on an amortized (annualized) basis over the lifetime of the Project (30 years).

Table 2 also shows annual indirect greenhouse gas emissions associated with electricity consumption of Line 5 pump stations. We calculated these estimates assuming Line 5 operation at full capacity based on emissions provided by Enbridge for the year 2019, when Line 5 was operating at an annual average throughput of 419,000 bbl/day.[215] (We recognize that the CO_2e emission factors for the electricity mix in the various regions may have changed but provide these estimates to illustrate the order of magnitude of indirect emissions from electricity consumption.)

In addition, Table 2 shows emissions associated with the lifecycle stages of the Project compared to shutdown of Line 5 (No Action alternative) based on the findings of Erickson on market supply and demand discussed in Comment II.C.

Table 2: Greenhouse gas emissions associated with the Project (in metric tons CO_2e/year)

	Project
Emission source	
Construction	662
Land clearing	1,155
Steel	150
Abandonment	14
Loss of carbon sequestration	895
Total	**2,876**
Lifecycle stage	
Upstream	4.2 million
Midstream	0.9 million
Downstream	24.2 million
Total	**29.3 million**

Note: the totals for emission sources and lifecycle stages are not additive F

(Note that this estimate does not include a number of sources of greenhouse gas emissions during construction and abandonment (*e.g.*, indirect emissions from electricity usage and fugitive emissions from fuel tanks and refueling) and during

[214] Draft EIS, p. 327.

[215] *See* footnote 189 supra, Rebuttal Testimony of Jeffrey Bennett, Exhibit A-26.

operation of the Project (*e.g.*, indirect emissions from electricity usage, combustion emissions from maintenance vehicles and aircraft).

III. The Social Cost of Carbon (Monetizing the Cost of Greenhouse Gas Emissions) Associated with the Project Must Be Disclosed

Greenhouse gas releases over the life of a project contribute to damages due to climate change. The costs to society from these damages are not accounted for and must be disclosed. An example to illustrate:

> When a power plant runs on coal or natural gas, the greenhouse gases it releases cause harm – but the power company isn't paying for the damage. Instead, the costs show up in the billions of tax dollars spent each year to deal with the effects of climate change, such as fighting wildfires and protecting communities from floods, and in rising insurance costs. This damage is what economists call a "negative externality." It is a cost to society, especially to future generations, that is not covered by the price society currently pays for fossil fuels and other activities that emit greenhouse gases.[216]

The social cost of carbon ("SCC") is a widely accepted method to monetize damages associated with an incremental increase of carbon (CO_2 equivalent) emissions in a given year. It translates the future harm inflicted into a present monetary value. The SCC represents an estimate (in dollars) of the damage to society and the environment over time from each additional metric ton of carbon dioxide (equivalent) emitted into the atmosphere. This value takes into account damage from the effects of climate change, such as sea-level rise, extreme weather, and water and food insecurity.[217] (Note: the SCC does not address environmental justice or intergenerational equity. If sufficiently incorporated these factors would significantly increase the SCC.[218])

A recent study summarizes:

> Monetizing climate damages fulfills an agency's legal obligations under NEPA in ways that simple quantification of tons of greenhouse gas emissions cannot. As described earlier in this Article, climate change is a "death by a thousand cuts problem," and this problem is exacerbated when agencies fail to use available

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[216] What Is the 'Social Cost of Carbon'? 2 Energy Experts Explain After Court Ruling Blocks Biden's Changes, updated: February 21, 2022; available at: https://theconversation.com/what-is-the-social-cost-of-carbon-2-energy-experts-explain-after-court-ruling-blocks-bidens-changes-176255.

[217] Marcy Casement, Stillwater Associates, The Social Cost of Carbon Part I: How Does the U.S. Estimate the Cost of Climate Change? March 29, 2021; available at: https://stillwaterassociates.com/the-social-cost-of-carbon-part-i-how-does-the-u-s-estimate-the-cost-of-climate-change/.

[218] Tom Erb, Center for Climate and Energy Solutions, The Social Cost of Carbon – Going Nowhere But Up, March 30, 2021; available at: https://www.c2es.org/2021/03/the-social-cost-of-carbon-going-nowhere-but-up/.

> tools that provide meaningful context for emissions. In 2014 alone, the extraction and combustion of fossil fuels from federal lands produced 1,279 million metric tons of CO_2, which amounts to 23% of U.S. total CO_2 emissions… It is generally easier to comprehend climate damages when presented in dollar terms. This makes our recommendation for agencies straightforward: use the global social cost of greenhouse gases in NEPA analyses.
>
> The U.S. Supreme Court has called the disclosure of impacts the "key requirement of NEPA," and held that agencies must "consider and disclose the actual environmental effects" of a proposed action in a way that "brings those effects to bear on [the agency's] decisions." Moreover, NEPA requires a "reasonably thorough discussion" and "necessary contextual information" on real-world climate impacts and their significance, which the social cost of greenhouse gases provides.
>
> The "actual environmental effects" of emitting greenhouse gases are the incremental climate impacts caused by those emissions, including: property lost or damaged by sea-level rise, coastal storms, flooding, and other extreme weather events; lost productivity and other impacts to agriculture, forestry, and fisheries; human health impacts, including cardiovascular and respiratory mortality from heat-related illnesses, changing disease; and changes in fresh water availability, to name just a few. While a lower bound estimate, the social cost of greenhouse gases was designed specifically to capture the aggregate cost of such impacts. Agencies should monetize climate costs using the social cost of greenhouse gases in all NEPA analysis in order to provide a meaningful accounting of actual environmental effects. This duty becomes heightened where economic benefits are presented in dollar terms. While not all courts are uniform on this point, lopsided analysis that omits a thorough accounting of climate damages is precisely the kind of "inaccurate economic information" that may defeat the purpose of NEPA analysis and skew the public's evaluation of the proposed agency action.[219]

Estimates of the social cost of carbon vary because of different assumptions about future emissions, how climate will respond, the impacts this will cause and the way we value future damages.

The usefulness of SCC to contextualize greenhouse gas emissions from a pipeline project was, for example, recognized by the Minnesota Department of Commerce in the environmental impact statement for Enbridge's Line 3 Project (providing estimates of the social cost of carbon for both the proposed project and its alternatives).[220]

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[219] Hein and Jacewicz, *op. cit.*

[220] Line 3 Final EIS, *op. cit.*, p. ES-21, pp. 5-447 through 5-465. (Note: the EIS for Line 3 only assessed SCC for construction and operational greenhouse gas emissions associated with the proposed capacity

III.A Social Discount Rates

Social discount rates are used to put a present value on costs and benefits that will occur at a later date. (Note: the lower the discount rate, the higher the calculated present-day dollar values for a ton of carbon dioxide emitted.) In the context of climate change policymaking, social discount rates are very important for assessing how much today's society should invest in trying to limit the impacts of climate change in the future. Even those who see climate change as a relatively minor problem agree that damages will exceed benefits above 1.1 degrees Celsius (34°F[221]) of warming.[222]

The discount rate – the rate used to discount future economic harm to the present – strongly affects the calculated social cost of carbon and is open to considerable debate. The rates used by the federal and state governments ranged from 2.5% to 7%.[223] (For example, the Obama administration relied on discount rates of 5%, 3%, and 2.5% and for a high impact scenario (95th percentile) of 3%. In contrast, the Trump administration eliminated the high impact scenario and relied on discount rates of 7% and 3%.)[224] However, a 2015 study based on expert surveys of 197 economists on the determinants of the long-term social discount rate recommended using a lower rate at 2.25% (2%). In fact, the most common single value recommended in these surveys was 2% and 92% of experts were comfortable with social discount rates somewhere in the interval of 1% to 3%.[225]

III.B Monetary Values of Social Cost of Carbon Used in the U.S. and Other Countries

The concept of a social cost of carbon was first raised by the Reagan administration in the early 1980s. Federal agencies such as the EPA and the Department of Transportation

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increase. For reasons discussed elsewhere in these comments, the social cost of carbon due to downstream greenhouse gas emissions must be addressed as well.)

221 (1.1°C × 9/5) + 32 = 33.98°F.

222 Carbon Brief, The Social Cost of Carbon, February 14, 2017; available at: https://www.carbonbrief.org/qa-social-cost-carbon.

223 Jim Mladenik, Stillwater Associates, The Social Cost of Carbon Part 2: Values Used Around the World & What it Costs to Reduce Carbon in California's Diesel Pool, October 19, 2021; available at: https://stillwaterassociates.com/the-social-cost-of-carbon-part-2-values-used-around-the-world-what-it-costs-to-reduce-carbon-in-californias-diesel-pool/.

224 *Ibid*.

225 Moritz Drupp, Mark Freeman, Ben Groom, and Frikk Nesje, Centre for Climate Change Economics and Policy, Discounting Disentangled: An Expert Survey on the Determinants of the Long-term Social Discount Rate, Working Paper No. 195, Grantham Research Institute on Climate Change and the Environment, Working Paper No. 172, May 2015; available at: http://piketty.pse.ens.fr/files/DruppFreeman2015.pdf.

began to develop other forms of social cost calculations during the George H.W Bush administration. The use of SCC was judicially mandated in regulatory cost-benefit analyses in 2008. The federal government formed the Interagency Working Group ("IWG") began developing uniform estimates for the social cost of carbon that could be used consistently by agencies across the government in 2009.[226]

Several states are using the social cost of carbon ("SCC") in policy proceedings in order to better account for the impact of greenhouse gas emissions, including California, Colorado, Illinois, Maine, Maryland, Minnesota, Nevada, New Jersey, New York, Virginia, Vermont, and Washington. According to the Institute for Policy Integrity, there is a widespread consensus that the SCC estimate developed by the IWG is the best available estimate.[227]

A June 2020 report by the U.S. Government Accountability Office ("GAO") offers an overview of SCC values used by the U.S. federal government and several U.S. states, as well as other countries, including Canada and Germany:[228]

- The Obama administration's IWG used a number of different models (integrated assessment models) to arrive at the cost, then a discount rate was applied to account for the difference in dollar value between present-day cost and future costs. The SCC values were determined as the average across models and socioeconomic emissions scenarios for three discount rates (2.5%, 3%, and 5%), plus a fourth value, selected as the 95th percentile of estimates based on a 3% discount rate, the so-called high-impact scenario, which is meant to represent higher-than-expected impacts from temperature changes (*i.e.*, low-probability but high-impact damages). The high-impact estimate is the result of averaging the damages in the 95th percentile—*i.e.*, higher than 95 percent of the damage results for each model—across all three of the integrated assessment models, which is then discounted at a 3% discount rate.[229]
- The Trump administration, with Executive Order 13783 in March 2017, changed two key assumptions for calculating SCC estimates: from global to domestic

[226] Environmental Defense Fund, The True Cost of Carbon Pollution; available at: https://www.edf.org/true-cost-carbon-pollution.

[227] Institute for Policy Integrity, The Cost of Carbon Pollution, States Using the SCC; available at: https://costofcarbon.org/states.

[228] GAO, Social Cost of Carbon, Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis, Report to Congressional Requesters, June 2020, GAO-20-254; available at: https://www.gao.gov/assets/gao-20-254.pdf.

[229] Mladenik, *op. cit*.

climate damages and from a lower to a higher range of discount rates (3% and 7%).[230]

- (Note: the Biden administration reinstated Obama administration's SCC estimates through Executive Order 13990, which directed federal agencies to apply an interim SCC value of $51 per ton (the SCC used under the Obama administration adjusted for inflation) while his administration weighed whether to raise it to as high as $125 per ton.[231])
- Two California agencies, the California Air Resources Board ("CARB") and the California Public Utilities Commission ("CPUC") developed social cost of carbon estimates for analyzing policy and regulating utilities by adopting some of the federal values established by the Obama administration: in November 2017, CARB, the primary agency responsible for regulating sources of air pollution in California, adopted the federal estimates based on 5%, 3%, and 2.5% discount rates based on updates published by the IWG in 2015; CPUC, the state's utility and essential service regulator, in 2019 adopted the federal estimates based on the use of a 3% discount rate and the high impact scenario, also based on the IWG's 2015 updates.[232]
- The Minnesota Public Utilities Commission ("MN PUC") developed two sets of SCC values. To develop its low estimates, the commission used a 5 percent discount rate but shortened the time period for projected damages to the year 2100 because, in the commission's view, projected damages after that point had greater uncertainty as they were extrapolated mathematically and not fully modelled. This step lowered the commission's estimates relative to the federal estimates on which they were based. To develop a set of high estimates, the commission used a 3% discount rate.[233] State officials from both CARB and CPUC expressed that using social cost of carbon that accounts for global, rather than domestic, climate damages is most appropriate. Furthermore, these officials noted that the 7% discount rate was rejected for two reasons: 1) the 7% discount rate is intended to reflect returns on capital and is not applicable to the effects of greenhouse gas emissions and 2) using such a high discount rate greatly

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[230] GAO, *op. cit.*, p. 17.

[231] The White House, A Return to Science: Evidence-Based Estimates of the Benefits of Reducing Climate Pollution, February 26, 2021; available at: https://www.whitehouse.gov/cea/written-materials/2021/02/26/a-return-to-science-evidence-based-estimates-of-the-benefits-of-reducing-climate-pollution/.

[232] CPUC, Decision Adopting Cost-Effectiveness Analysis Framework Policies for All Distributed Energy Resources, May 16, 2019; available at: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M293/K833/293833387.PDF.

[233] GAO, *op. cit.*, p. 34.

diminishes the benefits of actions taken now to prevent damages that future generations will otherwise experience.

- In 2016, the New York State Public Service Commission issued an order outlining a cost-benefit analysis framework for evaluating proposals to help implement the state's clean energy strategy. This order established slightly higher values than the Obama Administration using a 3% discount rate.[234] (Note: in 2021, the New York Department of Environmental Conservation adopted SCC values at a 2% discount rate.[235])
- To develop its estimates, Canada adopted some of the U.S. federal estimates of the social cost of carbon from the Obama administration. For its primary estimates, Canada calculated SCC using a 3% discount rate and, for use in sensitivity analysis, Canada adopted the U.S. high-impact estimates (95th percentile, 3% discount rate) that represent lower-probability but high-impact damages.[236]
- Germany developed two social cost of carbon estimates, a primary estimate and a high-impact estimate for use in sensitivity analysis. Germany chose to use discount rates that are not constant and that instead change over time based on the level of projected economic growth. Specifically, for its primary estimates, Germany's discount rate starts near 3% and declines to 2% by 2250. For estimates used in sensitivity analyses, the discount rate starts near 2% and declines to 1% by 2250.[237] Further, compared to the above-discussed estimates, the German estimates additionally reflect climate damages that are weighted based on a region's relative wealth—a method known as equity weighting—because climate damages that happen in a region with relatively less wealth (measured in gross domestic product per capita) will have a greater negative impact on the region than in a richer region.[238]

The above-discussed social cost of carbon values from the GAO report are summarized in attached Table A-6.

Table 3 summarizes SCC values from the GAO report established by these entities for a 3% discount rate for a direct comparison.

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[234] GAO, *op. cit.*, p. 37.

[235] New York Department of Environmental Conservation, Establishing a Value of Carbon, Guidelines for Use by State Agencies, revised October 2021; available at: https://www.dec.ny.gov/docs/administration_pdf/vocguidrev.pdf.

[236] GAO, *op. cit.*, p. 39.

[237] GAO, *op. cit.*, Appx. V, p. 66.

[238] GAO, *op. cit.*, p. 40 and Appx. V, p. 66.

Table 3: SCC values at a 3% discount rate (in 2018 USD per metric ton CO_2e)

Year of Emissions	U.S. Administration		California		Minnesota	New York	Canada	Germany
	Obama	Trump	CARB	CPUC	MN PUC			
2020	$50	$7	$50	$50	$45	$52	$38	-
2030	$60	$8	$60	$60	$54	$62	$45	$248
2040	$76	$9	-	-	$64	$73	-	-
2050	$82	$11	-	-	$73	$86	$62	$291

As shown in Table 3, SCC values adopted under the Trump administration based on a 3% discount rate were about seven times lower than those established by the Obama administration (in 2020: $7 vs. $50 per metric ton CO_2 in 2018 USD, respectively). Although both estimates were calculated using the same economic models (and are both based on a 3% discount rate), the Trump administration's estimates were based on domestic damages only rather than on global damages.[239] This approach disregards the global nature of climate change because greenhouse gas emissions become part of the global atmosphere and cause damages worldwide regardless of where they are emitted. If all countries only accounted for the domestic damages caused by their emissions, then not all relevant climate damages would be accounted for globally because each country would be ignoring the damages its emissions cause in other countries.[240] Although the exact value of the damage from carbon emissions is impossible to know, the dramatic devaluation of the SCC under the Trump administration is broadly considered to vastly underestimate the real damage.[241] We therefore eliminated these values from further consideration.

With the exception of Canada and Germany, all other SCC estimates in Table 3 for the year 2020 are in the range of range of $45 to $52 per metric ton CO_2 (in 2018 U.S. dollars). A recent bill introduced by the Wisconsin legislature falls in line with these SCC values.[242] As shown, Canada's SCC estimates are somewhat lower, and Germany's SCC estimates are roughly four times higher.

[239] GAO, *op. cit.*, Executive Summary.

[240] GAO, *op. cit.*, p. 41.

[241] *See*, for example, Mladenik, *op. cit.*

[242] Wisconsin Assembly Bill 801, introduced in January 2022, which aims to require the Wisconsin Public Service Commission to consider the social cost of carbon in determining whether to issue certificates, finds that the SCC is $50 per ton of CO_2 emitted to the atmosphere and requires the agency to annually evaluate and adjust this dollar amount; *see* Wisconsin State Legislature, 2021 Assembly Bill 801, An Act to Create 196.025 (1h) of the Statutes; Relating to: Evaluating the Social Cost of Carbon Emissions, January 4, 2022; available at: https://docs.legis.wisconsin.gov/2021/related/proposals/ab801.

III.C Social Costs Associated with Project Greenhouse Gas Emissions

We calculated the social costs attributable to greenhouse gas emissions associated with the Project over its lifetime (assumed to be 30 years) based on the emission estimates presented in Comment II.D.8. These costs are presented in 2020 USD per metric ton CO_2e based on the current interim annual estimates developed by the U.S. government's Interagency Working Group on Social Cost of Greenhouse Gases ("IWG")[243] and published (as unrounded values) by the U.S. Environmental Protection Agency ("EPA").[244] Table 4 summarizes our estimates for discount rates of 2.5% and 3% and for the high-impact scenario (also calculated at a 3% discount rate). We chose discount rates of 3% and lower based on the above-discussed consensus by economists to use discount rates between 1% and 3%. Specifically, Table 4 provides social cost estimates for emission sources for construction of the new 41.2-mile pipeline segment (steel for pipeline, combustion emissions, and land clearing), abandonment, and the loss of carbon sequestration over the 30-year lifetime of the Project in million U.S. dollars per metric ton CO_2e.

Table 4 also provides social cost estimates for life cycle emissions associated with the Project for upstream, midstream, and downstream emissions in billion U.S. dollars per metric ton CO_2e based on the economic analysis by Erickson, *i.e.*, assuming that the Project would result in an incremental increase in crude oil demand compared to shutting down Line 5 of about 150,000 bbl/day.

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[243] IWG, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990, February 2021; https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

[244] EPA, Social Cost of Greenhouse Gases (SC-GHGs) unrounded annual estimates through 2070, Docket EPA-HQ-OAR-2021-0208, June 9, 2021; available at: https://downloads.regulations.gov/EPA-HQ-OAR-2021-0208-0161/content.pdf.

Table 4: Estimate of social cost of carbon over 30-year lifetime of Project

	3% discount rate	2.5% discount rate	3% discount rate high impact scenario
Emission source	**(in million 2020 USD per metric ton CO_2e)**		
Steel[a]	0.2	0.4	0.7
Construction combustion[b]	1.1	1.6	3.2
Land clearing[c]	1.9	2.8	5.6
Abandonment[d]	<0.1	<0.1	0.1
Loss of carbon sequestration[e]	1.9	2.7	5.9
Total	**5.1**	**7.5**	**15.5**
Lifecycle stage	**(in billion 2020 USD per metric ton CO_2e)**		
Upstream[f]	8.9	12.6	27.3
Midstream[f]	2.0	2.8	6.1
Downstream[f]	51.9	73.4	158.4
Total	**62.9**	**88.9**	**191.8**

Note 1: Totals may not add up due to rounding

Note 2: the calculated values for social cost of carbon for emission sources are not based on the annualized values presented in Table 3, but rather are calculated based on the year they occur in: for example, construction combustion emissions were assumed to occur only in 2023 (*see* footnotes below for other assumptions)

Note 3: estimates for emission sources and lifecycle stages are not additive because a) they are calculated for different boundary conditions and b) emissions associated with the life cycle stages are calculated assuming that the Project would result in an incremental increase of 148,185 bbl/day of crude oil demand compared to the No Action Alternative of shutting down Line 5

a Assuming average embodied CO_2e emissions for steel produced in the U.S. and globally, calculated for 2022, the year before construction starts (*see* attached Table A-7a)

b Combustion CO_2e emissions from construction equipment and mobile sources during construction of new 41.2-mile pipeline section, calculated for 2023 (*see* attached Table A-7b)

c CO_2e emissions from vegetation removal (150-feet wide corridor along 41.2-mile replacement section), calculated for 2023 (*see* attached Table A-7c)

d Combustion CO_2e emissions from construction equipment and mobile sources during abandonment of 20-mile section through Bad River Reservation, calculated for 2024 (*see* attached Table A-7d)

e Loss of carbon sequestration from permanently removed forest land cover (50-feet wide corridor along 41.2-mile replacement section, 147.9 acres), for 2024 through 2053, *i.e.*, over lifetime of Project (*see* attached Table A-7e)

f CO_2e emissions from upstream, midstream, and downstream lifecycle stages, calculated for 2024 through 2053, *i.e.*, over lifetime of Project (*see* attached Tables A-7f, A-7g, A-7h)

(Note: when reviewing Table 4, please note that values are presented in two different units: million USD per ton CO_2e emitted for emission sources and billion USD per ton CO_2 for the lifecycle stages.)

We note that the social cost estimates presented in Table 4 are very conservative for several reasons:

First, the Project may well operate beyond the 30-year lifetime assumed for these calculations.

Second, widespread consensus amongst economic experts indicates that the 3% discount rate used for these estimates is too high and should be lowered to 2% or even 1%, which would drastically increase the net present value of the Project's climate costs.

Third, the methodologies for calculating the SCC currently do not include a large number of major health, environmental, and welfare impacts, such as:

- Wildfires, including acreage burned, health impacts from smoke, property losses, and deaths;
- Agricultural impacts, including food price spikes and changes from heat and precipitation extremes;
- Death, injuries, and illnesses from omitted natural disasters and interruptions in the supply of water, food, sanitation, and shelter;
- Impacts on labor productivity from extreme heat and weather;
- Catastrophic impacts and tipping points, including rapid sea level rise and damages at very high temperatures;
- Ocean acidification and extreme weather effects on fisheries and coral reefs;
- Biodiversity and habitat loss, and species extinction;
- Changes in land and ocean transportation;
- National security impacts from regional conflict, including from refugee migration stemming from extreme weather and from food, water, and land scarcity; and
- Many more categories.[245]

[245] As summarized in: Direct Testimony of Dr. Peter Howard on Behalf of the Environmental Law & Policy Center, The Michigan Climate Action Network, and the Bay Mills Indian Community, September 14, 2021 and December 14, 2021, MI PSC Case No. U-20763 (In the Matter of Enbridge Energy, Limited Partnership Application for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service, Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief); available at: https://mi-psc.force.com/s/case/500t000000UHxxLAAT/application-for-the-authority-to-replace-and-relocate-the-segment-of-line-5-crossing-the-straits-of-mackinac-into-a-tunnel-beneath-the-straits-of-mackinac-if-approval-is-required-pursuant-to-1929-pa-16-mcl-4831-et-seq-and-rule-447-of-the-michigan-publ.

Importantly, the current SCC estimates also do not consider environmental justice and intergenerational equity. If sufficiently incorporated, each of these factors would significantly increase the interim SCC estimates.[246]

[246] Tom Erb, Center for Climate and Energy Solutions, The Social Cost of Carbon – Going Nowhere But Up, March 30, 2021; available at: https://www.c2es.org/2021/03/the-social-cost-of-carbon-going-nowhere-but-up/.

Table A-1 Quantitative Thresholds for Greenhouse Gas Emissions

Agency	State	Year Adopted	**Numeric Threshold** (metric tons CO_2eq/year)	Applicability	Reference
Quantitative Significance Thresholds for Environmental Review Documents					
California Air Resources Board	CA	2008	7,000 (operational emissions)	industrial stationary source projects	https://www.arb.ca.gov/cc/localgov/ceqa/meetings/102708/prelimdraftproposal102408.pdf
South Coast Air Quality Management District	CA	2008	10,000 (construction emissions amortized over 30 years plus operational emissions)	stationary/industrial sector projects	http://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/ghg-significance-thresholds
County of Santa Barbara	CA	2015	1,000	oil and gas production, surface mining, industrial stationary source projects	https://www.countyofsb.org/plndev/projects/CEQAGHGthresholds.sbc
Placer County	CA	2016	10,000 (construction plus operational emissions for stationary sources, construction emissions for land use projects)	stationary source and land use projects	https://www.placerair.org/DocumentCenter/View/2047/Chapter-2-Thresholds-of-Significance-PDF
		2016	1,100 (operational emissions)	land use projects	
San Diego County	CA	2016	10,000	stationary source projects	https://www.sandiego.gov/sites/default/files/legacy/planning/genplan/cap/pdf/eestf_powerpoint%20_120513.pdf
Bay Area Air Quality Management District	CA	2017	10,000	stationary source projects	https://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/updated-ceqa-guidelines
Sacramento Metropolitan Air Quality Management District	CA	2021	1,100 (construction) 10,000 (operational)	stationary source projects	https://www.airquality.org/LandUseTransportation/Documents/CH2ThresholdsTable4-2020.pdf
Reporting Thresholds for Greenhouse Gas Emissions Reporting Programs					
EPA	US	2009	25,000 metric tons CO2e/year	industrial sources	https://www.epa.gov/sites/default/files/2015-07/documents/part98factsheet.pdf
Massachusetts Department of Environmental Protection	MA	2008	5,000 tons CO2e/year	industrial sources	https://www.mass.gov/guides/massdep-greenhouse-gas-emissions-reporting-program
Thresholds for Emission Reduction Registry					
Wisconsin Department of Natural Resources	WI	2000	25	Wisconsin Voluntary Emission Reduction Registry	https://www.nescaum.org/projects/greenhouse-gas-early-action-demonstration-project/ghg-state-registry-collaborative/wisconsin.pdf
Thresholds for Climate Change Plans					
California 2017 Climate Change Scoping Plan	CA	2017	no net increase	residential land use	https://www.airquality.org/residents/ceqa-land-use-planning/ceqa-guidance-tools

Table A2: Lifecycle CO_2 Emissions Associated with Project

CO_2 Emission Factors for Crude Oils and NGL**

	% of production	% in Line 5**	Upstream*** (kg CO_2e/bbl)	Midstream*** (kg CO_2e/bbl)	Downstream*** (kg CO_2e/bbl)	Total (kg CO_2e/bbl)	Source
Crude oils*							
Bakken* (no flare)	90%	66%	24	18	429	471	https://oci.carnegieendowment.org/#oil/u.s.-bakken-no-flare
Bakken* (flare)	10%	7%	85	18	429	532	https://oci.carnegieendowment.org/#oil/u.s.-bakken-flare
Bakken Combined**		73%	30	18	429	477	
Canada Athabasca FC-HC SCO		27%	206	16	507	729	https://oci.carnegieendowment.org/#oil/canada-athabasca-fc-hc-sco
Combined crude oils		**100%**	**77**	**17**	**450**	**545**	
NGLs		**0%**					

kg CO_2e/bbl = kg CO2 equivalents per barrel

* Crude oils:

- Bakken = Bakken Light Crude: a shale oil occurring in large deposits in the Bakken Formation of northwestern North Dakota, northeastern Montana, and southern Saskatchewan Canada
  Percent Production based on: https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/111721-bakken-shale-natural-gas-flaring-reaches-historical-low-as-production-climbs
- Canada Athabasca FC-HC SCO is the only light synthetic crude oil from Northern Alberta listed in the OCI database: an extra-heavy, high-sulfur bitumen mined from the Athabasca oil sands in Canada's Alberta Province that is upgraded into a light, sweet synthetic crude oil (SCO) before transport to the refinery. Upgrading this oil requires a fluid coker (FC) unit and a hydroconversion (HC) system. Athabasca FC-HC SCO generates more GHG emissions in the upgrading process but fewer emissions in refining and end use compared to other SCOs in OCI Phase 2, owing to its lighter, upgraded gravity.

** see worksheet 'into Sarnia'

*** Emission categories:
upstream = drilling, production, processing, venting, flaring, and fugitive emissions, miscellaneous, transport to refinery, and offsite emissions
midstream = heat, electricity, and steam
downstream = transport to consumers, gasoline, jet fuel, diesel, fuel oil, residual fuels, and liquefied petroleum gas

Percent not combusted	0.48% for petroleum for light crudes and NGL	see worksheet 'Non-combust'

CO_2 Emissions from Line 5 at Full Capacity (Petroleum)

Product	Throughput (bbl/day)	Upstream (MMT CO_2/year)	Midstream (MMT CO_2/year)	Downstream (MMT CO_2/year)	Total (MMT CO_2/year)
Crude oils	148,185	4.2	0.9	24.2	29.3
NGLs	0	0.0	0.0	0.0	0.0
Total	**148,185**	**4.2**	**0.9**	**24.2**	**29.3**

Table A-3: Construction Combustion Emissions

Pipeline Project	metric tons CO_2e	miles	metric tons CO_2e/mile	Emission Sources	Source
Keystone XL, US	243,284	882	276	mobile sources, construction camp emergency generators, construction camp electricity usage; not included: pump station construction, open burning	2019 FSEIS, p. 4-27
Line 3, MN	163,806	340	482	mobile sources; not included: open burning	2017 FEIS, Table 5.2.2-7
Plains, CA	47,477	123.4	385	mobile sources; not included: open burning	2018 Application, Att. C, Table 7, p. 7
Average			**381**		
Line 5 Replacement Project Construction	**15,688.34**	**41.2**	**381**	**based on average**	
	19,849.42	**41.2**	**482**	**based on Line 3**	

Abandonment and Removal Combustion Emissions

Pipeline Project	metric tons CO_2e	miles	metric tons CO_2e/mile	Emission Sources	Source
Plains Replacement Pipeline, CA	1,270	122.9	10	abandonment mobile sources	2018 Application, Att. C, Table 10, p. 9
Plains Replacement Pipeline, CA	1,951	122.9	16	removal mobile sources	2018 Application, Att. C, Table 13, p. 9
Line 5 Replacement Project Abandonment	**425.62**	**41.2**	**10**	**based on Plains**	
Line 5 Replacement Project Removal	**654**	**41.2**	**16**	**based on Plains**	

Construction and Abandonment Combustion Emissions for Line 5 Replacement Project

Pipeline Project	metric tons CO_2e	Basis for construction emissions
Total Line 5 Replacement Project	**16,114**	**Average**
	20,275	**Line 3**

Sources:

U.S. Department of State, Final Supplemental EIS for the Keystone XL Project, December 2019; available at: https://2017-2021.state.gov/releases-keystone-xl-pipeline/index.html

Minnesota Department of Commerce, Energy Environmental Review and Analysis, Final Environmental Impact Statement, Line 3 Project, Docket Nos. PPL-15-137/CN-14-916, August 17, docket available at: ://mn.gov/commerce/energyfacilities/line3/

Santa Barbara County, Plains Pipeline, LP, Line 901-903 Pipeline Replacement Project (see 2017 Application Submittal, Attachment C.3 Air Quality Report and Attachment C.12, and 2020 Updated Documents, Attachment C.12); available at: https://cosantabarbara.app.box.com/s/t6d9jjoy80dy132ecn61qekjtf53yu5k

Table A-4: CO_2 Emissions from Land Clearing of Forested Land Cover for Proposed Project

Project Information	Acres impacted	Unit	Source
Forest land cover impacted	357.7	acres (based on 120 feet right-of-way)	Draft EIS, p. Table 3.2.3-1
Forest land cover permanently removed	147.9	acres (based on 50 feet permanent right-of-way)	Draft EIS, p. Table 3.2.3-1
Forest land cover temporarily impacted	209.8	acres (357.7 acres - 147.9 acres)	calculated
Lifetime of Project	30	years	assumed

CO_2 Emissions from Biomass Removal		Unit	Source
Average carbon (C) intensity in Wisconsin forests for aboveground live trees	65.3	metric tons C/hectare	Hoover and Smith 2021, Table S1
Project CO_2 emissions from removal of 355 acres of forest land cover resulting form vegetation removal	**34,659.48**	**metric tons CO_2**	calculated
Project CO_2 emissions from removal of 355 acres of forest land cover resulting from vegetation removal amortized over lifetime of Project (30 years)	**1,155**	**metric tons CO_2**	calculated

Loss of Carbon Sequestration		Unit	Source
Carbon sequestration rate in Wisconsin	0.46	metric tons C/hectare/year	Coeli et al. 2021
Project CO_2 emissions from removal of 355 acres of forest land cover resulting from vegetation removal	**26,857.11**	**metric tons CO_2 over lifetime of Project**	calculated
Project CO_2 emissions from removal of 355 acres of forest land cover resulting from vegetation removal amortized over lifetime of Project (30 years)	**895.24**	**metric tons CO_2/year**	calculated

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Total CO_2 Emissions from Land Clearing of Forested Land Cover for Proposed Project		
	61,517	**metric tons CO_2 over lifetime of Project**
	2,051	**metric tons CO_2/year**

Conversion factors	
2.47105	acres/hectare
26.4	metric tons C/acre
3.667	ton CO_2/ton C

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References

Coeli et al. 2021: Coeli M. Hoover and James E. Smith, Current Aboveground Live Tree Carbon Stocks and Annual Net Change in Forests of Conterminous United States, Carbon Balance Manager (2021) 16:17; available at: https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-021-00179-2

Hoover and Smith 2021: Coeli M. Hoover and James E. Smith, Current Aboveground Live Tree Carbon Stocks and Annual Net Change in Forests of Conterminous United States, Carbon Balance Manager (2021) 16:17, Supplemental Table S2, Carbon Accumulation Rates (Live Aboveground Tree Carbon Only) by State and Vegetation Class (tC/ha/y); available at: https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-021-00179-2

Table A-5: CO_2 Emissions from Pipeline Steel Production for Proposed Project

Pipeline Specifications for Line 5 Replacement Project			
		Unit	**Source**
Total length	41.2	miles	Draft EIS, p. 2
Outside diameter (OD)	30	inches	Draft EIS, Table 2.4-1, p. 28
Wall thickness	0.500	inches (35.2 miles = 41.2 miles - 3 miles - 3 miles)	Draft EIS, p. 28
	0.625	inches (3 miles)	Draft EIS, p. 29
	0.750	inches (3 miles)	Draft EIS, p. 30
Industrial specification	API 5L PSL2		Draft EIS, Table 2.4-1, p. 28
Total weight of steel pipe required	3411.6984	tons of steel	calculated based on API 5L PSL2 Specifications

Steel Pipe Specifications for API 5L PSL2			
Weight per unit length steel pipe	157.68	lb/foot (0.500")	API 5L 2004, Table 6C (Plain-end Pipe Dimensions...) for 30" OD, 0.500" diameter
	196.26	lb/foot (0.625")	API 5L 2004, Table 6C (Plain-end Pipe Dimensions...) for 30" OD, 0.625" diameter
	234.51	lb/foot (0.750")	API 5L, 2004 Table 6C (Plain-end Pipe Dimensions...) for 30" OD, 0.750" diameter

CO_2 emissions from Manufacture of Steel			
for steel produced in U.S.	933	kg CO_2/metric ton steel	Hasanbeigi and Springer 2019, estimated from Figure 14 (total CO_2 emissions intensity of steel industry in U.S. in 2016)
	2,889	**metric ton CO_2 for 41.2 miles of pipeline steel**	
for steel produced globally	1,971	kg CO_2/metric ton steel	Hasanbeigi and Springer 2019, p. 20 (weighted average CO_2 emissions intensity (weighted by share of production from total production) in 15 countries in 2016)
	6,100	**metric ton CO_2 for 41.2 miles of pipeline steel**	
average steel production	1,452	kg CO_2/metric ton steel	average
	4,495	**metric ton CO_2 for 41.2 miles of pipeline steel**	average
	150		

Conversions	
12	in/foot
63,360	in/mile
0.453592	lb/kg
1.10231	ton/metric ton

Notes

Canada, Brazil and South Korea are the top three countries from which the U.S. imported steel in 2016*(Hasanbeigi and Springer 2019)*
The U.S has a substantial deficit in steel products and is the world's largest steel importer (2019 ranking)
Top 5 import sources for pipe and tube: South Korea, Canada, Mexico, Taiwan, Germany
The top three U.S. steel producers acccounted for over 70 percent of U.S. crude steel production in 2018
20% of U.S. steel imports are pipe and tube products
Among the top six U.S. steel producers, only one, United States Steel Corp. produces tubular products (seamless or welded pipe and tube products used most commonly in construction and energy sector
The United States imported 17 percent of its pipe and tube imports from South Korea (889 thousand metric tons), followed by Canada at 13 percent (695 thousand metric tons
(Steel Imports 2020)

References

API 5L, 2004: American Petroleum Institute, API 5L: Specification for Line Pipe, 2004; available at: https://global.ihs.com/api_spec_5l.cfm

Hasanbeigi and Springer 2019: Ali Hasanbeigi and Cecilia Springer, How Clean Is the U.S. Steel Industry? An International Benchmarking of Energy and CO_2 Intensities. San Francisco CA: Global Efficiency Intelligence, 2019; available at: https://static1.squarespace.com/static/5877e86f9de4bb8bce72105c/t/60c136b38eeef914f9cf4b95/1623275195911/How+Clean+is+the+U.S.+Steel+Industry.pdf

Steel Imports 2020: U.S. Department of Commerce, International Trade Administration, Global Steel Trade Monitor, Steel Imports Report: United States, May 2020; available at: https://legacy.trade.gov/steel/countries/pdfs/imports-us.pdf

Table A-6: Social Cost of Carbon Estimates Developed by U.S. Federal Government, U.S. States, Canada, and Germany*

(in 2018 U.S. Dollars)

Year of Emissions / Discount Rate	Obama Administration				Trump Administration		California Air Resources Board			California Public Utilities Commission		Minnesota		New York	Canada		Germany	
	5%	3%	2.5%	3% High Impact	7%	3%	5%	3%	2.5%	3%	3% High Impact	5%	3%	3%	3%	3% High Impact	3%	3% High Impact
2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$218	$776
2020	$14	$50	$74	$147	$1	$7	$14	$50	$74	$50	$147	$10	$45	$52	$38	$159	-	-
2025	$17	$55	$81	$165	$1	$7	$17	$55	$81	$55	$165	-	-	-	-	-	-	-
2030	$19	$60	$87	$181	$1	$8	$19	$60	$87	$60	$181	$12	$54	$62	$45	$197	$248	$812
2035	$21	$72	$93	$200	$2	$9	-		-	-	-	-	-	-	-	-	-	
2040	$25	$76	$100	$218	$2	$9	-	-	-	-	-	$14	$64	$73	-	-	-	-
2045							-		-	-	-	-	-	-	-	-	-	
2050	$27	$82	$106	$235	$2	$10	-	-	-	-	-	$16	$73	$86	$62	$267	$291	$885

* Source

GAO, Social Cost of Carbon, Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis, Report to Congressional Requesters, June 2020, GAO-20-254; available at: https://www.gao.gov/assets/gao-20-254.pdf

Table A-7a: Total Project SCC (30-year lifetime)

billion 2020$	million 2020$	2020$	Discount Rate
0.0	0.1	69,454	5% Average
0.0	0.2	239,192	3% Average
0.0	0.4	355,213	2.5% Average
0.0	0.7	712,959	3% 95% Percentile

Project Greenhouse Gas Emissions*

(metric ton CO_2e/year)	Calendar Year	Emission sources
4,495	2022	steel
	2023	construction combustion
	2023	land clearing
	2024	abandonment combustion
	2024-2053	loss of carbon sequestration
	2024-2053	up/mid/downstream
	2024-2053	operation electricity

* see worksheet 'Total CO2eq'

	Social Cost of Carbon (2020$/Metric Tonne CO_2) Discount Rate and Statistic				Interim Global Social Cost of Carbon Values, 2020-2070 (2020$/Metric Tonne CO_2)** Discount Rate and Statistic			
Year	5% Average	3% Average	2.5% Average	3% 95th Percentile	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020					14.47562	51.08224	76.42065	151.6082
2021					14.96436	52.15044	77.72665	155.1185
2022	69,454	239,192	355,213	712,959	15.4531	53.21864	79.03265	158.6289
2023	0	0	0	0	15.94184	54.28685	80.33865	162.1392
2024	0	0	0	0	16.43058	55.35505	81.64465	165.6496
2025	0	0	0	0	16.91932	56.42325	82.95064	169.1599
2026	0	0	0	0	17.40806	57.49145	84.25664	172.6703
2027	0	0	0	0	17.89679	58.55965	85.56264	176.1806
2028	0	0	0	0	18.38553	59.62785	86.86864	179.691
2029	0	0	0	0	18.87427	60.69605	88.17464	183.2013
2030	0	0	0	0	19.36301	61.76426	89.48063	186.7117
2031	0	0	0	0	19.94657	62.90827	90.84388	190.5353
2032	0	0	0	0	20.53012	64.05229	92.20713	194.359
2033	0	0	0	0	21.11367	65.19631	93.57038	198.1826
2034	0	0	0	0	21.69722	66.34033	94.93363	202.0062
2035	0	0	0	0	22.28077	67.48435	96.29687	205.8299
2036	0	0	0	0	22.86432	68.62836	97.66012	209.6535
2037	0	0	0	0	23.44788	69.77238	99.02337	213.4771
2038	0	0	0	0	24.03143	70.9164	100.3866	217.3008
2039	0	0	0	0	24.61498	72.06042	101.7499	221.1244
2040	0	0	0	0	25.19853	73.20444	103.1131	224.9481
2041	0	0	0	0	25.84471	74.35021	104.4489	228.4477
2042	0	0	0	0	26.4909	75.49599	105.7847	231.9474
2043	0	0	0	0	27.13708	76.64176	107.1204	235.4471
2044	0	0	0	0	27.78327	77.78754	108.4562	238.9468
2045	0	0	0	0	28.42945	78.93332	109.792	242.4465
2046	0	0	0	0	29.07564	80.07909	111.1278	245.9462
2047	0	0	0	0	29.72182	81.22487	112.4636	249.4459
2048	0	0	0	0	30.368	82.37065	113.7993	252.9456
2049	0	0	0	0	31.01419	83.51642	115.1351	256.4453
2050	0	0	0	0	31.66037	84.6622	116.4709	259.9449
2051	0	0	0	0	32.54014	85.18739	118.1069	260.8228
2052	0	0	0	0	33.12754	86.12578	119.1969	261.7006
2053	0	0	0	0	33.71494	87.06417	120.2868	262.5784
2054	0	0	0	0	34.30234	88.00256	121.3768	263.4562
2055	0	0	0	0	34.88974	88.94094	122.4668	266.0737
2056	0	0	0	0	35.49332	89.90579	123.5863	268.1086
2057	0	0	0	0	36.09691	90.87063	124.7059	270.1434
2058	0	0	0	0	36.70049	91.83547	125.8255	272.1782
2059	0	0	0	0	37.30408	92.80032	126.945	274.2131
2060	0	0	0	0	37.90766	93.76516	128.0646	276.2479
2061	0	0	0	0	39.07438	95.16651	129.5994	281.2479
2062	0	0	0	0	40.24109	96.56786	131.1341	286.2479
2063	0	0	0	0	41.40781	97.96922	132.6689	291.2479
2064	0	0	0	0	42.57452	99.37057	134.2036	296.2479
2065	0	0	0	0	43.74124	100.7719	135.7384	301.2478
2066	0	0	0	0	44.92395	102.1974	137.2993	306.5125
2067	0	0	0	0	46.10666	103.623	138.8602	311.7772
2068	0	0	0	0	47.28937	105.0485	140.4211	317.0419
2069	0	0	0	0	48.47208	106.474	141.982	322.3066
2070	0	0	0	0	49.65479	107.8995	143.5429	327.5713

** Source: U.S. EPA, Social Cost of Greenhouse Gases (SC-GHGs) Unrounded Annual Estimates Through 2070, Docket EPA-HQ-OAR-2021-0208, June 9, 2021; available at: https://downloads.regulations.gov/EPA-HQ-OAR-2021-0208-0161/content.pdf. The document states that SCC values are in $2018/metric ton$CO_2$; however checking the February 2021 Interagency Working Group report shows that these values are instead in $2020/metric ton CO_2. See https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

Table A-7b: Total Project SCC (30-year lifetime)

billion 2020$	million 2020$	2020$	Discount Rate
0.0	0.3	316,436	5% Average
0.0	1.1	1,077,562	3% Average
0.0	1.6	1,594,676	2.5% Average
0.0	3.2	3,218,369	3% 95% Percentile

Project Greenhouse Gas Emissions*

(metric ton CO_2e/year)	Calendar Year	Emission sources
	2022	steel
19,849	2023	construction combustion
	2023	land clearing
	2024	abandonment combustion
	2024-2053	loss of carbon sequestration
	2024-2053	up/mid/downstream
	2024-2053	operation electricity

* see worksheet 'Total CO2eq'

	Social Cost of Carbon (2020$/Metric Tonne CO_2) Discount Rate and Statistic				Interim Global Social Cost of Carbon Values, 2020-2070 (2020$/Metric Tonne CO_2)** Discount Rate and Statistic			
Year	5% Average	3% Average	2.5% Average	3% 95th Percentile	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020					14.47562	51.08224	76.42065	151.6082
2021					14.96436	52.15044	77.72665	155.1185
2022	0	0	0	0	15.4531	53.21864	79.03265	158.6289
2023	316,436	1,077,562	1,594,676	3,218,369	15.94184	54.28685	80.33865	162.1392
2024	0	0	0	0	16.43058	55.35505	81.64465	165.6496
2025	0	0	0	0	16.91932	56.42325	82.95064	169.1599
2026	0	0	0	0	17.40806	57.49145	84.25664	172.6703
2027	0	0	0	0	17.89679	58.55965	85.56264	176.1806
2028	0	0	0	0	18.38553	59.62785	86.86864	179.691
2029	0	0	0	0	18.87427	60.69605	88.17464	183.2013
2030	0	0	0	0	19.36301	61.76426	89.48063	186.7117
2031	0	0	0	0	19.94657	62.90827	90.84388	190.5353
2032	0	0	0	0	20.53012	64.05229	92.20713	194.359
2033	0	0	0	0	21.11367	65.19631	93.57038	198.1826
2034	0	0	0	0	21.69722	66.34033	94.93363	202.0062
2035	0	0	0	0	22.28077	67.48435	96.29687	205.8299
2036	0	0	0	0	22.86432	68.62836	97.66012	209.6535
2037	0	0	0	0	23.44788	69.77238	99.02337	213.4771
2038	0	0	0	0	24.03143	70.9164	100.3866	217.3008
2039	0	0	0	0	24.61498	72.06042	101.7499	221.1244
2040	0	0	0	0	25.19853	73.20444	103.1131	224.9481
2041	0	0	0	0	25.84471	74.35021	104.4489	228.4477
2042	0	0	0	0	26.4909	75.49599	105.7847	231.9474
2043	0	0	0	0	27.13708	76.64176	107.1204	235.4471
2044	0	0	0	0	27.78327	77.78754	108.4562	238.9468
2045	0	0	0	0	28.42945	78.93332	109.792	242.4465
2046	0	0	0	0	29.07564	80.07909	111.1278	245.9462
2047	0	0	0	0	29.72182	81.22487	112.4636	249.4459
2048	0	0	0	0	30.368	82.37065	113.7993	252.9456
2049	0	0	0	0	31.01419	83.51642	115.1351	256.4453
2050	0	0	0	0	31.66037	84.6622	116.4709	259.9449
2051	0	0	0	0	32.54014	85.18739	118.1069	260.8228
2052	0	0	0	0	33.12754	86.12578	119.1969	261.7006
2053	0	0	0	0	33.71494	87.06417	120.2868	262.5784
2054	0	0	0	0	34.30234	88.00256	121.3768	263.4562
2055	0	0	0	0	34.88974	88.94094	122.4668	266.0737
2056	0	0	0	0	35.49332	89.90579	123.5863	268.1086
2057	0	0	0	0	36.09691	90.87063	124.7059	270.1434
2058	0	0	0	0	36.70049	91.83547	125.8255	272.1782
2059	0	0	0	0	37.30408	92.80032	126.945	274.2131
2060	0	0	0	0	37.90766	93.76516	128.0646	276.2479
2061	0	0	0	0	39.07438	95.16651	129.5994	281.2479
2062	0	0	0	0	40.24109	96.56786	131.1341	286.2479
2063	0	0	0	0	41.40781	97.96922	132.6689	291.2479
2064	0	0	0	0	42.57452	99.37057	134.2036	296.2479
2065	0	0	0	0	43.74124	100.7719	135.7384	301.2478
2066	0	0	0	0	44.92395	102.1974	137.2993	306.5125
2067	0	0	0	0	46.10666	103.623	138.8602	311.7772
2068	0	0	0	0	47.28937	105.0485	140.4211	317.0419
2069	0	0	0	0	48.47208	106.474	141.982	322.3066
2070	0	0	0	0	49.65479	107.8995	143.5429	327.5713

** Source: U.S. EPA, Social Cost of Greenhouse Gases (SC-GHGs) Unrounded Annual Estimates Through 2070, Docket EPA-HQ-OAR-2021-0208, June 9, 2021; available at: https://downloads.regulations.gov/EPA-HQ-OAR-2021-0208-0161/content.pdf. The document states that SCC values are in $2018/metric ton$CO_2$; however checking the February 2021 Interagency Working Group report shows that these values are instead in $2020/metric ton CO_2. See https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

Table A-7d: Total Project SCC (30-year lifetime)

billion 2020$	million 2020$	2020$	Discount Rate
0.0	0.3	314,070	5% Average
0.0	0.0	23,560	3% Average
0.0	0.0	34,750	2.5% Average
0.0	0.1	70,504	3% 95% Percentile

Project Greenhouse Gas Emissions*

(metric ton CO_2e/year)	Calendar Year	Emission sources
	2022	steel
	2023	construction combustion
	2023	land clearing
426	2024	abandonment combustion
	2024-2053	loss of carbon sequestration
	2024-2053	up/mid/downstream
	2024-2053	operation electricity

* see worksheet 'Total CO2eq'

	Social Cost of Carbon (2020$/Metric Tonne CO_2) Discount Rate and Statistic				**Interim Global Social Cost of Carbon Values, 2020-2070 (2020$/Metric Tonne CO_2)**** Discount Rate and Statistic			
Year	5% Average	3% Average	2.5% Average	3% 95th Percentile	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020					14.47562	51.08224	76.42065	151.6082
2021					14.96436	52.15044	77.72665	155.1185
2022	0	0	0	0	15.4531	53.21864	79.03265	158.6289
2023	0	0	0	0	15.94184	54.28685	80.33865	162.1392
2024	6,993	23,560	34,750	70,504	16.43058	55.35505	81.64465	165.6496
2025	7,201	0	0	0	16.91932	56.42325	82.95064	169.1599
2026	7,409	0	0	0	17.40806	57.49145	84.25664	172.6703
2027	7,617	0	0	0	17.89679	58.55965	85.56264	176.1806
2028	7,825	0	0	0	18.38553	59.62785	86.86864	179.691
2029	8,033	0	0	0	18.87427	60.69605	88.17464	183.2013
2030	8,241	0	0	0	19.36301	61.76426	89.48063	186.7117
2031	8,490	0	0	0	19.94657	62.90827	90.84388	190.5353
2032	8,738	0	0	0	20.53012	64.05229	92.20713	194.359
2033	8,986	0	0	0	21.11367	65.19631	93.57038	198.1826
2034	9,235	0	0	0	21.69722	66.34033	94.93363	202.0062
2035	9,483	0	0	0	22.28077	67.48435	96.29687	205.8299
2036	9,732	0	0	0	22.86432	68.62836	97.66012	209.6535
2037	9,980	0	0	0	23.44788	69.77238	99.02337	213.4771
2038	10,228	0	0	0	24.03143	70.9164	100.3866	217.3008
2039	10,477	0	0	0	24.61498	72.06042	101.7499	221.1244
2040	10,725	0	0	0	25.19853	73.20444	103.1131	224.9481
2041	11,000	0	0	0	25.84471	74.35021	104.4489	228.4477
2042	11,275	0	0	0	26.4909	75.49599	105.7847	231.9474
2043	11,550	0	0	0	27.13708	76.64176	107.1204	235.4471
2044	11,825	0	0	0	27.78327	77.78754	108.4562	238.9468
2045	12,100	0	0	0	28.42945	78.93332	109.792	242.4465
2046	12,375	0	0	0	29.07564	80.07909	111.1278	245.9462
2047	12,650	0	0	0	29.72182	81.22487	112.4636	249.4459
2048	12,925	0	0	0	30.368	82.37065	113.7993	252.9456
2049	13,200	0	0	0	31.01419	83.51642	115.1351	256.4453
2050	13,475	0	0	0	31.66037	84.6622	116.4709	259.9449
2051	13,850	0	0	0	32.54014	85.18739	118.1069	260.8228
2052	14,100	0	0	0	33.12754	86.12578	119.1969	261.7006
2053	14,350	0	0	0	33.71494	87.06417	120.2868	262.5784
2054	14,600	0	0	0	34.30234	88.00256	121.3768	263.4562
2055	14,850	0	0	0	34.88974	88.94094	122.4668	266.0737
2056	15,107	0	0	0	35.49332	89.90579	123.5863	268.1086
2057	15,364	0	0	0	36.09691	90.87063	124.7059	270.1434
2058	15,620	0	0	0	36.70049	91.83547	125.8255	272.1782
2059	15,877	0	0	0	37.30408	92.80032	126.945	274.2131
2060	16,134	0	0	0	37.90766	93.76516	128.0646	276.2479
2061	16,631	0	0	0	39.07438	95.16651	129.5994	281.2479
2062	17,127	0	0	0	40.24109	96.56786	131.1341	286.2479
2063	17,624	0	0	0	41.40781	97.96922	132.6689	291.2479
2064	18,121	0	0	0	42.57452	99.37057	134.2036	296.2479
2065	18,617	0	0	0	43.74124	100.7719	135.7384	301.2478
2066	19,121	0	0	0	44.92395	102.1974	137.2993	306.5125
2067	19,624	0	0	0	46.10666	103.623	138.8602	311.7772
2068	20,127	0	0	0	47.28937	105.0485	140.4211	317.0419
2069	20,631	0	0	0	48.47208	106.474	141.982	322.3066
2070	21,134	0	0	0	49.65479	107.8995	143.5429	327.5713

** Source: U.S. EPA, Social Cost of Greenhouse Gases (SC-GHGs) Unrounded Annual Estimates Through 2070, Docket EPA-HQ-OAR-2021-0208, June 9, 2021; available at: https://downloads.regulations.gov/EPA-HQ-OAR-2021-0208-0161/content.pdf. The document states that SCC values are in $2018/metric ton$CO_2$; however checking the February 2021 Interagency Working Group report shows that these values are instead in $2020/metric ton CO_2. See https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

Table A-7c: Total Project SCC (30-year lifetime)

billion 2020$	million 2020$	2020$	Discount Rate
0.0	0.6	552,536	5% Average
0.0	1.9	1,881,554	3% Average
0.0	2.8	2,784,496	2.5% Average
0.0	5.6	5,619,660	3% 95% Percentile

Project Greenhouse Gas Emissions*

(metric ton CO_2e/year)	Calendar Year	Emission sources
	2022	steel
	2023	construction combustion
34,659	2023	land clearing
	2024	abandonment combustion
	2024-2053	loss of carbon sequestration
	2024-2053	up/mid/downstream
	2024-2053	operation electricity

* see worksheet 'Total CO2eq'

	Social Cost of Carbon (2020$/Metric Tonne CO_2) Discount Rate and Statistic				Interim Global Social Cost of Carbon Values, 2020-2070 (2020$/Metric Tonne CO_2)** Discount Rate and Statistic			
Year	5% Average	3% Average	2.5% Average	3% 95th Percentile	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020					14.47562	51.08224	76.42065	151.6082
2021					14.96436	52.15044	77.72665	155.1185
2022	0	0	0	0	15.4531	53.21864	79.03265	158.6289
2023	552,536	1,881,554	2,784,496	5,619,660	15.94184	54.28685	80.33865	162.1392
2024	0	0	0	0	16.43058	55.35505	81.64465	165.6496
2025	0	0	0	0	16.91932	56.42325	82.95064	169.1599
2026	0	0	0	0	17.40806	57.49145	84.25664	172.6703
2027	0	0	0	0	17.89679	58.55965	85.56264	176.1806
2028	0	0	0	0	18.38553	59.62785	86.86864	179.691
2029	0	0	0	0	18.87427	60.69605	88.17464	183.2013
2030	0	0	0	0	19.36301	61.76426	89.48063	186.7117
2031	0	0	0	0	19.94657	62.90827	90.84388	190.5353
2032	0	0	0	0	20.53012	64.05229	92.20713	194.359
2033	0	0	0	0	21.11367	65.19631	93.57038	198.1826
2034	0	0	0	0	21.69722	66.34033	94.93363	202.0062
2035	0	0	0	0	22.28077	67.48435	96.29687	205.8299
2036	0	0	0	0	22.86432	68.62836	97.66012	209.6535
2037	0	0	0	0	23.44788	69.77238	99.02337	213.4771
2038	0	0	0	0	24.03143	70.9164	100.3866	217.3008
2039	0	0	0	0	24.61498	72.06042	101.7499	221.1244
2040	0	0	0	0	25.19853	73.20444	103.1131	224.9481
2041	0	0	0	0	25.84471	74.35021	104.4489	228.4477
2042	0	0	0	0	26.4909	75.49599	105.7847	231.9474
2043	0	0	0	0	27.13708	76.64176	107.1204	235.4471
2044	0	0	0	0	27.78327	77.78754	108.4562	238.9468
2045	0	0	0	0	28.42945	78.93332	109.792	242.4465
2046	0	0	0	0	29.07564	80.07909	111.1278	245.9462
2047	0	0	0	0	29.72182	81.22487	112.4636	249.4459
2048	0	0	0	0	30.368	82.37065	113.7993	252.9456
2049	0	0	0	0	31.01419	83.51642	115.1351	256.4453
2050	0	0	0	0	31.66037	84.6622	116.4709	259.9449
2051	0	0	0	0	32.54014	85.18739	118.1069	260.8228
2052	0	0	0	0	33.12754	86.12578	119.1969	261.7006
2053	0	0	0	0	33.71494	87.06417	120.2868	262.5784
2054	0	0	0	0	34.30234	88.00256	121.3768	263.4562
2055	0	0	0	0	34.88974	88.94094	122.4668	266.0737
2056	0	0	0	0	35.49332	89.90579	123.5863	268.1086
2057	0	0	0	0	36.09691	90.87063	124.7059	270.1434
2058	0	0	0	0	36.70049	91.83547	125.8255	272.1782
2059	0	0	0	0	37.30408	92.80032	126.945	274.2131
2060	0	0	0	0	37.90766	93.76516	128.0646	276.2479
2061	0	0	0	0	39.07438	95.16651	129.5994	281.2479
2062	0	0	0	0	40.24109	96.56786	131.1341	286.2479
2063	0	0	0	0	41.40781	97.96922	132.6689	291.2479
2064	0	0	0	0	42.57452	99.37057	134.2036	296.2479
2065	0	0	0	0	43.74124	100.7719	135.7384	301.2478
2066	0	0	0	0	44.92395	102.1974	137.2993	306.5125
2067	0	0	0	0	46.10666	103.623	138.8602	311.7772
2068	0	0	0	0	47.28937	105.0485	140.4211	317.0419
2069	0	0	0	0	48.47208	106.474	141.982	322.3066
2070	0	0	0	0	49.65479	107.8995	143.5429	327.5713

** Source: U.S. EPA, Social Cost of Greenhouse Gases (SC-GHGs) Unrounded Annual Estimates Through 2070, Docket EPA-HQ-OAR-2021-0208, June 9, 2021; available at: https://downloads.regulations.gov/EPA-HQ-OAR-2021-0208-0161/content.pdf. The document states that SCC values are in $2018/metric ton$CO_2$; however checking the February 2021 Interagency Working Group report shows that these values are instead in $2020/metric ton CO_2. See https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

Table A-7e: Total Project SCC (30-year lifetime)

billion 2020$	million 2020$	2020$	Discount Rate
0.0	0.7	660,578	5% Average
0.0	1.9	1,919,238	3% Average
0.0	2.7	2,713,273	2.5% Average
0.0	5.9	5,852,591	3% 95% Percentile

Project Greenhouse Gas Emissions*

(metric ton CO_2e/year)	Calendar Year	Emission sources
	2022	steel
	2023	construction combustion
	2023	land clearing
	2024	abandonment combustion
895	2024-2053	loss of carbon sequestration
	2024-2053	up/mid/downstream
	2024-2053	operation electricity

* see worksheet 'Total CO2eq'

	Social Cost of Carbon (2020$/Metric Tonne CO_2) Discount Rate and Statistic				Interim Global Social Cost of Carbon Values, 2020-2070 (2020$/Metric Tonne CO_2)** Discount Rate and Statistic			
Year	5% Average	3% Average	2.5% Average	3% 95th Percentile	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020					14.47562	51.08224	76.42065	151.6082
2021					14.96436	52.15044	77.72665	155.1185
2022	0	0	0	0	15.4531	53.21864	79.03265	158.6289
2023	0	0	0	0	15.94184	54.28685	80.33865	162.1392
2024	14,709	49,554	73,088	148,290	16.43058	55.35505	81.64465	165.6496
2025	15,146	50,510	74,257	151,432	16.91932	56.42325	82.95064	169.1599
2026	15,584	51,466	75,427	154,574	17.40806	57.49145	84.25664	172.6703
2027	16,021	52,423	76,596	157,717	17.89679	58.55965	85.56264	176.1806
2028	16,459	53,379	77,765	160,859	18.38553	59.62785	86.86864	179.691
2029	16,896	54,335	78,934	164,002	18.87427	60.69605	88.17464	183.2013
2030	17,334	55,291	80,103	167,144	19.36301	61.76426	89.48063	186.7117
2031	17,856	56,315	81,323	170,567	19.94657	62.90827	90.84388	190.5353
2032	18,379	57,340	82,544	173,990	20.53012	64.05229	92.20713	194.359
2033	18,901	58,364	83,764	177,413	21.11367	65.19631	93.57038	198.1826
2034	19,423	59,388	84,985	180,836	21.69722	66.34033	94.93363	202.0062
2035	19,946	60,412	86,205	184,259	22.28077	67.48435	96.29687	205.8299
2036	20,468	61,436	87,425	187,682	22.86432	68.62836	97.66012	209.6535
2037	20,991	62,460	88,646	191,105	23.44788	69.77238	99.02337	213.4771
2038	21,513	63,484	89,866	194,528	24.03143	70.9164	100.3866	217.3008
2039	22,035	64,508	91,087	197,951	24.61498	72.06042	101.7499	221.1244
2040	22,558	65,533	92,307	201,374	25.19853	73.20444	103.1131	224.9481
2041	23,136	66,558	93,503	204,506	25.84471	74.35021	104.4489	228.4477
2042	23,715	67,584	94,698	207,639	26.4909	75.49599	105.7847	231.9474
2043	24,293	68,610	95,894	210,772	27.13708	76.64176	107.1204	235.4471
2044	24,872	69,635	97,090	213,905	27.78327	77.78754	108.4562	238.9468
2045	25,450	70,661	98,286	217,038	28.42945	78.93332	109.792	242.4465
2046	26,029	71,687	99,482	220,171	29.07564	80.07909	111.1278	245.9462
2047	26,607	72,713	100,677	223,304	29.72182	81.22487	112.4636	249.4459
2048	27,185	73,738	101,873	226,437	30.368	82.37065	113.7993	252.9456
2049	27,764	74,764	103,069	229,570	31.01419	83.51642	115.1351	256.4453
2050	28,342	75,790	104,265	232,703	31.66037	84.6622	116.4709	259.9449
2051	29,130	76,260	105,729	233,489	32.54014	85.18739	118.1069	260.8228
2052	29,656	77,100	106,705	234,274	33.12754	86.12578	119.1969	261.7006
2053	30,182	77,940	107,681	235,060	33.71494	87.06417	120.2868	262.5784
2054	30,707	78,780	108,657	235,846	34.30234	88.00256	121.3768	263.4562
2055	31,233	79,620	109,632	238,189	34.88974	88.94094	122.4668	266.0737
2056	31,774	80,484	110,634	240,011	35.49332	89.90579	123.5863	268.1086
2057	32,314	81,347	111,637	241,832	36.09691	90.87063	124.7059	270.1434
2058	32,854	82,211	112,639	243,654	36.70049	91.83547	125.8255	272.1782
2059	33,395	83,075	113,641	245,476	37.30408	92.80032	126.945	274.2131
2060	33,935	83,939	114,643	247,297	37.90766	93.76516	128.0646	276.2479
2061	34,979	85,193	116,017	251,773	39.07438	95.16651	129.5994	281.2479
2062	36,024	86,448	117,391	256,249	40.24109	96.56786	131.1341	286.2479
2063	37,068	87,702	118,765	260,725	41.40781	97.96922	132.6689	291.2479
2064	38,113	88,957	120,139	265,201	42.57452	99.37057	134.2036	296.2479
2065	39,157	90,211	121,513	269,677	43.74124	100.7719	135.7384	301.2478
2066	40,216	91,487	122,910	274,390	44.92395	102.1974	137.2993	306.5125
2067	41,275	92,763	124,308	279,103	46.10666	103.623	138.8602	311.7772
2068	42,333	94,039	125,705	283,816	47.28937	105.0485	140.4211	317.0419
2069	43,392	95,316	127,102	288,529	48.47208	106.474	141.982	322.3066
2070	44,451	96,592	128,500	293,242	49.65479	107.8995	143.5429	327.5713

** Source: U.S. EPA, Social Cost of Greenhouse Gases (SC-GHGs) Unrounded Annual Estimates Through 2070, Docket EPA-HQ-OAR-2021-0208, June 9, 2021; available at: https://downloads.regulations.gov/EPA-HQ-OAR-2021-0208-0161/content.pdf. The document states that SCC values are in $2018/metric ton$CO_2$; however checking the February 2021 Interagency Working Group report shows that these values are instead in $2020/metric ton CO_2. See https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

Table A-7f: Total Project SCC (30-year lifetime)

billion 2020$	million 2020$	2020$	Discount Rate
3.1	3,077.9	3,077,920,576	5% Average
8.9	8,942.6	8,942,563,704	3% Average
12.6	12,642.3	12,642,321,498	2.5% Average
27.3	27,269.8	27,269,767,960	3% 95% Percentile

Project Greenhouse Gas Emissions*

(metric ton CO_2e/year)	Calendar Year	Emission sources
	2022	steel
	2023	construction combustion
	2023	land clearing
	2024	abandonment combustion
	2024-2053	loss of carbon sequestration
4,171,127	2024-2053	upstream
	2024-2053	operation electricity

* see worksheet 'Total CO2eq'

	Social Cost of Carbon (2020$/Metric Tonne CO_2) Discount Rate and Statistic				Interim Global Social Cost of Carbon Values, 2020-2070 (2020$/Metric Tonne CO_2)** Discount Rate and Statistic			
Year	5% Average	3% Average	2.5% Average	3% 95th Percentile	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020					14.47562	51.08224	76.42065	151.6082
2021					14.96436	52.15044	77.72665	155.1185
2022	0	0	0	0	15.4531	53.21864	79.03265	158.6289
2023	0	0	0	0	15.94184	54.28685	80.33865	162.1392
2024	68,534,028	230,892,918	340,550,167	690,945,443	16.43058	55.35505	81.64465	165.6496
2025	70,572,625	235,348,516	345,997,616	705,587,349	16.91932	56.42325	82.95064	169.1599
2026	72,611,221	239,804,113	351,445,108	720,229,672	17.40806	57.49145	84.25664	172.6703
2027	74,649,776	244,259,710	356,892,599	734,871,577	17.89679	58.55965	85.56264	176.1806
2028	76,688,372	248,715,308	362,340,090	749,513,900	18.38553	59.62785	86.86864	179.691
2029	78,726,969	253,170,905	367,787,581	764,155,805	18.87427	60.69605	88.17464	183.2013
2030	80,765,565	257,626,544	373,235,031	778,798,128	19.36301	61.76426	89.48063	186.7117
2031	83,199,668	262,398,355	378,921,319	794,746,847	19.94657	62.90827	90.84388	190.5353
2032	85,633,728	267,170,207	384,607,607	810,695,984	20.53012	64.05229	92.20713	194.359
2033	88,067,789	271,942,059	390,293,896	826,644,703	21.11367	65.19631	93.57038	198.1826
2034	90,501,850	276,713,911	395,980,184	842,593,423	21.69722	66.34033	94.93363	202.0062
2035	92,935,911	281,485,764	401,666,430	858,542,559	22.28077	67.48435	96.29687	205.8299
2036	95,369,972	286,257,574	407,352,719	874,491,279	22.86432	68.62836	97.66012	209.6535
2037	97,804,075	291,029,426	413,039,007	890,439,998	23.44788	69.77238	99.02337	213.4771
2038	100,238,136	295,801,278	418,725,212	906,389,135	24.03143	70.9164	100.3866	217.3008
2039	102,672,196	300,573,131	424,411,709	922,337,854	24.61498	72.06042	101.7499	221.1244
2040	105,106,257	305,344,983	430,097,788	938,286,991	25.19853	73.20444	103.1131	224.9481
2041	107,801,556	310,124,134	435,669,579	952,884,265	25.84471	74.35021	104.4489	228.4477
2042	110,496,896	314,903,328	441,241,370	967,481,957	26.4909	75.49599	105.7847	231.9474
2043	113,192,195	319,682,479	446,812,744	982,079,648	27.13708	76.64176	107.1204	235.4471
2044	115,887,535	324,461,673	452,384,535	996,677,340	27.78327	77.78754	108.4562	238.9468
2045	118,582,834	329,240,866	457,956,325	1,011,275,031	28.42945	78.93332	109.792	242.4465
2046	121,278,174	334,020,018	463,528,116	1,025,872,723	29.07564	80.07909	111.1278	245.9462
2047	123,973,472	338,799,211	469,099,907	1,040,470,415	29.72182	81.22487	112.4636	249.4459
2048	126,668,771	343,578,405	474,671,281	1,055,068,106	30.368	82.37065	113.7993	252.9456
2049	129,364,111	348,357,556	480,243,072	1,069,665,798	31.01419	83.51642	115.1351	256.4453
2050	132,059,410	353,136,750	485,814,863	1,084,263,072	31.66037	84.6622	116.4709	259.9449
2051	135,729,042	355,327,384	492,638,826	1,087,924,904	32.54014	85.18739	118.1069	260.8228
2052	138,179,161	359,241,527	497,185,353	1,091,586,319	33.12754	86.12578	119.1969	261.7006
2053	140,629,281	363,155,670	501,731,464	1,095,247,734	33.71494	87.06417	120.2868	262.5784
2054	143,079,401	367,069,814	506,277,992	1,098,909,149	34.30234	88.00256	121.3768	263.4562
2055	145,529,521	370,983,916	510,824,520	1,109,827,073	34.88974	88.94094	122.4668	266.0737
2056	148,047,129	375,008,427	515,494,096	1,118,314,898	35.49332	89.90579	123.5863	268.1086
2057	150,564,779	379,032,897	520,164,090	1,126,802,306	36.09691	90.87063	124.7059	270.1434
2058	153,082,388	383,057,367	524,834,083	1,135,289,715	36.70049	91.83547	125.8255	272.1782
2059	155,600,038	387,081,878	529,503,659	1,143,777,540	37.30408	92.80032	126.945	274.2131
2060	158,117,647	391,106,348	534,173,652	1,152,264,948	37.90766	93.76516	128.0646	276.2479
2061	162,984,184	396,951,556	540,575,497	1,173,120,581	39.07438	95.16651	129.5994	281.2479
2062	167,850,679	402,796,764	546,976,925	1,193,976,214	40.24109	96.56786	131.1341	286.2479
2063	172,717,215	408,642,014	553,378,770	1,214,831,846	41.40781	97.96922	132.6689	291.2479
2064	177,583,710	414,487,222	559,780,198	1,235,687,479	42.57452	99.37057	134.2036	296.2479
2065	182,450,247	420,332,347	566,182,043	1,256,542,695	43.74124	100.7719	135.7384	301.2478
2066	187,383,480	426,278,288	572,692,755	1,278,502,425	44.92395	102.1974	137.2993	306.5125
2067	192,316,713	432,224,646	579,203,466	1,300,462,155	46.10666	103.623	138.8602	311.7772
2068	197,249,946	438,170,587	585,714,177	1,322,421,884	47.28937	105.0485	140.4211	317.0419
2069	202,183,179	444,116,528	592,224,889	1,344,381,614	48.47208	106.474	141.982	322.3066
2070	207,116,413	450,062,468	598,735,600	1,366,341,344	49.65479	107.8995	143.5429	327.5713

** Source: U.S. EPA, Social Cost of Greenhouse Gases (SC-GHGs) Unrounded Annual Estimates Through 2070, Docket EPA-HQ-OAR-2021-0208, June 9, 2021; available at: https://downloads.regulations.gov/EPA-HQ-OAR-2021-0208-0161/content.pdf. The document states that SCC values are in $2018/metric ton$CO_2$; however checking the February 2021 Interagency Working Group report shows that these values are instead in $2020/metric ton CO_2. See https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

Table A-7h: Total Project SCC (30-year lifetime)

billion 2020$	million 2020$	2020$	Discount Rate
17.9	17,875.3	17,875,327,165	5% Average
51.9	51,934.8	51,934,820,270	3% Average
73.4	73,421.5	73,421,528,379	2.5% Average
158.4	158,371.9	158,371,865,678	3% 95% Percentile

Project Greenhouse Gas Emissions*

(metric ton CO_2e/year)	**Calendar Year**	**Emission sources**
	2022	steel
	2023	construction combustion
	2023	land clearing
	2024	abandonment combustion
	2024-2053	loss of carbon sequestration
24,224,229	2024-2053	downstream
	2024-2053	operation electricity

* see worksheet 'Total CO2eq'

	Social Cost of Carbon (2020$/Metric Tonne CO_2) Discount Rate and Statistic				**Interim Global Social Cost of Carbon Values, 2020-2070 (2020$/Metric Tonne CO_2)**** Discount Rate and Statistic			
Year	5% Average	3% Average	2.5% Average	3% 95th Percentile	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020					14.47562	51.08224	76.42065	151.6082
2021					14.96436	52.15044	77.72665	155.1185
2022	0	0	0	0	15.4531	53.21864	79.03265	158.6289
2023	0	0	0	0	15.94184	54.28685	80.33865	162.1392
2024	398,018,126	1,340,933,385	1,977,778,665	4,012,733,776	16.43058	55.35505	81.64465	165.6496
2025	409,857,475	1,366,809,706	2,009,415,265	4,097,768,086	16.91932	56.42325	82.95064	169.1599
2026	421,696,825	1,392,686,027	2,041,052,108	4,182,804,818	17.40806	57.49145	84.25664	172.6703
2027	433,535,932	1,418,562,348	2,072,688,950	4,267,839,127	17.89679	58.55965	85.56264	176.1806
2028	445,375,281	1,444,438,669	2,104,325,793	4,352,875,860	18.38553	59.62785	86.86864	179.691
2029	457,214,631	1,470,314,990	2,135,962,635	4,437,910,169	18.87427	60.69605	88.17464	183.2013
2030	469,053,980	1,496,191,553	2,167,599,235	4,522,946,901	19.36301	61.76426	89.48063	186.7117
2031	483,190,271	1,523,904,313	2,200,622,915	4,615,570,662	19.94657	62.90827	90.84388	190.5353
2032	497,326,320	1,551,617,315	2,233,646,595	4,708,196,844	20.53012	64.05229	92.20713	194.359
2033	511,462,368	1,579,330,317	2,266,670,274	4,800,820,605	21.11367	65.19631	93.57038	198.1826
2034	525,598,417	1,607,043,319	2,299,693,954	4,893,444,365	21.69722	66.34033	94.93363	202.0062
2035	539,734,466	1,634,756,321	2,332,717,391	4,986,070,548	22.28077	67.48435	96.29687	205.8299
2036	553,870,514	1,662,469,080	2,365,741,071	5,078,694,309	22.86432	68.62836	97.66012	209.6535
2037	568,006,805	1,690,182,082	2,398,764,751	5,171,318,069	23.44788	69.77238	99.02337	213.4771
2038	582,142,854	1,717,895,084	2,431,787,946	5,263,944,252	24.03143	70.9164	100.3866	217.3008
2039	596,278,902	1,745,608,086	2,464,812,837	5,356,568,012	24.61498	72.06042	101.7499	221.1244
2040	610,414,951	1,773,321,088	2,497,835,305	5,449,194,195	25.19853	73.20444	103.1131	224.9481
2041	626,068,163	1,801,076,483	2,530,194,030	5,533,969,306	25.84471	74.35021	104.4489	228.4477
2042	641,721,617	1,828,832,119	2,562,552,754	5,618,746,838	26.4909	75.49599	105.7847	231.9474
2043	657,374,829	1,856,587,514	2,594,909,056	5,703,524,371	27.13708	76.64176	107.1204	235.4471
2044	673,028,283	1,884,343,150	2,627,267,781	5,788,301,904	27.78327	77.78754	108.4562	238.9468
2045	688,681,495	1,912,098,787	2,659,626,505	5,873,079,437	28.42945	78.93332	109.792	242.4465
2046	704,334,950	1,939,854,181	2,691,985,230	5,957,856,970	29.07564	80.07909	111.1278	245.9462
2047	719,988,162	1,967,609,818	2,724,343,954	6,042,634,502	29.72182	81.22487	112.4636	249.4459
2048	735,641,374	1,995,365,455	2,756,700,257	6,127,412,035	30.368	82.37065	113.7993	252.9456
2049	751,294,828	2,023,120,849	2,789,058,981	6,212,189,568	31.01419	83.51642	115.1351	256.4453
2050	766,948,040	2,050,876,486	2,821,417,706	6,296,964,678	31.66037	84.6622	116.4709	259.9449
2051	788,259,790	2,063,598,808	2,861,048,544	6,318,231,129	32.54014	85.18739	118.1069	260.8228
2052	802,489,102	2,086,330,582	2,887,452,953	6,339,495,156	33.12754	86.12578	119.1969	261.7006
2053	816,718,413	2,109,062,356	2,913,854,940	6,360,759,184	33.71494	87.06417	120.2868	262.5784
2054	830,947,725	2,131,794,130	2,940,259,349	6,382,023,212	34.30234	88.00256	121.3768	263.4562
2055	845,177,037	2,154,525,662	2,966,663,758	6,445,430,131	34.88974	88.94094	122.4668	266.0737
2056	859,798,297	2,177,898,409	2,993,782,782	6,494,724,013	35.49332	89.90579	123.5863	268.1086
2057	874,419,799	2,201,270,913	3,020,904,228	6,544,015,474	36.09691	90.87063	124.7059	270.1434
2058	889,041,059	2,224,643,418	3,048,025,674	6,593,306,934	36.70049	91.83547	125.8255	272.1782
2059	903,662,561	2,248,016,165	3,075,144,698	6,642,600,817	37.30408	92.80032	126.945	274.2131
2060	918,283,821	2,271,388,670	3,102,266,145	6,691,892,277	37.90766	93.76516	128.0646	276.2479
2061	946,546,713	2,305,335,292	3,139,445,491	6,813,013,420	39.07438	95.16651	129.5994	281.2479
2062	974,809,363	2,339,281,915	3,176,622,414	6,934,134,563	40.24109	96.56786	131.1341	286.2479
2063	1,003,072,255	2,373,228,780	3,213,801,760	7,055,255,706	41.40781	97.96922	132.6689	291.2479
2064	1,031,334,905	2,407,175,403	3,250,978,684	7,176,376,849	42.57452	99.37057	134.2036	296.2479
2065	1,059,597,797	2,441,121,541	3,288,158,030	7,297,495,569	43.74124	100.7719	135.7384	301.2478
2066	1,088,248,034	2,475,653,179	3,325,969,628	7,425,028,866	44.92395	102.1974	137.2993	306.5125
2067	1,116,898,271	2,510,187,239	3,363,781,227	7,552,562,162	46.10666	103.623	138.8602	311.7772
2068	1,145,548,509	2,544,718,877	3,401,592,825	7,680,095,458	47.28937	105.0485	140.4211	317.0419
2069	1,174,198,746	2,579,250,515	3,439,404,424	7,807,628,754	48.47208	106.474	141.982	322.3066
2070	1,202,848,984	2,613,782,153	3,477,216,022	7,935,162,051	49.65479	107.8995	143.5429	327.5713

** Source: U.S. EPA, Social Cost of Greenhouse Gases (SC-GHGs) Unrounded Annual Estimates Through 2070, Docket EPA-HQ-OAR-2021-0208, June 9, 2021; available at: https://downloads.regulations.gov/EPA-HQ-OAR-2021-0208-0161/content.pdf. The document states that SCC values are in $2018/metric ton$CO_2$; however checking the February 2021 Interagency Working Group report shows that these values are instead in $2020/metric ton CO_2. See https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

Table A-7g: Total Project SCC (30-year lifetime)

billion 2020$	million 2020$	2020$	Discount Rate
0.7	693.6	693,590,622	5% Average
2.0	2,015.2	2,015,152,168	3% Average
2.8	2,848.9	2,848,870,013	2.5% Average
6.1	6,145.1	6,145,075,825	3% 95% Percentile

Project Greenhouse Gas Emissions*

(metric ton CO_2e/year)	**Calendar Year**	**Emission sources**
	2022	steel
	2023	construction combustion
	2023	land clearing
	2024	abandonment combustion
	2024-2053	loss of carbon sequestration
939,938	2024-2053	midstream
	2024-2053	operation electricity

* see worksheet 'Total CO2eq'

	Social Cost of Carbon (2020$/Metric Tonne CO_2) Discount Rate and Statistic				**Interim Global Social Cost of Carbon Values, 2020-2070 (2020$/Metric Tonne CO_2)**** Discount Rate and Statistic			
Year	5% Average	3% Average	2.5% Average	3% 95th Percentile	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020					14.47562	51.08224	76.42065	151.6082
2021					14.96436	52.15044	77.72665	155.1185
2022	0	0	0	0	15.4531	53.21864	79.03265	158.6289
2023	0	0	0	0	15.94184	54.28685	80.33865	162.1392
2024	15,443,725	52,030,310	76,740,902	155,700,340	16.43058	55.35505	81.64465	165.6496
2025	15,903,110	53,034,352	77,968,452	158,999,804	16.91932	56.42325	82.95064	169.1599
2026	16,362,496	54,038,394	79,196,011	162,299,362	17.40806	57.49145	84.25664	172.6703
2027	16,821,872	55,042,435	80,423,570	165,598,826	17.89679	58.55965	85.56264	176.1806
2028	17,281,257	56,046,477	81,651,129	168,898,384	18.38553	59.62785	86.86864	179.691
2029	17,740,642	57,050,519	82,878,687	172,197,848	18.87427	60.69605	88.17464	183.2013
2030	18,200,027	58,054,570	84,106,237	175,497,406	19.36301	61.76426	89.48063	186.7117
2031	18,748,537	59,129,868	85,387,607	179,091,353	19.94657	62.90827	90.84388	190.5353
2032	19,297,038	60,205,176	86,668,978	182,685,394	20.53012	64.05229	92.20713	194.359
2033	19,845,539	61,280,484	87,950,348	186,279,340	21.11367	65.19631	93.57038	198.1826
2034	20,394,040	62,355,792	89,231,718	189,873,287	21.69722	66.34033	94.93363	202.0062
2035	20,942,541	63,431,099	90,513,079	193,467,327	22.28077	67.48435	96.29687	205.8299
2036	21,491,041	64,506,398	91,794,450	197,061,274	22.86432	68.62836	97.66012	209.6535
2037	22,039,551	65,581,705	93,075,820	200,655,221	23.44788	69.77238	99.02337	213.4771
2038	22,588,052	66,657,013	94,357,172	204,249,261	24.03143	70.9164	100.3866	217.3008
2039	23,136,553	67,732,321	95,638,589	207,843,208	24.61498	72.06042	101.7499	221.1244
2040	23,685,054	68,807,629	96,919,912	211,437,248	25.19853	73.20444	103.1131	224.9481
2041	24,292,423	69,884,581	98,175,481	214,726,655	25.84471	74.35021	104.4489	228.4477
2042	24,899,801	70,961,544	99,431,051	218,016,156	26.4909	75.49599	105.7847	231.9474
2043	25,507,170	72,038,496	100,686,526	221,305,657	27.13708	76.64176	107.1204	235.4471
2044	26,114,549	73,115,458	101,942,095	224,595,157	27.78327	77.78754	108.4562	238.9468
2045	26,721,918	74,192,420	103,197,664	227,884,658	28.42945	78.93332	109.792	242.4465
2046	27,329,296	75,269,373	104,453,233	231,174,159	29.07564	80.07909	111.1278	245.9462
2047	27,936,666	76,346,335	105,708,802	234,463,660	29.72182	81.22487	112.4636	249.4459
2048	28,544,035	77,423,297	106,964,277	237,753,160	30.368	82.37065	113.7993	252.9456
2049	29,151,413	78,500,250	108,219,846	241,042,661	31.01419	83.51642	115.1351	256.4453
2050	29,758,782	79,577,212	109,475,415	244,332,068	31.66037	84.6622	116.4709	259.9449
2051	30,585,711	80,070,858	111,013,154	245,157,239	32.54014	85.18739	118.1069	260.8228
2052	31,137,831	80,952,886	112,037,686	245,982,317	33.12754	86.12578	119.1969	261.7006
2053	31,689,950	81,834,915	113,062,124	246,807,394	33.71494	87.06417	120.2868	262.5784
2054	32,242,070	82,716,943	114,086,657	247,632,472	34.30234	88.00256	121.3768	263.4562
2055	32,794,190	83,598,962	115,111,189	250,092,759	34.88974	88.94094	122.4668	266.0737
2056	33,361,517	84,505,861	116,163,449	252,005,439	35.49332	89.90579	123.5863	268.1086
2057	33,928,854	85,412,751	117,215,804	253,918,025	36.09691	90.87063	124.7059	270.1434
2058	34,496,182	86,319,640	118,268,158	255,830,610	36.70049	91.83547	125.8255	272.1782
2059	35,063,519	87,226,539	119,320,419	257,743,290	37.30408	92.80032	126.945	274.2131
2060	35,630,847	88,133,429	120,372,773	259,655,876	37.90766	93.76516	128.0646	276.2479
2061	36,727,491	89,450,611	121,815,390	264,355,565	39.07438	95.16651	129.5994	281.2479
2062	37,824,126	90,767,793	123,257,913	269,055,255	40.24109	96.56786	131.1341	286.2479
2063	38,920,771	92,084,985	124,700,529	273,754,944	41.40781	97.96922	132.6689	291.2479
2064	40,017,406	93,402,167	126,143,052	278,454,634	42.57452	99.37057	134.2036	296.2479
2065	41,114,050	94,719,330	127,585,669	283,154,230	43.74124	100.7719	135.7384	301.2478
2066	42,225,724	96,059,211	129,052,818	288,102,721	44.92395	102.1974	137.2993	306.5125
2067	43,337,398	97,399,187	130,519,967	293,051,212	46.10666	103.623	138.8602	311.7772
2068	44,449,072	98,739,068	131,987,116	297,999,703	47.28937	105.0485	140.4211	317.0419
2069	45,560,746	100,078,950	133,454,265	302,948,194	48.47208	106.474	141.982	322.3066
2070	46,672,420	101,418,831	134,921,414	307,896,685	49.65479	107.8995	143.5429	327.5713

** Source: U.S. EPA, Social Cost of Greenhouse Gases (SC-GHGs) Unrounded Annual Estimates Through 2070, Docket EPA-HQ-OAR-2021-0208, June 9, 2021; available at: https://downloads.regulations.gov/EPA-HQ-OAR-2021-0208-0161/content.pdf. The document states that SCC values are in $2018/metric ton$CO_2$; however checking the February 2021 Interagency Working Group report shows that these values are instead in $2020/metric ton CO_2. See https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.