DRAFT Environmental Impact Statement: Otter Tail to Wilkin Carbon Dioxide Pipeline Project

The human and environmental impacts of constructing and operating this pipeline and associated facilities.

January 2024

PUC Docket No. IP-7093/PPL-22-422

OAH Docket No. 22-2500-38948

COMMERCE DEPARTMENT

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Sources

Much of the information used to prepare this draft environmental impact statement comes from the routing permit application and the scoping environmental assessment worksheet. Additional sources include new information provided by the applicant, field visits, geospatial analysis, and the work of consultants. Unless otherwise noted, URL addresses were current as of January 12, 2024.

Project Mailing List

To place your name on the project mailing list contact eservice.admin@state.mn.us or (651) 296-0406 and provide the docket number (22-422), your name, email address, and mailing address. Please indicate how you would like to receive notices: by email or U.S. mail. Placing your name on the project mailing list ensures you receive the most up-to-date information about the project.

Alternative Formats

This document can be made available in alternative formats, that is, large print or audio, by calling (651) 539-1530 (voice).

Additional Information

Scan QR code with your smart phone to view project webpage.

Scan QR code with your smart phone to view project map.

Executive Summary

Summit Carbon Solutions, LLC (applicant) must obtain a pipeline routing permit from the Minnesota Public Utilities Commission (Commission) before it can construct the Otter Tail to Wilkin Carbon Dioxide (CO_2) Pipeline Project (project).

What is this document?

This document is an environmental impact statement. The Commission will use the information in this document to inform its decision about issuing a permit for the project. Your comments on this document can help the Commission make its decision.

This environmental impact statement (EIS) contains an overview of the resources affected by the project. It also discusses potential human and environmental impacts and mitigation measures. Energy Environmental Review and Analysis (EERA) staff within the Department of Commerce (Commerce) prepared this document as part of the environmental review process.

Where do I get more information?

For additional information don't hesitate to contact Commerce or Commission staff.

If you would like more information or if you have questions, please contact Commerce staff, Andrew Levi at andrew.levi@state.mn.us or (651) 539-1840, or the Commission public advisor, Sam Lobby at publicadvisor.puc@state.mn.us or (651) 201-2251.

Additional documents and information, including the routing permit application, can be found on the State of Minnesota eDockets system at https://www.edockets.state.mn.us/EFiling/search.jsp by searching "22" for year and "422" for number.

Information is also available on the Commerce webpage: https://eera.web.commerce.state.mn.us/web/project/14959.

What does the applicant propose to construct and why?

The project consists of a carbon dioxide (CO_2) capture facility and 28.1 miles of pipeline that would transport captured CO_2.

The applicant proposes to construct and operate approximately 28.1 miles of 4-inch-diameter, carbon steel pipeline and associated facilities for the transport of CO_2 from the Green Plains Ethanol Plant (ethanol plant). The project would extend from the ethanol plant near Fergus Falls in Otter Tail County, Minnesota, west to the Minnesota-North Dakota border near Breckenridge in Wilkin County, Minnesota. In addition to the pipeline facilities, the project would include a CO_2 capture facility at the ethanol plant and access roads.

The project is designed to capture approximately 0.19 million metric tons per annum (MMTPA) of CO_2 generated by the ethanol plant and transport it by pipeline to the North Dakota border. The CO_2 would ultimately be injected into permanent underground sequestration facilities in North Dakota. The project would reduce the carbon intensity of the ethanol produced and thereby improve the ethanol plant's ability to compete in low carbon fuel standard (LCFS) markets.

What permits are needed?

The project requires a routing permit from the Commission.

Before constructing the project, the applicant needs a pipeline routing permit from the Commission. A routing permit determines where the project would be located and how impacts must be mitigated. If the Commission grants a routing permit, various other federal, state, and local permits and approvals might be required for activities related to construction and operation of the project. The applicant must obtain these other permits before construction begins.

What alternatives does this EIS study?

In its final scoping decision, the Commission identified the following alternatives to be addressed in the EIS: no action, alternative routes, alternative technologies, modified designs or layouts (pipe diameter), modified scale or magnitude (reduced throughput), and alternatives incorporating reasonable mitigation measures.

No Action

Under the no action alternative, the Commission would not issue a pipeline routing permit and the project would not be constructed. Impacts, both adverse and beneficial, associated with construction and operation of the project would not occur. Ethanol production might increase, decrease, or remain the same without the project.

Alternative Routes

This EIS studies and compares three alternative pipeline routes, one of which is the applicant's proposed pipeline route. An alternative route represents an alternative path for the pipeline between the ethanol plant and the Minnesota-North Dakota border near Breckenridge.

Route Alternative – North (RA-North) is 23.0 miles long. It parallels roadways from the ethanol plant straight west to the North Dakota border just north of Breckenridge. This route would not connect with the proposed MCE Project pipeline system in North Dakota. However, the connection point remains undefined because the applicant has not obtained a permit for the pipeline in North Dakota.

Route Alternative – Hybrid (RA-Hybrid) is 29.1 miles long. This route is the same as RA-North between the ethanol plant and 100th Street where it turns south to connect with Route Alternative – South (RA-South) before continuing west along the same path as RA-South.

Route Alternative – South (RA-South) is 28.1 miles long and is the applicant's proposed route. This route parallels roadways in a general southwest direction until it meets County Road 58, which it parallels west to the North Dakota border south of Breckenridge.

Alternative Technologies

The EIS analyzes two alternative technologies that could reduce the carbon intensity of the ethanol produced at the ethanol plant: (1) a suite of agricultural practices to be implemented by farmer producers, and (2) a suite of energy use and efficiency changes to be implemented by the ethanol plant. These alternative technologies could reduce the carbon intensity of the ethanol produced through lowered greenhouse gas (GHG) emissions and increased sequestration of CO_2 in soil.

Modified Designs or Layouts and Modified Scale or Magnitude

The EIS analyzes whether a modified design or layout (alternative pipeline diameter of 3 inches or 6 inches) or modified scale or magnitude (reduced throughput) would result in a significant environmental benefit over the project. The EIS finds that neither alternative provides significant environmental benefits relative to the project. Therefore, these alternatives were not studied in detail in this EIS.

Alternatives Incorporating Reasonable Mitigation Measures

The EIS incorporates into its analysis reasonable mitigation measures identified through agency, Tribal, and public comments received during scoping. Suggested mitigation measures are addressed under the relevant resource sections.

What potential impacts were identified?

The project would impact human and environmental resources.

A potential impact is the anticipated change to an existing condition caused either directly or indirectly by the construction and operation of a proposed project. Potential impacts can be adverse or beneficial, and short- or long-term. Impacts vary in duration and size, by resource, and across locations. Potential impacts can be mitigated by avoiding, minimizing, or correcting the effect.

Human Settlement

Aesthetics

Aesthetic impacts are subjective. Thus, potential impacts are unique to the individual and can vary widely. Potential impacts along each alternative route are expected to be minimal to moderate during construction. RA-North would have several more residents with at least a partial view of the construction workspace compared to RA-Hybrid. RA-South would have several fewer residents with at least a partial view of the construction workspace compared to RA-Hybrid. The pipeline would be underground and not visible during project operation. Mainline valves (MLVs) would create long-term aesthetic impacts within a small viewshed. The capture facility would be located at the ethanol plant and its impact would be incremental to the viewshed. Aesthetic impacts from project operation would be negligible to minimal, with no noticeable difference among the route alternatives.

Cultural Resources

Cultural resources contribute to the principles that form the foundation for community unity. These principles can pull from heritage, local resources, and common experiences/events and can include work and leisure pursuits, land use, Tribal-identified cultural resources, and native Minnesota plants and wildlife of Tribal significance. Cultural resources impacts are subjective. Thus, potential impacts are unique to the individual or community and can vary widely. Agricultural operations, which can have contemporary cultural value, would be impacted temporarily along each of the routes, but the project would not remove cultivated land from production. The project could temporarily impact hunting activities and the habitats of plants and wildlife of Tribal cultural interest during construction and until restoration of disturbed areas is complete. Overall, potential impacts on cultural resources during construction and operation of the project are anticipated to be minimal and would be similar for all route alternatives.

Environmental Justice

An environmental justice (EJ) assessment identifies disadvantaged communities that have been historically marginalized and overburdened by pollution and evaluates if a project would disproportionally affect these communities. Census Tract 9609, which is crossed by all three route alternatives, was identified by the MPCA screening tool as an EJ area of concern. Potential impacts along each of the route alternatives are expected to be minimal for EJ communities during construction. Local roadways would experience a short-term minimal increase in traffic during construction activities. Construction would use horizontal direction drill (HDD) and boring techniques at road crossings to limit impacts on local traffic. Residents within Census Tract 9609 and the other census tracts crossed by the project might experience intermittent, short-term noise from construction equipment for up to 30 days. Operation of the capture facility and pipeline facilities would not generate noticeable noise. The project would not result in significant impacts on air quality during construction or operation. Overall, EJ impacts from construction and operation of the project would not result in disproportionate adverse impacts for EJ areas of concern.

Land Use and Zoning

Land use in the route width for each alternative, and in the area of the project generally, is predominantly agriculture. Land use impacts would be the same across the three route alternatives. Project construction would have a short-term, minimal to moderate impact on land use within the construction workspace. Pipeline operation would have a long-term, minimal impact on land use. An operational right-of-way (ROW) would be created, but agriculture (the most prevalent land use) could continue. Landowners could not plant trees or build structures within the operational pipeline ROW. The project would be compatible with local and regional land use plans. Overall, impacts on land use and zoning are anticipated to be minimal.

Noise

Heavy equipment needed to construct the pipeline would have an intermittent and short-term impact on noise levels in the vicinity of the project. Except for HDDs and some hydrostatic testing activities, construction would be limited to daytime hours. Construction equipment noise would be expected to decrease to levels below state daytime standards within 500 to 1,600 feet. The project is expected to conform to state noise standards. Compared to the other route alternatives, RA-South would have fewer noise sensitive receptors (NSRs) close to the construction workspace but more NSRs within 0.5 mile of an HDD entry. Noise from the operation of the capture facility is not expected to result in a perceptible increase in the sound levels experienced at NSRs near the capture facility and would not be distinguishable from the noise already produced at the ethanol plant. Operation of the pipeline facilities would not have a noticeable impact on ambient sound levels. Because the project is expected to conform to state noise standards and the applicant would use barrier walls as needed for mitigating noise from HDDs, potential impacts would be minimal for all route alternatives.

Populated Areas

Populated areas are defined for this analysis as incorporated areas or legal entities, and census-designated places, which are statistical entities and the equivalent of incorporated places. There would be no impacts on populated areas because no populated areas are within 1,600 feet of the route width for any of the three route alternatives.

Property Values

A property's value is influenced by a complex interaction of characteristics such as size, location, and improvements. The value of a tract of land is related to many tract-specific variables, including the utilities and services available or accessible, the current land use, and the values of adjacent properties. Construction-specific impacts on property values would be temporary (less than 6 months), and the applicant would be responsible for any construction-related damages. Potential impacts on property values would be similar for all three route alternatives. The presence of the pipeline would not be expected to affect the value of residential properties during project operation. Overall, impacts on property values are anticipated to be minimal and dissipate quickly with distance from the pipeline. However, impacts on specific properties could vary widely.

Public Health and Safety

Construction of the project would have negligible impacts on public health and safety. The presence of construction personnel and equipment could temporarily increase demand for local public services. As with any major construction project, worker health and safety concerns exist. Normal operation of the project would not impact public health and safety. Operational impacts to health and safety would be a concern primarily in the event of an accidental release of CO_2, when public health and safety impacts are expected to be minimal to significant (depending on the extent and where a release occurs). Aerial dispersion modeling and computational fluid dynamics modeling were conducted to estimate the extent of a CO_2 plume in the event of a rupture. Potential impacts on public health and safety are expected to be similar for all three route alternatives.

Public Services and Infrastructure

Public services and infrastructure include emergency services, hospitals, school districts, and public utilities that serve residents and business. Public services and infrastructure impacts are anticipated to be short-term, negligible to minimal, and similar across the three route alternatives. The presence of additional construction personnel could affect law enforcement agencies, fire protection services, and health care facilities in the communities adjacent to the project for all route alternatives. Local emergency services would be able to manage these minor increases during the 6 months of construction. There are no anticipated impacts on schools, public transit, or railroads. Impacts on roads would be minimal and primarily from increased construction traffic. A temporary increase of water use, sewage, and solid waste is anticipated due to the influx of construction workers and materials. The existing utilities would be sufficient to handle the temporary increase. During operation, electrical service would be supplied to the capture facility through existing service lines, and the project is not anticipated to require additional power generation capacity.

Recreation

Recreational facilities could be affected by construction-related impacts on aesthetics, noise, and air quality. Recreation impacts are anticipated to be short-term and minimal to moderate. All three route alternatives would cross the King of Trails Scenic Byway (US Highway 75). RA-Hybrid and RA-South would cross the Otter Tail River, a state-designated water trail. The project could temporarily impact these recreational resources during construction due to the presence of equipment in the viewshed, generation of dust, removal of vegetation in the viewshed, and increased noise. RA-South would pass through the Fergus Falls Fish & Game Club’s Orwell property. The applicant would continue to communicate with the club to minimize visual and noise impacts during construction. RA-North would not cross the Otter Tail River or the Orwell property and would be anticipated to have fewer impacts on recreation than the other two route alternatives. Operation of the project would not cause visual or noise impacts on recreational resources.

Socioeconomics

Socioeconomics assesses overall social and economic character of an area and the project's effects on the well-being of current and future residents of the affected community. Socioeconomic impacts are anticipated to be minimal, short-term to long-term, and similar across the three route alternatives. Most impacts would be beneficial. Construction would result in a temporary increase in local population associated with the workers and associated spending from lodging, transportation, and food. The nearby cities have adequate housing and infrastructure to support the additional workers for all three route alternatives. Local labor would also be used, increasing employment in the surrounding area. The applicant estimates the total cost for the project to be $69.75 million for RA-North, $70.12 million for RA-Hybrid, and $66.75 million for RA-South, with a construction payroll of $30,910,000. The project would increase tax revenues, benefiting the counties and state. The applicant estimates that the project would generate property tax revenues of $894,000 in Otter Tail County and $972,000 in Wilkin County during the first year of operations.

Tribal Treaty Rights

Lands in the local vicinity of the project were ceded to the United States government in two 1851 treaties, and neither treaty that ceded lands within the project area established government-recognized usufructuary hunting or gathering rights within the ceded lands. Therefore, potential impacts on Tribal treaty rights along each of the route alternatives during construction and operation of the project are expected to be negligible.

Economies

Agriculture

Short-term agricultural impacts would be minimal across the three route alternatives. Long-term agricultural impacts would also be minimal. During construction, lands would not be available for agricultural production. Easement agreements can compensate landowners for lost crops due to construction. Following construction of the pipeline, agricultural land would be restored, and agricultural activities could resume. Crop production could be reduced in areas that were disturbed by construction, typically for 2 to 3 years and potentially up to 5 years, depending on impacts on soils from the construction disturbance.

Industrial

Industrial economies encompass industrial property and businesses. An ethanol plant is located at the east end of the three route alternatives. No other industrial facilities exist within the route width of the three alternatives. Impacts would be short-term and negligible across the three route alternatives. Construction of the pipeline and capture facility might result in temporary localized traffic delays for workers and delivery of raw materials and products to and from the ethanol plant. Impacts during operation of the pipeline and capture facility are not anticipated.

Tourism

Tourism includes traveling to a destination for recreation or relaxation related activities. Otter Tail and Wilkin Counties offer a variety of recreational opportunities as their primary tourist attraction, such as nature preserves, hiking trails, biking trails, fishing, hunting, snowmobiling, boating, canoeing, kayaking, and swimming. Tourism opportunities are similar for the three route alternatives. Construction would result in temporary and minimal noise, dust, and visual impacts within the local vicinity that could be experienced by tourists in the area. The pipeline facilities would be almost entirely underground during operation and create minimal visual impacts on surrounding areas. The carbon capture facility would be adjacent to the ethanol plant and compatible with its surrounding viewshed. Once construction is finished and the project is in operation, it is not expected to cause any noise or dust impacts on adjacent tourism areas. The project's impacts on tourism economies would be negligible during operation.

Archaeological and Historic Resources

Archaeological Resources

Archaeological resources or unrecorded historic cemeteries identified within the project area, but outside the route width, are not expected to be impacted by the project. Known archaeological resources were identified within the route widths for all route alternatives —none have been determined to be Eligible for or Listed in the National Register of Historic Places (NRHP).

Archaeological potential is based on proximity to waterbodies and the number of previously identified archaeological resources in the project area (area within 1 mile of the route width). While RA-North has not been extensively surveyed for archaeological resources, its lack of archaeological potential compared to RA-Hybrid and RA-South indicates it would likely have the least impact on archaeological resources of the three route alternatives. RA-Hybrid has more potential for unknown archaeological resources to exist than RA-North, but less than RA-South. Of the three route alternatives, RA-South crosses or is near the most waterbodies, increasing its overall archaeological potential, which is evidenced by the number of sites identified by the applicant's survey. If the previously identified archaeological sites within the route widths that have not been evaluated for the NRHP are determined to be Eligible for listing in the NRHP, construction of the project could result in moderate, permanent adverse impacts from direct construction activities. If previously identified archaeological resources are determined Not Eligible for listing in the NRHP, construction of the project could result in negligible impacts from direct construction activities.

Historic Architectural Resources

Historic architectural resources identified within the project area of the route alternatives, but outside the route width, are not expected to be impacted by the project. Historic architectural resources were identified within the route widths for all alternatives —none have been determined to be Eligible for or Listed in the NRHP. Construction of the project would result in negligible impacts on the previously identified Not Eligible historic architectural resources in the project area.

Natural Environment

Air Quality and Greenhouse Gas Emissions

Air quality and GHG emission impacts from the project could contribute to increased levels of air pollution in Minnesota. However, by capturing and sequestering CO_2 underground, the project would provide a net benefit to GHG emissions because the CO_2 sequestered from ongoing annual operations would outweigh construction and operation emissions. Construction impacts would include emissions from construction equipment and vehicles as well as temporary changes in land use along the pipeline ROW. Operational impacts would include emissions from operation of the pipeline and the CO_2 capture facility, including equipment leaks. Construction emissions for the route alternatives would be directly proportional to their lengths. In other words, RA-North would have somewhat lower construction emissions and RA-Hybrid would have somewhat higher emissions compared to RA-South. Emissions from project operation would be the same regardless of the pipeline route. Operational impacts on air quality would be minimal and would not differ depending on the route alternative.

Climate Change

Climate change is expected to result in increasing temperatures and a greater frequency and intensity of extreme weather events. In Minnesota, climate models have identified the potential for increased rainfall, heat, localized flooding, and persisting drought conditions. The project would have a net beneficial effect on climate change as it would capture and store CO_2 emissions from the ethanol plant. Because the pipeline would be underground, flooding would not impact operation of the project. Any MLVs located in floodplains would be constructed in accordance with floodplain permitting requirements. Drought conditions might require contingency water sources. All route alternatives would face similar impacts regarding climate change.

Geology and Topography

The surficial geology in the area of the project is unconsolidated deposits consisting of till and sandy/silty glacial lake sediment from Pleistocene continental glaciation. Bedrock is generally deeper than 50 feet. The topography in the project area is relatively flat with localized areas of steeper slopes occurring adjacent to waterbodies. No mineral resources are within the construction workspaces for any of the three route alternatives. The risk to the project facilities from geologic hazards such as earthquakes and landslides is low. Surface contours would be restored after construction; however, differential settling could occur, causing crowning or subsidence (low areas). The applicant would monitor for and rectify areas of crowning or subsidence caused by settling. With these measures, impacts on geology and topography would be short-term and minimal. Impacts would not vary among the route alternatives.

Public and Designated Lands

The only direct impact on public and designated lands would be at one Waterfowl Production Area (WPA), which would be crossed by all three route alternatives. Impacts to the wetland associated with this WPA are not expected. The route width of RA-South would partially overlap with two other WPAs; however, the WPAs would be outside of the construction workspace. Potential project impacts on public and designated lands for all three route alternatives would be short-term and negligible.

Rare and Unique Resources

Most vegetation cover occurring along all route alternatives does not provide suitable habitat for rare and unique species. Potential impacts for all three route alternatives would be unique to individual listed species, could vary widely, and would be highly localized and limited to specific habitats. No federally listed species are expected to be directly taken. Indirect impacts on federally listed species would be negligible and could be avoided by following USFWS guidance. No bald or golden eagle nests would be removed or disturbed. There would be no direct take of adult state-listed birds. There is a possibility of take of eggs or young state-listed birds through inadvertent destruction of ground nests during construction. Overall, for each of the three route alternatives, impacts on rare and unique species would be localized, negligible to minimal, and short-term.

Soils

Soils in the project area consist mainly of well to poorly drained loams and clays. The route alternatives generally share similar soil characteristics. During construction, vegetation clearing, topsoil removal, and trenching would expose soils and increase the potential for erosion, compaction, and mixing of topsoil with subsoil. The applicant would minimize these impacts by complying with required permits and implementing the applicant’s Minnesota Environmental Construction Plan and Minnesota Agricultural Protection Plan. With these measures, impacts on soils during construction would be minimal and temporary. Impacts on soils during operation would be negligible.

Vegetation

Vegetation in the construction workspace for the three route alternatives is dominated by cultivated crops. Vegetation associated with developed areas is also prevalent along all three route alternatives. Impacts on agricultural vegetation during construction and operation are lowest for RA-North, due to its shorter length. Agricultural impacts along RA-South and RA-Hybrid are about equal. Otherwise, the relative percent of cover and distribution of non-agricultural vegetation types is similar among all three route alternatives. Impacts on vegetation would result almost entirely from removal and crushing during construction. Indirect impacts include possible introduction of invasive species. Overall, construction impacts on vegetation are expected to be short-term and minimal for all route alternatives.

Removal of woody vegetation in forested areas would be long term due to longer regeneration time for woody cover. Forested areas comprise less than 1 acre total for each of the route alternatives. Operational impacts on vegetation would be long-term and minimal. Routine maintenance during operation of the pipeline would result in long-term, localized, minimal impacts on vegetation in the operational ROW.

Water Resources

None of the three route alternatives would cross lakes, or waters with federal or state designations related to high resource value. The route alternatives would cross a similar number of drainage ditches. RA-North would cross fewer rivers and streams than RA-Hybrid and RA-South. While there are wells within 1 mile of the route width for all three route alternatives, the majority are outside of the construction workspaces of RA-North and RA-South, and no wells are within the construction workspace of RA-Hybrid. Potential impacts on surface waters would occur during construction and would be short-term and minimal for all route alternatives. Construction activities would have temporary, minimal, and localized impacts on groundwater. Floodplain impacts would be short-term and negligible during construction for all three route alternatives. Water supply appropriations would be regulated by DNR-issued permits that would have conditions to minimize impacts on groundwater resources. DNR would review permit applications and would not issue a permit if the amount of water to be withdrawn would adversely affect the aquifer or other users. Therefore, no long-term impacts on water resources are expected during project operation.

Wetlands

Wetlands listed in the National Wetlands Inventory were compared for the three route alternatives. Primarily emergent wetlands were identified, with lesser amounts of forested and riverine wetlands. Direct wetland impacts would occur during pipeline construction. Wetland impacts are comparable among the three route alternatives. Impacts on forested wetlands would be slightly higher for RA-Hybrid relative to RA-North and RA-South. Wetland impacts would be minimal and short-term in emergent wetlands, and minimal to moderate and longer-term in forested wetlands. Indirect impacts on wetlands would be comparable among all three route alternatives and would be negligible to minimal and long-term during operation of the project. Wetland impacts would be minimized through implementation of standard best management practices and conditions required under the state and federal permits for work in wetlands.

Wildlife and their Habitats

For all three route alternatives, the majority of wildlife species present are common generalist species well-adapted to disturbed habitats and human activities. Wildlife species range from larger mammals to smaller reptiles, amphibians, and invertebrates. Fish, aquatic amphibians, and aquatic invertebrates could be present in intermittent and perennial streams crossed by the route alternatives. Larger, more mobile wildlife species would likely avoid portions of the route width during construction. Smaller, less mobile wildlife species and/or species in burrows could be inadvertently injured or killed by construction equipment. Habitat loss or degradation would be minimal, as most of the route width for all three route alternatives is agricultural land. Potential impacts on wildlife would be comparable across all three route alternatives. Most impacts on wildlife would be highly localized, short-term, and negligible. Operation of the project would have minimal impact on wildlife and their habitats.

What are the risks and potential impacts of a CO_2 release?

The piping and aboveground facilities associated with the project must be designed, constructed, operated, and maintained in accordance with the Pipeline and Hazardous Materials Safety Administration (PHMSA) Minimum Federal Safety Standards. Pipeline design, installation, and operation would incorporate measures to minimize the risks of an accidental release.

There are two types of accidental releases discussed in this EIS: leaks and ruptures. Leaks can occur from a small opening, crack, or hole in a pipeline. A rupture occurs when the pipeline breaks open or bursts. Based on PHMSA's data for accidental pipeline releases, rupture is the least common form of CO_2 pipeline accident.

Pipeline leaks create a significantly lower hazard than pipeline ruptures. Leaks can be detected during routine pipeline inspections, and are not necessarily hazardous, depending on their location and size. In the vicinity of a leak, liquid CO_2 will escape and immediately vaporize and expand. Leaks would have negligible to minimal impacts, depending on the resource.

The initial release associated with a rupture of a CO_2 pipeline transporting pressurized liquid can be explosive in the immediate area. Like a leak, in the vicinity of a rupture, liquid CO_2 will escape and immediately vaporize and expand. Because CO_2 is denser than air, a plume can settle into lower-lying areas, displacing oxygen. The CO_2 plume can flow for a distance from the pipeline. This distance is impacted by a variety of factors, including wind speed, temperature, and pressure.

An accidental release of CO_2 from a rupture could expose humans and terrestrial and aquatic animals to dangerous levels of CO_2 resulting in asphyxiation (unconsciousness or death) from CO_2 gas, blast injury, or exposure to very cold solid CO_2. Vegetation in contact with a CO_2 plume would likely be frozen. Impacts to vegetation might be short-term (row crops) or long-term (trees). A pipeline rupture could damage previously unidentified buried archaeological and cultural resources. A large release of CO_2 into a stream or wetland could temporarily acidify water or soil in the immediate vicinity. If a rupture occurs, impacts to resources would be minimal to significant, depending on the extent and location.

Dispersion modeling was conducted to determine the extent and duration of a release of CO_2 during a potential pipeline rupture. Using conservative assumptions, the maximum distance at which CO_2 concentrations from a pipeline rupture could reach levels immediately dangerous to life and health was calculated to be 617 feet. The distance at which CO_2 concentrations could reach the maximum time-weighted average concentration to which a person could be exposed over a 15-minute period without injury was calculated to be 701 feet. The toxic impact distance at which CO_2 concentrations could reach levels that could cause mild respiratory stimulation of some people was calculated to be 910 feet. The applicant is required to develop a plan that follows federal guidelines to respond to any emergency on the pipeline, including an accidental release of CO_2. What's next?

Public meetings will be held in the project area and virtually. You can provide comments on this draft EIS either at a meeting or as part of the associated public comment period. Your input on the draft EIS will be incorporated into a final EIS.

Now that the draft EIS is complete and has been made available, a public comment period is now open. Public meetings will be held in the project area in February 2024, to allow for public comment on the draft EIS. Prior to these public meetings, a notice will be issued indicating the place and time of each meeting. EERA staff will respond to substantive comments received and incorporate your input on the draft EIS into the final EIS. A comment period concerning the adequacy of the final EIS will then occur.

Following publication of the final EIS, public hearings will be held with an associated public comment period. An administrative law judge will consolidate public comments, prepare a report, and make recommendations for the Commission to consider. The Commission will then review the record and decide whether to grant a pipeline routing permit. The Commission is expected to make this decision in summer 2024.

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AC/DC	alternating current/direct current
AD Report	Aerial and Thermal Dispersion Report
ALJ	administrative law judge
Allied	Allied Solutions, Inc.
ANSI	American National Standards Institute
API	American Petroleum Institute
APP	Agricultural Protection Plan
applicant	Summit Carbon Solutions, LLC
AQI	Air Quality Index
ASME	American Society of Mechanical Engineers
BMP	best management practice
BWSR	Board of Water and Soil Resources
CARB	California Air Resources Board
CDP	census-designated place
CFD	computational fluid dynamics
CFR	Code of Federal Regulations
CH_4	methane
CI score	carbon intensity score
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
Commerce	Department of Commerce
Commission	Minnesota Public Utilities Commission
CRP	Conservation Reserve Program
CRU	Cultural Resource Unit
CSW Permit	Construction Stormwater Permit
CURE	Clean Up the River Environment
dB	decibels
dBA	decibels on the A-weighted scale
DDGS	dried distiller's grains with solubles
DNR	Department of Natural Resources
DOE	United States Department of Energy
DPM	diesel particulate matter
EAW	environmental assessment worksheet
ECP	Environmental Construction Plan
EERA	Energy Environmental Review and Analysis
EIS	environmental impact statement
EJ	environmental justice
EOR	enhanced oil recovery

EPA	United States Environmental Protection Agency
EQB	Environmental Quality Board
ethanol plant	Green Plains Ethanol Plant
FEMA	Federal Emergency Management Agency
gCO_2e/MJ	grams of CO_2e per megajoule of energy
GHG	greenhouse gas
GRE	Great River Energy
GREET	Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation
HAP	hazardous air pollutant
HDD	horizontal directional drill
I-94	Interstate 94
IPaC	Information for Planning and Consultation
kWh	kilowatt hours
LCA	life cycle analysis
LCFS	low-carbon fuel standard
LGU	Local Government Unit
MBS	Minnesota Biological Survey
MCE	Midwest Carbon Express
MDA	Department of Agriculture
MDH	Department of Health
Minn. R.	Minnesota Rule
Minn. Stat.	Minnesota Statute
MLV	mainline valve
MMTPA	million metric tons per annum
MnDOT	Department of Transportation
MnRISKS	Minnesota Statewide Screening of Heath Risks from Air Pollution
MP	milepost
MPCA	Minnesota Pollution Control Agency
MS 433	Mississippi Highway 433
MWh	megawatt hour
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NHIS	Natural Heritage Information System
NIMS	National Incident Management System
NLCD	National Land Cover Database
NO_X	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSR	noise sensitive receptors
NWI	National Wetlands Inventory
PHMSA	Pipeline and Hazardous Materials Safety Administration
PM	particulate matter

$PM_{2.5}$ particulate matter equal to or less than 2.5 microns in diameter
PM_{10} particulate matter equal to or less than 10 microns in diameter
ppm parts per million
project Otter Tail to Wilkin Carbon Dioxide (CO_2) Pipeline Project
psi pounds per square inch
psig pounds per square inch gauge
RA-Hybrid Route Alternative – Hybrid
RA-North Route Alternative – North
RA-South Route Alternative – South
ROI region of influence
ROW right-of-way
SBS Sites of Biodiversity Significance
SDS State Disposal System
SGCN Species in Greatest Conservation Need
SHPO State Historic Preservation Office
SO_2 sulfur dioxide
SPCC Spill Prevention, Control, and Countermeasure
SSM Startup, shutdown, and malfunction
SSURGO Soil Survey Geographic Database
tpy tons per year
USACE United States Army Corps of Engineers
USDA United States Department of Agriculture
USDOT United States Department of Transportation
USFWS United States Fish and Wildlife Service
VMP Vegetation Management Plan
VMPWG Vegetation Management Plan Working Group
VOC volatile organic compound
WPA Waterfowl Production Area
WMA Wildlife Management Area

Chapter 1 Introduction

The Department of Commerce (Commerce) prepared this environmental impact statement (EIS) on behalf of the Minnesota Public Utilities Commission (Commission) for the Otter Tail to Wilkin Carbon Dioxide (CO_2) Pipeline Project (project). The project is proposed by Summit Carbon Solutions, LLC, referred to herein as the applicant.

1.1 What does the applicant propose to construct?

The project consists of a CO_2 capture facility and 28.1 miles of pipeline that would transport captured CO_2.

The applicant proposes to construct and operate approximately 28.1 miles of 4-inch-diameter[1] carbon steel pipeline and associated facilities for the transport and sequestration of CO_2 from the Green Plains Ethanol Plant (ethanol plant). The project would extend from the ethanol plant near Fergus Falls in Otter Tail County, Minnesota, west to the Minnesota-North Dakota border near Breckenridge in Wilkin County, Minnesota. Associated facilities would include:

- a CO_2 capture facility at the ethanol plant;
- a pipeline pig/inspection tool launcher at the ethanol plant;
- five mainline valves (MLV) and an impressed current cathodic protection system within the pipeline operational right-of-way (ROW);
- temporary and permanent access roads.

The project is designed to capture approximately 0.19 million metric tons per annum (MMTPA) of the CO_2 generated by the ethanol plant.

1.2 What is the project's purpose?

In summary, the project's purpose is to capture CO_2 from the ethanol plant and transport it to the North Dakota border, enhancing the marketability of the ethanol produced at the ethanol plant.

As stated in the Commission's September 26, 2023, *Order Approving Scope of Environmental Review and Denying Stay,* the purpose of the project is to "capture and transport [CO_2] from the Green Plains ethanol plant via pipeline to permanent underground sequestration facilities in North Dakota and reduce the carbon-intensity score of ethanol produced at the Green Plains ethanol plant and enhance its marketability in low-carbon fuel standard markets."[2]

The applicant has a CO_2 offtake agreement with the ethanol plant. The project would offer the ethanol plant a viable option to capture, transport, and permanently store its CO_2 emissions and continue to be competitive with other ethanol facilities that can capture and permanently store CO_2. Because the project would capture the ethanol plant's CO_2 for permanent sequestration, the carbon intensity score, or carbon footprint, of the ethanol plant's ethanol would be reduced by an estimated 40 percent, improving the ethanol plant's ability to compete in low-carbon fuel standard (LCFS) markets.

The pipeline would be part of a larger applicant-proposed CO_2 pipeline network, referred to as the Midwest Carbon Express (MCE) Project. While the project reviewed in this EIS ends at the Minnesota-North Dakota border, the pipeline itself would continue into North Dakota and interconnect with the larger MCE pipeline system to transport the CO_2 to a sequestration area in North Dakota. There, the CO_2 would be stored underground in saline formations using federal Class VI injection wells permitted by the state of North Dakota, which has primary enforcement authority for these types of wells in North Dakota.

1.3 What is the public's role?

Minnesota needs the public's help to make an informed decision.

During scoping, you told us your concerns about the project so that we could collect the right facts. At the upcoming public meetings and hearing, you can tell us what those facts mean and if you think we have represented them correctly. Your help in pulling together the facts and determining what they mean will help the Commission make informed decisions regarding the project.

1.4 What is the State of Minnesota's role?

The Commission will make a permit decision that is informed by this EIS as well as public meetings, public hearings, and comment periods.

Before constructing the project, the applicant needs a pipeline routing permit from the Commission. A routing permit determines where the project would be located and how impacts must be mitigated. Additionally, if the Commission grants a routing permit, other state, federal, and local permits might be required. The applicant must obtain these other permits before construction begins.

To ensure a fair and robust airing of the issues, the Commission follows an environmental review and permitting process when considering routing permit applications.[3] On February 6, 2023, the Commission determined the routing permit application[4] was complete and required that an EIS be prepared in accordance with Minnesota Rules 4410 and 7852.[5] The Commission subsequently approved the scope of the EIS.[6]

Energy Environmental Review and Analysis (EERA) staff within Commerce prepared this EIS. It is currently in draft form. An EIS contains an overview of affected resources and discusses potential human and environmental impacts and mitigation measures. EERA will prepare a final EIS based on public comments.

1.5 How is this document organized?

The EIS is organized to address the matters identified in the Commission's scoping decision.

This EIS addresses the matters identified by the Commission in its September 26, 2023, *Order Approving Scope of the Environmental Review and Denying Stay*.[7] The scoping decision is based on public input gathered at four public meetings and during an associated comment period (see **Appendix A**). The EIS is organized as follows:

- **Chapter 1 Introduction** provides a brief overview of this document and the project.
- **Chapter 2 Project Information** describes the project—its design, construction, operation, and decommissioning.

- **Chapter 3 Regulatory Framework** describes the necessary authorization from the Commission and required approvals from federal and state agencies, local units of government, and others with permitting authority for actions related to the project.
- **Chapter 4 Alternatives** describes alternative pipeline routes and alternatives to the project itself, including a no action alternative, that were included in the scoping decision.
- **Chapter 5 Potential Impacts and Mitigation for Alternative Routes** discusses the environmental setting and details potential human and environmental impacts and mitigative measures for the three alternative pipeline routes.
- **Chapter 6 Potential Impacts and Mitigation for Other Alternatives** details alternative technologies to the project itself and discusses potential human and environmental impacts and mitigative measures for these technologies.
- **Chapter 7 No Action Alternative** discusses potential human and environmental impacts from not constructing the project.
- **Chapter 8 Accidental Release of CO_2** assesses the impacts of an unanticipated release of CO_2 in the event of a pipeline rupture based on the rupture analysis contained in **Appendix G**.
- **Chapter 9 Unavoidable Impacts and Irreversible and Irretrievable Commitments of Resources** identifies impacts that cannot be avoided and commitments of resources that would be impossible or very difficult to redirect to a different future use or that would not be recoverable for later use by future generations.
- **Chapter 10 Cumulative Impacts** summarizes the potential cumulative effects of the project with other projects in the environmentally relevant area.
- **Chapter 11 Application of Route Selection Criteria** applies input from the public and the information available in the routing permit application, the scoping environmental assessment worksheet (EAW), and this EIS to the routing factors listed in Minnesota Rule 7852.2000.
- **Chapter 12 List of Preparers** lists the names of the people who prepared this EIS.

Consistent with the scoping decision, the EIS does not consider the following:

- Any alternative not specifically identified for study in the scoping decision.
- The two additional MCE Project pipelines proposed for south-central Minnesota.
- Easements and acquisition of land for the pipeline.
- The appropriateness of federal and state policies regarding carbon capture and ethanol. The EIS may reference these policies; however, the EIS will take no position for or against these policies.
- The appropriateness of United States Department of Transportation (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations and related standards for CO_2 pipelines. The EIS may reference certain PHMSA standards; however, the EIS will not address the adequacy of these standards.

1.6 What's next?

Public meetings will be held in the project area and virtually. You can provide comments on this draft EIS either at a meeting or as part of the associated public comment period. Your input on the draft EIS will be incorporated into a final EIS. Following publication of the final EIS, public hearings will be held with an associated public comment period. An administrative law judge (ALJ) will consolidate public

comments, prepare a report, and make recommendations for the Commission to consider. The Commission will then review the record and decide whether to grant a routing permit.

Now that the draft EIS is complete and has been made available, a public comment period is now open. Public meetings will be held in the project area to allow for public comment on the draft EIS. EERA staff will respond to substantive comments received and incorporate your input on the draft EIS into the final EIS. A comment period concerning the adequacy of the final EIS will then occur.

Following publication of the final EIS and the close of the comment period concerning EIS adequacy, an ALJ with the Office of Administrative Hearings will hold public hearings in the project area with an associated comment period to allow the public to comment on the project. The ALJ will consolidate comments from the public, other interested stakeholders, and government agencies into a written report. The ALJ will submit this report and a recommendation to the Commission. The record developed during this process—including all public input—will be available to the Commission when it makes a routing permit decision. More information on this process is available in Chapter 3.

The Commission is expected to make a routing permit decision in summer 2024.

1.7 Where do I get more information?

For additional information, don't hesitate to contact Commission or Commerce staff. If you would like more information or if you have questions, please contact the Commission public advisor: Sam Lobby (publicadvisor.puc@state.mn.us), (651) 201-2251 or Commerce staff: Andrew Levi (andrew.levi@state.mn.us), (651) 539-1840.

Project documents, including the routing permit application and scoping EAW can be found on eDockets at https://www.edockets.state.mn.us/EFiling/search.jsp by searching "22" for year and "422" for number. Information is also available on the Commerce webpage: https://eera.web.commerce.state.mn.us/web/project/14959.

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[1] A 4-inch nominal diameter pipeline has an outside diameter of 4.5 inches.

[2] Commission. September 26, 2023. *Order Approving Scope of Environmental Review and Denying Stay*. eDockets No. 20239-199149-01.

[3] See generally Minnesota Statute 216G and Minnesota Rule 7852.

[4] Summit Carbon Solutions. September 12, 2022. Route Permit Application. eDockets No. 20229-189023-02 and 20229-189023-03 and appendices.

[5] Commission. February 6, 2023. *Order Accepting Application, Requiring Environmental Impact Statement, and Denying Petition; Notice and Order for Hearing*. eDockets No. 20232-192950-01.

[6] Commission. September 26, 2023. *Order Approving Scope of Environmental Review and Denying Stay*. eDockets No. 20239-199149-01.

[7] Department of Commerce, Energy Environmental Review and Analysis. October 5, 2023. Final Scoping Decision. eDockets No. 202310-199403-01.

Chapter 2 Project Information

Chapter 2 describes how the project would be designed, constructed, operated, maintained, and decommissioned. Unless otherwise noted, the sources of information for this chapter are the routing permit application, the scoping EAW,[1] and supplemental information provided by the applicant (see **Appendix I**).

The applicant is designing the project but would hire contractors to construct the pipeline, restore the ROW, and other activities. Because the applicant would direct the work of the contractors, the EIS refers to the applicant as the entity that would conduct all project activities.

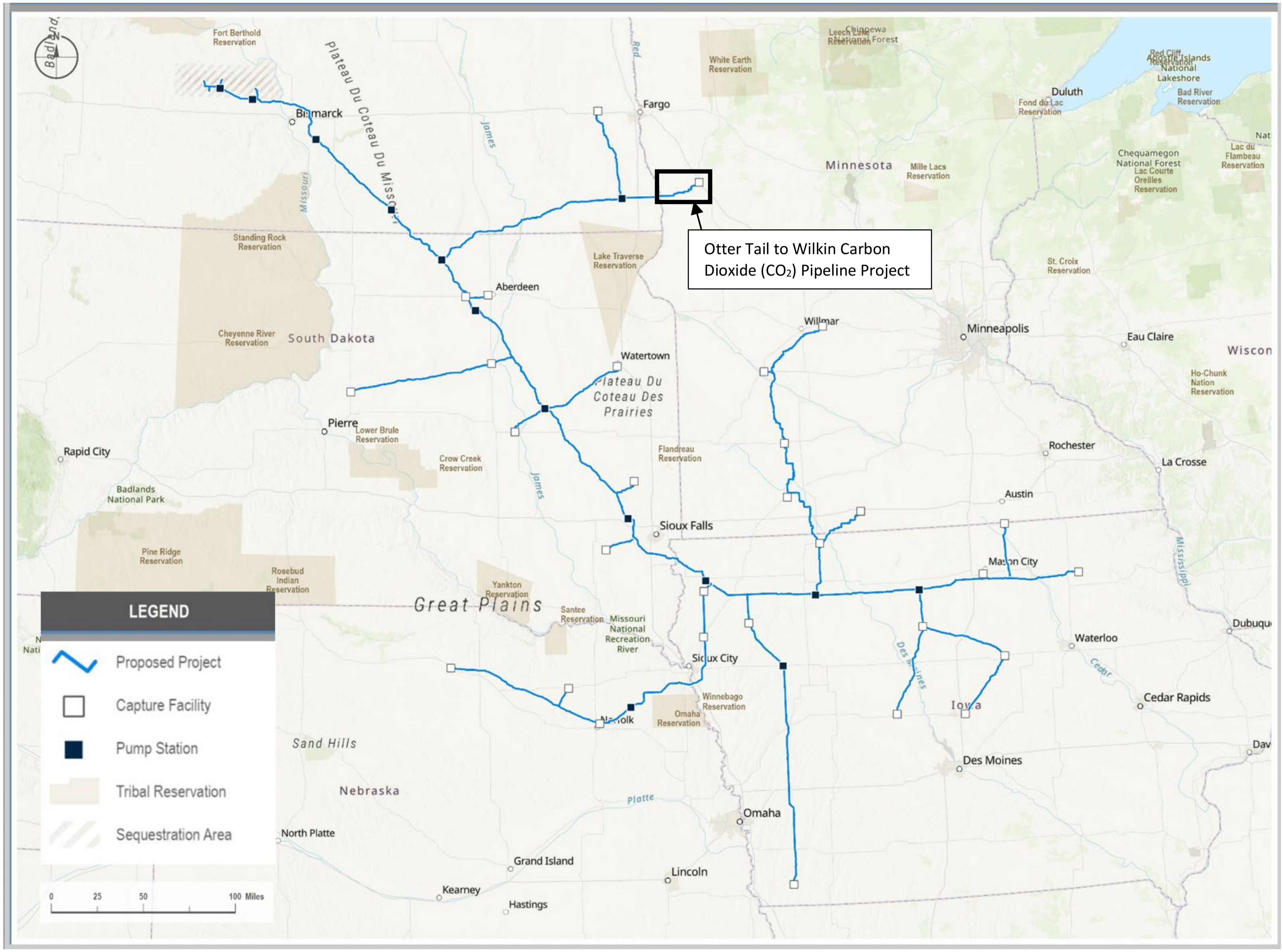
2.1 Applicant's Proposed Project

The applicant would construct and operate a CO_2 capture facility at the ethanol plant in Fergus Falls and an approximately 28-mile-long, 4-inch-diameter pipeline to transport the captured CO_2 west across Otter Tail and Wilkin Counties to the Minnesota-North Dakota border and the Bois de Sioux River. The project would capture and transport 524 metric tons of CO_2 per day (approximately 0.19 MMTPA assuming a 355-day operational year).

The project would connect to a larger CO_2 system known as the MCE Project. The MCE Project would include approximately 2,000 miles of pipeline for the capture and transportation of CO_2 from 32 ethanol plants across five states to permitted underground sequestration facilities in North Dakota (see **Figure 2-1**). The MCE Project is in the permitting phase across the five-state footprint. In North Dakota, the applicant is submitting supplemental information and preparing for additional hearings as part of the reconsideration process before the North Dakota Public Service Commission. The applicant expects to submit additional routing permit applications in the future. The applicant anticipates having permits for all pending applications in hand to start construction for portions of the project by first quarter 2025 and plans to begin operation by early 2026.

Following construction, the applicant indicates that land would be restored to pre-construction conditions and would remain suitable for farming, pasturing, and other activities. Structures and trees within the operational ROW would be restricted. Permanent roads would also be established to access aboveground MLV sites.

Figure 2-1 Overview of Proposed Midwest Carbon Express Project



2.2 Route Width and Right-of-Way Requirements

A route is the location of a pipeline between two end points. The width of the route, or route width, is typically wider than the actual ROW needed to construct and operate the pipeline. This extra width provides flexibility when constructing the pipeline but is not so wide that it is impossible to determine where the pipeline would be constructed, which makes it possible to analyze potential impacts. The route width is a temporary designation. Construction and operational ROW are needed for construction and safe operation of the pipeline. These ROW must be located within the route width.

The applicant requested a 500-foot route width for most of its proposed route. However, in some areas the requested route width is wider, up to 1,808 feet, allowing for additional route study and the potential need to make modifications to the pipeline alignment.

The applicant generally proposes a construction workspace width of 100 feet in uplands and 75 feet at crossings of wetlands and waterbodies. This is where construction activities would occur. The construction workspace must be within the route width. Some locations, such as at waterbody and road crossings, would require additional temporary workspace for specialized construction methods. Additional temporary workspace is typically used to stage equipment near waterbody, wetland, road, railroad, and foreign utility crossings, steep slopes, and for staging equipment and materials for specialized construction methods. The construction workspace would be reduced to 50 feet wide at horizontal directional drill (HDD) or bore crossings of waterbodies, roads, and railroads.

The applicant is not proposing to use any construction or staging yards for the project. The applicant would use temporary roads to access the construction workspace and permanent access roads to access aboveground facilities during operation. The maps in **Appendix B** show the proposed construction workspace configurations at each of these features.

The applicant would retain a 50-foot-wide operational ROW centered over the pipeline for inspection and maintenance access during operation. The widths of the construction workspace and operational ROW could be reduced due to land restrictions. **Appendix B** contains an overview map and detailed maps of each route alternative that show route widths, construction workspaces, and the operational ROW. Although two of the alternative routes have not undergone the same level of engineering design as the route proposed by the applicant, EERA staff have coordinated with the applicant to develop footprints of the construction workspace in sufficient detail to allow a reasonable comparison of impacts among the three route alternatives.

2.3 Engineering and Design

2.3.1 Capture Facility

The CO_2 capture facility would be constructed at the ethanol plant.

The CO_2 capture facility constructed at the ethanol plant would collect the CO_2 gas produced during the ethanol fermentation process and then would compress, dehydrate, and cool the CO_2 to a dense phase so that it could be transported through the pipeline. High purity CO_2 (that is, greater than 96 percent CO_2) would be captured from the ethanol fermentation process near ambient temperature and pressure. The facility would be connected to the vent from the existing CO_2 fermentation scrubber.

The capture facility would consist of piping, valves, vessels, electrical and instrumentation components, dehydration equipment, compressors, a cooling system, a pump, metering equipment, and other components. The compressors, associated vessels, and pump would be housed in a structure; the blower, scrubbers, compressor intercoolers/aftercooler, and dehydration equipment would be outdoors. The outdoor area containing capture facility equipment would be graveled. All outdoor vessels and pipes would have heat tracing and insulation. Electricity, provided via underground cable from an existing Lake Region Electric Cooperative substation adjacent to the ethanol plant, would be the only source of power. The capture facility would include instrumentation to allow metering as well as onsite and remote operation. **Appendix C** shows the layout of the CO_2 capture facility.

2.3.2 Pipeline

Pipeline construction practices are similar for all route alternatives. The pipeline facilities also include MLVs, pipeline inspection facilities, and cathodic protection systems to prevent corrosion.

The project includes a 4-inch-diameter high-strength steel pipeline that would cross approximately 28.1 miles (10.8 miles in Otter Tail County and 17.3 miles in Wilkin County). The pipeline would originate at milepost (MP) 0.0 at the capture facility and would transport the captured CO_2 west to the Minnesota-North Dakota border at the Bois de Sioux River at MP 28.1 (see **Figure 2-1** and the overview map in **Appendix B**). All route alternatives would also originate at MP 0.0 and similarly would transport captured CO_2 west to the Minnesota-North Dakota border.

The applicant states that the pipeline would be constructed of high-strength carbon steel pipe that meets the American Petroleum Institute (API) 5L Pipe Specification. API 5L is the industry standard specification for the seamless and welded steel line pipes used in pipeline transportation systems. It would be manufactured in the United States using a high-frequency longitudinal welded process. The proposed pipeline and associated facilities would be designed, constructed, inspected, tested, and operated in accordance with applicable requirements and regulations, including the USDOT PHMSA regulations in Title 49 Code of Federal Regulations (CFR) Part 195, Transportation of Hazardous Liquids by Pipeline; American Society of Mechanical Engineers (ASME) Standard B31.4, Pipeline Transportation Systems for Liquids and Slurries; API Standard 1104, Welding Pipelines and Related Facilities; and other standards, practices, and guidelines referenced by USDOT and ASME.

The applicant would apply an external fusion-bonded epoxy coating to the pipeline prior to installation to protect against corrosion. HDD crossings would also have an abrasion-resistant overcoat installed as a secondary coating prior to installation. In addition, the applicant would install an impressed current cathodic protection system (cathodic protection system) and electrical mitigation along the pipeline as further described in Section 2.3.2.2.

2.3.2.1 Mainline Valves

The applicant proposes to construct five MLVs along the project: one at the capture facility (MP 0.0), one at MP 4.8, one on each side of the Otter Tail River (MPs 18.8 and 20.4), and one east of the Bois de Sioux River (MP 27.8). The purpose of an MLV is to isolate segments of the pipeline to contain the dense phase CO_2 during both normal and abnormal operations. MLVs would be 4-inch-diameter sectionalizing block valves constructed within a graveled 50-foot-wide by 50-foot-long footprint within the operational ROW.

The applicant indicates that spacing intervals between the MLVs were designed in accordance with PHMSA requirements[2] and take into account CO_2 release dispersion modeling, risk assessments, the potential to impact populated areas and sensitive environmental areas, and other topographic and environmental considerations. The applicant would be able to operate all MLVs remotely. All remotely operated valves would be either solar powered or utility powered and connected to the applicant's control center in Ames, Iowa, through the most reliable public communications network available. MLVs and other aboveground facilities would be surrounded by a locked chain-link fence to limit physical access.

2.3.2.2 Inspection and Corrosion Protection Facilities

A pipeline internal inspection tool (commonly referred to as a “pig”) launcher would be installed at the beginning of the pipeline within the CO_2 capture facility to allow the applicant to insert internal inspection tools that can travel down the pipeline and gather information regarding pipeline integrity.

The applicant would install a cathodic protection system designed to protect the pipeline from corrosion. In addition, the applicant would install alternating current/direct current (AC/DC) mitigation systems within the operational ROW where necessary to protect the pipeline and the cathodic protection system from corrosive electromagnetic voltage and stray current from nearby electric powerlines. The cathodic protection system would have some minor aboveground components that would be designed and constructed to minimize long-term surface impacts. These components would be located within the fenced area of the MLV sites.

2.3.2.3 Access Roads

Existing public roads and private driveways would be used to access the pipeline construction workspace. In addition, the applicant would build four temporary access roads to access the construction workspace where existing public roads do not exist, and four permanent access roads, as listed in **Table 2-1**. Temporary access roads would be 30 feet wide and would be restored after use. Permanent access roads would be 20 feet wide.

Four of the permanent access roads would be new and would extend to the MLVs along the pipeline. The fifth permanent access road is an existing road that would be upgraded and would extend to the MLV collocated with the CO_2 capture facility. These permanent access roads would be used both during construction and operation. The permanent roads would be designed to applicable standards.

Table 2-1 Access Roads

County	Access Road Name	Milepost	Length (feet)	Acres
		Temporary Access Roads		
Otter Tail	TAR-MNL-321-MP.0-1	0.0	1,466	1.0
Otter Tail	TAR-MNL-321-MP3.3-1	3.3	2,030	1.4
Wilkin	TAR-MNL-321-MP19.5-1	20.0	76	<0.1
Wilkin	TAR-MNL-321-MP24.0-1	24.6	20	<0.1
		Total	3,591	2.5
		Permanent Access Roads		
Otter Tail	PAR-MNL-321-MP.0-1	0.0	1,292	0.9
Otter Tail	PAR-MNL-321-MP4.8-2	4.8	20	<0.1
Wilkin	PAR-MNL-321-MP18.1-1	18.7	45	<0.1
Wilkin	PAR-MNL-321-MP19.7-1	20.3	34	<0.1
Wilkin	PAR-MNL-321-MP26.9-1	27.4	74	<0.1
		Total	1,465	1.0

Note: The sum of addends might not total due to rounding.

2.4 Construction

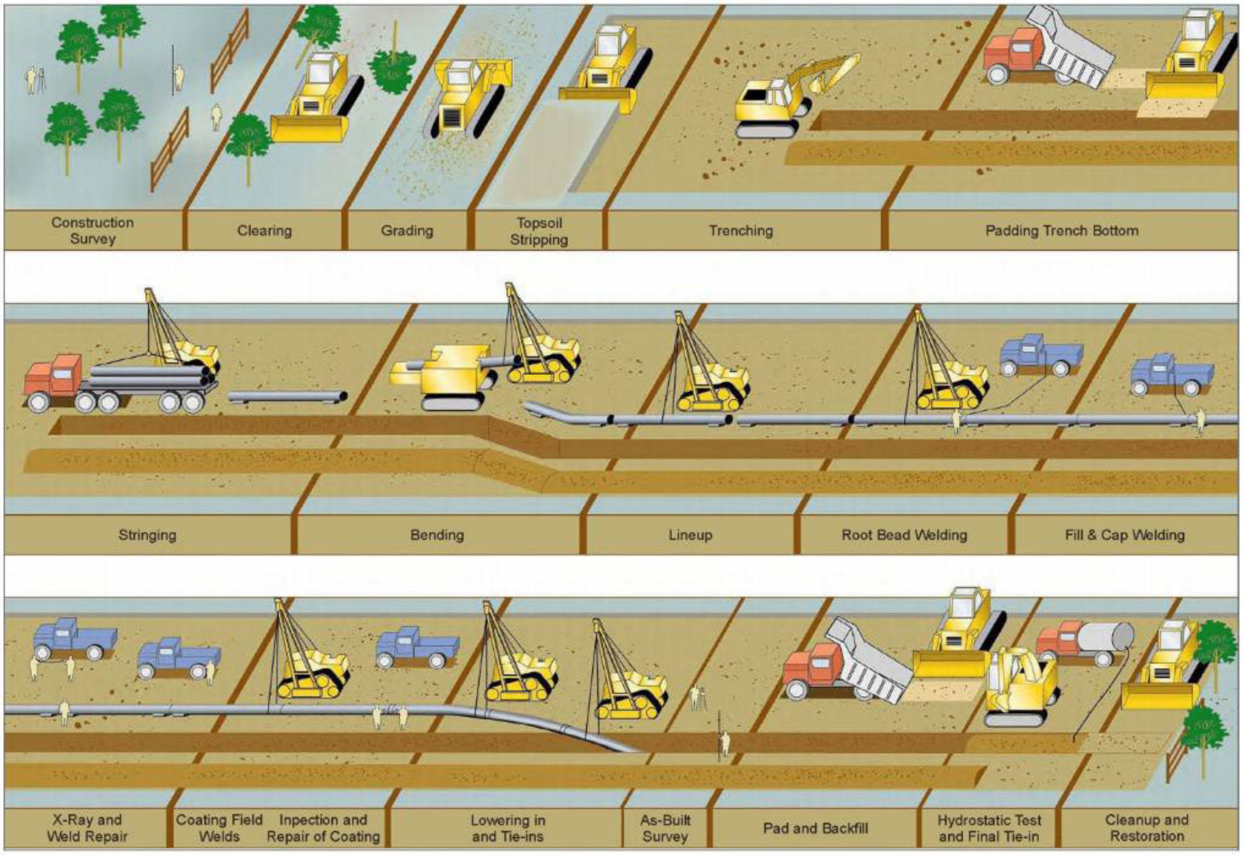
Pipeline construction practices would be similar for all route alternatives.

Workers would drive personal or company vehicles directly to the project and would park in designated areas, such as along the construction workspace or on landowner property with landowner permission. The need for parking and the decision of where workers would park would vary over time depending on the location and accessibility of the work area and the available space within the construction workspace.

Figure 2-2, provided by the applicant, shows the typical pipeline construction sequence. The project would be constructed using the following high-level steps:

- Construction surveying and staking
- Clearing, grading, and site preparation
- Topsoil segregation
- Stringing, bending, welding, coating, and inspecting pipe
- Trenching and lowering in the pipeline, or completing trenchless crossings
- Backfilling the trench
- Hydrostatic testing and final tie-in
- Restoration and revegetation

Figure 2-2 Typical Pipeline Construction Sequence



Construction procedures are described further in the following sections. Additional details can be found in the applicant's Minnesota Environmental Construction Plan (ECP), provided as **Appendix D**, and in the applicant's Minnesota Agricultural Protection Plan (APP), provided as **Appendix E**. These plans include generally recognized best management practices (BMP) and project-specific procedures that would be implemented to minimize and mitigate construction impacts. Chapter 5 analyzes the effects of the project and proposed mitigation measures.

2.4.1 Construction Surveying and Staking

The applicant would coordinate with Gopher State One Call to determine the locations of existing underground utilities before beginning any ground-disturbing activity. Construction/civil survey crews would flag/stake the pipeline centerline and exterior boundary of the construction workspace, associated facilities, and access roads. Access points from existing public roads would be marked and flagged, and fences would be cut and gated with landowner permission to control access to the construction workspace. Drain tile and irrigation systems would also be marked.

Environmental survey crews or environmental inspectors would place signage at wetland and waterbody boundaries as well as any other locations where environmental constraints or restrictions are required. Sections 2.4, 3.1, 4.1, and 5.1 of the applicant's Minnesota ECP (see **Appendix D**) describe requirements for staking and signing the construction workspace and sensitive resources prior to construction.

2.4.2 Clearing, Grading, and Site Preparation

Following civil surveys, the construction workspace would be cleared of vegetation. The applicant's environmental inspectors would inspect the clearing and grading activities to ensure construction activities stay within the authorized limits of disturbance.

The applicant would conduct all clearing and grading work in accordance with applicable permits and landowner requests. Agricultural areas with crops present would be mowed or disced to ground level unless the landowner requests to remove the crops themselves. Tree stump removal and grading activities would be limited to areas directly over the pipeline trench or where needed to ensure a safe and level work area. Bushes and trees would be disposed offsite, burned, or chipped and spread over the construction workspace outside of wetlands and active agricultural fields.

The applicant would establish a travel lane within the construction workspace, which might include the use of construction mats when crossing wetland areas. Bridges, when permitted, would be installed at waterbody crossings to create a single travel lane along the construction workspace.

No ground disturbance would occur between the entry and exit of HDDs. In these areas, the applicant would limit any vegetation clearing to trimming using hand tools where necessary to place the HDD guidewires or to access a water source to withdraw water for HDD operations or hydrostatic testing of the pipeline.

The applicant would install temporary erosion control measures and would maintain redundant sediment control measures immediately after clearing and prior to initial ground disturbance at wetlands and waterbodies within 50 feet of the construction workspace and where stormwater flows to a wetland or waterbody. Sediment barriers would be installed at the following locations:

- The base of slopes where wetlands, waterbodies, or roads are at a lower elevation
- The edge of construction workspaces adjacent to a wetland, waterbody, or road
- Between topsoil/subsoil stockpiles and streams or wetlands, as needed and if adequate, and where separation cannot be achieved
- Dewatering or discharge locations where required

Temporary erosion control measures and sediment barriers would remain in place and would be maintained or replaced until the area is revegetated.

The applicant would control fugitive dust on the ROW and access roads during construction by spraying water from water trucks. The applicant indicates water would not be applied in quantities that would cause runoff from the ROW or access roads.

2.4.3 Topsoil Segregation

The applicant would segregate topsoil after clearing is complete and during trenching activities according to the applicant's Minnesota ECP and Minnesota APP. Topsoil would be segregated in wetlands according to the requirements of the United States Army Corps of Engineers (USACE) Section 404 Utility Regional General Permit authorization.

Topsoil and subsoil piles would be placed so that at least 1 foot of separation would be maintained between the piles to prevent mixing. If a 1-foot separation gap could not be maintained, a physical barrier such as a silt fence, geotextile fabric, or a thick layer of mulch would be used. The applicant would apply a soil tackifier to the soil stockpiles to control dust in windy conditions.

2.4.4 Stringing, Bending, Welding, Coating, and Inspecting Pipe

The applicant would string (lay parallel to the trench) the pipe segments on temporary supports within the construction workspace either before or after trenching. Once pipe segments are in place along the trench, the applicant would align the pipe lengths and fabricate bends. Welding of the joints would be performed in accordance with 49 CFR Part 195; API Standard 1104, Welding of Pipelines and Related Facilities; and applicant or contractor welding specifications. All welds would be inspected with non-destructive methods (that is, real-time radiography and/or ultrasound) to ensure there are no defects, and the welds would be epoxy coated for corrosion protection.

2.4.5 Trenching and Lowering in the Pipeline

Trenching would be completed using a trenching machine, backhoe, or similar equipment. Bedrock is not expected to be encountered, so no blasting would be needed. The applicant would deposit subsoil adjacent to the trench within the construction workspace separate from the topsoil, as discussed in Section 2.4.3. If groundwater were to accumulate in the open trench, it would be pumped out and discharged to a dewatering structure or filter bag as required by applicable permits.

The trench would be deep enough to comply with the minimum depth of cover requirements described in USDOT PHMSA requirements, agricultural area standards at Minnesota Statute 216G.07, and/or landowner agreements. The applicant would install the pipeline to allow for a minimum depth of cover of 54 inches, measured from the ground surface to the top of the pipe. The minimum depth of cover would be increased to 60 inches at waterbody and drainage ditch crossings as well as at private road crossings as measured at the bottom of the road ditch. The Department of Transportation (MnDOT) has indicated that it would require a minimum depth of cover of 10 feet below the lowest part of the road surface in MnDOT ROW. The depth of cover would also be increased if requested by local, state, or federal agencies in areas adjacent to wetlands or waterbodies or in sensitive habitat.

At locations constructed using trenchless methods (HDD and bore, see Section 2.4.8), the pipeline would typically be installed deeper, resulting in greater depth of cover. The applicant would complete an as-built survey to ensure that the depth of the pipeline would meet state and federal requirements before the trench is backfilled.

The applicant would limit the amount of excavated open trench in uplands to a maximum of 15 days of anticipated welding production, or 15 miles. In areas where the project would cross waters of the United States (where the USACE Section 404 Utility Regional General Permit would apply), the amount of open trench would be limited to 5,280 linear feet. Site-specific activities that are typically conducted with separate crews, such as HDDs, bores, and MLV installation, might be performed independent of open trench work. To allow the passage of wildlife and livestock and to facilitate natural drainage patterns, spoil piles would be placed with gaps that align with the breaks of strung pipe that are lying along an open trench. Temporary bridges might also be constructed over the open trench to allow the passage of wildlife and livestock.

Prior to lowering in the pipe, the trench would be visually inspected to ensure that it is free of rock and other debris that could damage the pipe or the pipe coating, and the trench bottom would be padded with sandbags or clean fill if needed to protect the pipeline. Completed sections of pipe would be lifted off the temporary supports by side boom tractors or similar equipment and lowered into the trench. Tie-in welding and pipeline coating would be conducted within the trench to join the newly lowered-in section with the previously installed sections of pipe. These welds would be inspected.

2.4.6 Backfilling the Trench

After lowering in the pipeline, the trench would be backfilled with the previously excavated material, using the subsoil first. Any damaged drain tiles would be repaired before backfilling the trench. Disturbed areas would be regraded to restore original surface contours. Topsoil that was segregated as described in Section 2.4.3 would be spread over the trench line and other construction workspaces after hydrostatic testing and decompaction of the subsoil is complete.

2.4.7 Hydrostatic Testing and Final Tie-in

To comply with PHMSA pipe testing requirements listed in 49 CFR Part 195, Subpart E, the applicant would conduct hydrostatic testing of the pipeline after backfilling but before topsoil is spread. The completed pipeline would be tested in two segments. Hydrostatic testing involves filling installed segments of the new pipeline with water, which would be appropriated from surface water, municipal, or groundwater sources, and then raising the internal pressure and holding that pressure for the PHMSA-specified period. The applicant does not plan to add chemicals or other additives to hydrostatic test water.

The applicant would perform hydrostatic pre-tests on pre-built HDD segments while the pipe is laid aboveground within the construction workspace, prior to installation. HDD segments would be tested again after installation and tie-in as part of the overall hydrostatic testing.

After hydrostatic testing is complete, the pipeline would be depressurized and the water discharged according to applicable Minnesota Pollution Control Agency (MPCA) discharge permits and the applicant's Minnesota ECP. The hydrostatic test water would be completely removed from the pipeline using a series of pig runs, which would be propelled by compressed air. The applicant would discharge the water back to the source from which the water was appropriated, or to an upland area using an agency-approved method. At the two hydrostatic test locations, pipe segments would be welded together to create one contiguous pipeline. These welds would be inspected.

2.4.8 Trenchless Construction

Some features, such as highways, railroads, and certain waterbodies, would be crossed using trenchless construction methods. Trenchless construction methods include HDD and conventional bores.

The typical HDD construction method includes staging the drilling equipment on one side of the feature being crossed (the HDD entry) and the welded pipeline segment for the crossing length on the other side (the HDD exit). After the borehole is drilled, the pipeline segment is pulled back through the hole using the drill rig. The applicant would construct each HDD waterbody crossing in accordance with a site-specific plan. A typical configuration for an HDD crossing is shown in Figure 14 of Appendix A to the Minnesota ECP (see **Appendix D**).

Table 2-2 shows the locations of the five HDDs proposed for the project along with the anticipated minimum depth of cover at the lowest point of the feature being crossed. The actual depths of the HDDs could be greater. For example, the geotechnical investigation report for the Otter Tail River crossing indicates an estimated HDD depth of 46 feet below the bottom of the river channel.

Table 2-2 Horizontal Directional Drills

Feature Crossed	Entry Milepost	Exit Milepost	Length (feet)	Minimum Cover at Lowest Point (feet)
Pelican River	2.0	1.8	940	25
Otter Tail Valley Railroad / State Highway 210	3.3	3.2	394	20
Otter Tail River	19.8	19.2	3,525	25
BNSF Railway / US Highway 75	24.6	24.5	420	20
Bois de Sioux River	28.0	–	752	25

Note: The HDD exit for the Bois de Sioux River is outside the project area in North Dakota.

Drilling fluids and additives used for the HDD would be non-toxic to the aquatic environment and humans. The applicant would develop a contingency plan to address an inadvertent release of drilling fluid at the ground surface should one occur during an HDD. The contingency plan would include instructions for monitoring during the HDD and mitigation if there is an inadvertent release. Containment, response, and clean-up equipment would be available on site prior to beginning the HDD to ensure a timely response if there is an inadvertent release.

The applicant would dispose of drill cuttings and drilling mud without additives, or drilling mud with additives that are approved by the Minnesota Department of Health (MDH) or that meet NSF International / American National Standards Institute (ANSI) Standard 60, Drinking Water Treatment Chemicals - Health Effects, by spreading the material over the construction ROW in an upland location approved by the applicant and the landowner. Drilling mud mixed with additives that are not on the MDH-approved additive list and/or do not meet NSF/ANSI Standard 60 would be disposed of as solid waste at an approved facility, or the applicant would obtain a land application permit from MPCA. In all cases, the applicant could choose to contain and then dispose of the drilling mud at a waste management facility that is authorized to accept drilling mud. The applicant would be responsible for tracking and disposing of waste material from the construction workspace.

The bore method uses a smaller footprint than a conventional HDD rig, and the borehole is drilled from either an entry pit or the surface of the ground. Construction workspace on either side of the feature to be crossed is used to establish the pit, if needed, and to provide area to string and stage the pipe and equipment. In some instances, based on length, depth, and diameter, pressurized water or drilling mud may be used to hold the hole open. A typical configuration for a guided bore crossing is provided as Figure 13 of Appendix A to the Minnesota ECP (see **Appendix D**).

2.4.9 Winter Construction

Currently, the applicant's proposed schedule does not include winter construction. If constructing the pipeline in frozen conditions through agricultural lands becomes necessary, the applicant proposes the following mitigation measures to minimize potential impacts to agricultural lands:

- **Minimize topsoil stripping in frozen conditions.** Frozen conditions can preclude effective topsoil stripping. When soil is frozen beyond the depth of the topsoil, topsoil cannot be efficiently separated from the subsoil without pulling subsoil and mixing it with topsoil. If topsoil stripping must proceed under these conditions, topsoil would be removed from the area of the trench only. A ripper (deep tillage device or scarifier) would be used to break up the frozen topsoil over the trenchline, and a backhoe would remove the topsoil layer and store the material in a separate pile. The ripper would extend to the depth of topsoil or to a maximum depth of 12 inches, whichever is less.

- **Minimize final clean-up activities in frozen conditions.** Frozen conditions can preclude effective topsoil replacement, removal of construction debris, removal of excess rock, decompaction of soil as required, final grading, and installation of permanent erosion control structures. If seasonal or other weather conditions preclude final clean-up activities, the trench would be backfilled and stabilized, and temporary erosion control measures would be installed until restoration can be completed. Frozen topsoil would not be placed back into the trench until thawing had occurred to prevent settlement of soil in the trench. If topsoil/subsoil piles would remain throughout the winter, these piles would be stabilized by methods approved by the Department of Agriculture (MDA). Backfill operations would resume when the ground was thawed, and the subsoil would be compacted (as needed) prior to final clean-up activities. The applicant would be required to monitor these areas until final restoration is complete.

In the unlikely event that hydrostatic testing must occur in the winter, the applicant would consider adding an anti-freeze additive, such as glycol, to prevent freezing. All additives would be subject to review and approval by relevant regulatory agencies. The applicant has prepared a winter construction plan that would be implemented if necessary (see **Appendix F**).

2.4.10 Capture Facility Construction

The applicant's Minnesota ECP would also be applied to construction at the CO_2 capture facility. The applicant would implement relevant measures, such as installing temporary erosion control measures and sediment barriers, and implementing fugitive dust controls.

Work at the site would begin with grading and excavation, installation of pilings, and concrete work. Approximately 1 month after civil works begins, steel work, pipe spooling, and electrical work would begin. These items would be fabricated and installed at the capture facility. Major equipment would then be brought in and set in place, and the compressor and pump buildings would be erected. The greatest number of employees would be on site at this time. Upon completion of steel work, piping, and electrical work, commissioning activities would start with a planned duration of 1 month, followed by start-up of the capture facility. Overall, construction duration of the capture facility (mobilization to demobilization) would take 5 to 6 months, according to the applicant.

2.5 Restoration

Restoration practices would be similar for all route alternatives.

After pipeline construction and hydrostatic testing, the applicant would de-compact subsoil, re-spread topsoil over the construction workspace, and perform final grading to restore pre-construction contours. Final grading would also remove any remaining debris or construction material before seeding and mulching. The applicant would install temporary and permanent stabilization measures such as slope breakers, mulching, and seeding where appropriate; rebuild fences removed for pipeline installation or install permanent gates; and return the land as close as practicable to its pre-construction use. Disturbed areas would be seeded with seed mixes appropriate to the existing land use or left unseeded if in active agricultural fields (according to landowner requests).

Any excess subsoil remaining after the backfilling process and any remaining construction debris would be removed and disposed of at an approved location. Temporary erosion control measures such as silt fence, temporary slope breakers, and coir logs and wattles would be removed once perennial vegetative cover or vegetation similar to natural terrain is established with a density of 70 percent when compared to the background vegetative cover, or areas are stabilized and permanent erosion control measures installed, if necessary.

The applicant would conduct post-construction monitoring in accordance with requirements in state permits and landowner agreements. Monitoring would continue in both wetland and upland areas until revegetation efforts are determined to be successful.

2.6 Operation and Maintenance

Operation and maintenance practices would be similar for all route alternatives.

The applicant would be responsible for the operation, maintenance, and, when necessary, repair of the CO_2 capture facility and pipeline facilities. The applicant states that the operational ROW would be maintained free of woody vegetation over 15 feet tall as part of its vegetation maintenance program.

Maintenance would involve mowing or tree/shrub removal in non-cultivated areas. Minnesota's Buffer Law requires perennial vegetative buffers of up to 50 feet adjacent to lakes, rivers, and streams and buffers of 16.5 feet adjacent to ditches. Therefore, post-construction vegetation maintenance would be limited adjacent to waterbodies to promote the growth of the riparian buffer. At these locations, the applicant would limit vegetation maintenance along a 10-foot-wide corridor centered over the pipeline to facilitate visual inspection of the pipeline and to allow for corrosion and leak surveys. Additionally, vegetation between HDD entry and exit points would not be routinely cleared or mowed.

The applicant indicates that the project would meet or exceed state and federal safety requirements and, at a minimum, would be operated and maintained in accordance with PHMSA's regulations in 49 CFR Part 195.

2.6.1 Normal Operations and Routine Maintenance

The applicant states that during normal operating conditions, the pipeline would operate between 115 degrees Fahrenheit (°F) and 30°F. The CO_2 captured from the ethanol fermentation process at the ethanol plant would be near ambient air temperature. The CO_2 would then be compressed and dehydrated into a supercritical state. During this process, the temperature would be between 90°F and 115°F. Then the CO_2, once in a supercritical state, would be sent into the pipeline where it would cool to the ground ambient temperature.

The operational ROW would be patrolled and visually inspected every 2 weeks, weather permitting, and not less than 26 times annually. Patrols would check for abnormal conditions/appearances or dangerous activity such as unauthorized excavation or construction.

The applicant explains that its staff at a control center in Ames would continuously monitor and control pipeline operations. A supervisory control and data acquisition system would communicate with all field sites and provide real-time status along the project as part of the larger MCE Project. Data such as pressure, temperature, and flow would be monitored to ensure pipeline operation is within established operating parameters. Control center personnel would be able to remotely shut down the capture facility and isolate pipeline segments via the project's MLVs if abnormal operating conditions are observed. The applicant points out that the control center would have redundant communication methods, using the best option relative to reliability for primary communications and the next best option for secondary communications.

The applicant would deploy a leak detection system consisting of a real-time hydraulic model of the pipeline system that runs in parallel with instrument monitoring of pressure and volume. If the behavior of the pipeline does not match the hydraulic model, the system would notify the control center that an analysis is needed. Alarms would alert pipeline controllers when this analysis detects a potential leak profile. The applicant would develop operations and maintenance procedures for control center and field personnel prior to beginning operations. These operations and maintenance procedures would include both normal and abnormal operating conditions.

2.6.2 Abnormal Operations

The applicant indicates that the project would comply with federal emergency response requirements set forth in 49 CFR Section 195.402(e). The applicant would finalize an Emergency Response Plan before placing the project in service. Field personnel would be trained in emergency response procedures and would coordinate with local first responders and local authorities to conduct training to ensure preparedness. The applicant would conduct public education outreach programs, including damage prevention programs. The applicant indicates the programs would meet or exceed industry standards and regulatory requirements concerning public awareness of pipelines and pipeline operations.

Potential incidents vary in type, scope, size, and risk. The Emergency Response Plan would provide guidance and structure for a coordinated response to an emergency. The National Incident Management System's Incident Command System would be used to manage the applicant's emergency response activities. The applicant's staffing levels would be adjusted to meet specific response team needs based on incident size, severity, and type of emergency. Local agencies and first responders would be trained on the applicant's final Emergency Response Plan and could fill roles during a coordinated response effort.

2.7 Decommissioning

Project decommissioning practices would be similar for all route alternatives.

The design life of the project is 25 years. However, the anticipated physical life would likely extend beyond this time. Should the project reach the end of its economic or physical life, it would be decommissioned as described in the applicant's decommissioning plan.

The decommissioning plan, submitted with the applicant's routing permit application, provides a description of the decommissioning process, risks, and estimated costs. The applicant states that the decommissioning plan is intended and designed to minimize risks to public safety, the environment, and current and future land use. The applicant states that it would decommission the project in accordance with industry standards, including ASME B31.4.

The decommissioning process calls for abandoning the pipeline in place and removing all capture facility components and aboveground associated facilities, including access roads. The applicant might abandon some portions of the pipeline by removal, depending on landowner agreements and local authority requirements.

Prior to beginning decommissioning, the project would be isolated from the larger CO_2 system using existing MLVs. Once isolated, the project would be depressurized. Because CO_2 is itself an inert gas, purging with another inert gas, such as nitrogen, would not be necessary. Electrical connections would be de-energized, locked out, and tagged out.

The applicant would coordinate with the ethanol plant to determine the schedule and extent of the capture facility equipment removal. For purposes of this EIS, it is assumed that all the capture facility equipment and appurtenances would be removed, including piping, blowers, scrubbers, compressors, coolers, dehydrator, pump, and launcher.

The applicant would remove all pipeline surface appurtenances (for example, MLVs, aboveground portions of the cathodic protection system) from the operational ROW and would properly dispose of all materials. The pipeline would be cut at 54 inches or lower below ground surface in multiple locations, depending on final engineering design. The cut pipeline would then be capped or grouted with cement for segmentation. The cathodic protection system would be turned off, and the above grade facilities associated with the cathodic protection system and AC/DC mitigation equipment would be removed. Electrical service equipment such as utility connections or batteries would be removed from the site. Equipment that is no longer fit for service would be disposed of through regional salvage or disposal companies.

The BMPs in the applicant's Minnesota ECP and Minnesota APP would be applied during decommissioning.

Following decommissioning, pipeline segments abandoned in place would degrade over time and could serve as potential conduits for groundwater or cause minor subsidence when they collapse.

2.8 Cost and Accessibility

As of October 2023, the total engineering cost estimate for the project is $66.75 million. **Table 2-3** provides the applicant's cost estimates for construction of the pipeline and the capture facility. These estimates are engineering estimates and are anticipated to reflect actual costs within 15 percent.

Table 2-3 Engineering Cost Estimate

Work Item	Pipeline Cost[a] ($)	Capture Facility Cost[a] ($)
Planning/Permitting	2,500,000	500,000
ROW Acquisition	8,500,000	–
Engineering	500,000	1,750,000
Procurement	2,500,000	10,500,000
Construction	21,500,000	16,500,000
Closeout	1,500,000	1,000,000
Total	**37,000,000**	**29,750,000**

[a] Estimate accuracy: +/- 15%

2.9 Schedule

As of October 2023, the applicant proposes to construct the pipeline from March to July 2025, and to construct the capture facility from May to August 2025. The applicant states that it does not plan to construct the project during the winter.

[1] Scoping Environmental Assessment Worksheet (EAW) for the Otter Tail to Wilkins Carbon Dioxide Pipeline Project. April 11, 2023. https://eera.web.commerce.state.mn.us/eera/web/file-list/15002.

[2] PHMSA requirements for CO_2 and other liquid pipelines are found in 49 CFR Part 195, available at https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-D/part-195?toc=1.

Chapter 3 Regulatory Framework

Chapter 3 describes the necessary authorizations from the Commission, including the environmental review process, and highlights the criteria the Commission must consider when making a pipeline routing permit decision. This chapter also discusses required approvals from federal and state agencies, local units of government, and others with permitting authority for actions related to the project.

3.1 What Commission approvals are required?

A certificate of need is not required. A pipeline routing permit is required.

In Minnesota, no person may construct a "large energy facility" without a certificate of need from the Commission. The project does not meet this definition because it would not transport natural gas, synthetic gas, or any other energy source, and it is not more than 50 miles long in Minnesota.[1]

A routing permit is required for the project in accordance with Minnesota Statute 216G.02 because the pipeline is designed to operate at a pressure of more than 275 pounds per square inch (psi) and carry a gas. Minnesota Statue 216G.02 defines "gas" as "natural gas, flammable gas, carbon dioxide, gas that is toxic, or gas that is corrosive, regardless of whether the material has been compressed or cooled to a liquid or supercritical state."

Pipeline routing permit application content requirements and procedural rules are provided in Minnesota Rule 7852. A pipeline routing permit designates a route and anticipated alignment for the pipeline and the conditions for preparing the ROW, constructing the pipeline and associated facilities, and cleaning up and restoring the ROW, in addition to any other appropriate conditions relevant to minimizing human and environmental impacts. The Commission's website includes details regarding the pipeline routing permit process: https://mn.gov/puc/activities/energy-facilities/pipeline/route-permit/. Section 3.3 describes the criteria the Commission uses in issuing a routing permit. The Commission issued a sample routing permit for the project on January 18, 2023,[2] a copy of which is provided in **Appendix H**.

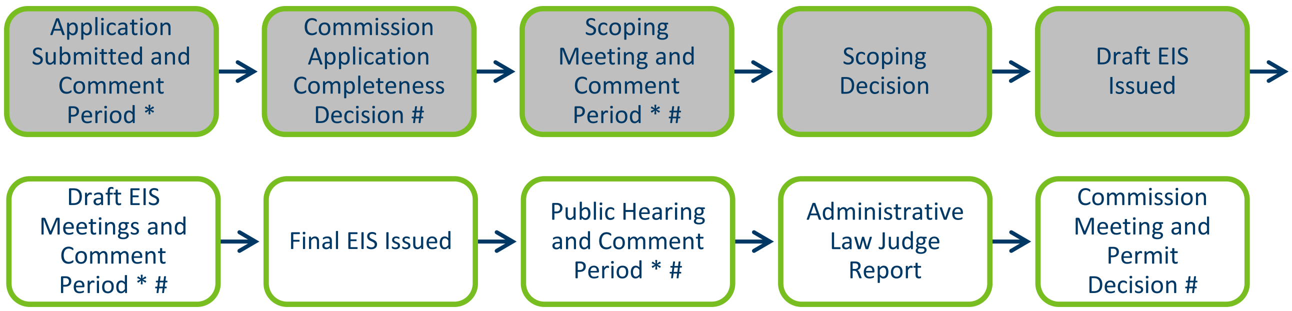
3.2 What is an environmental review?

Environmental review informs the Commission's pipeline routing permit decision. It calls attention to potential human and environmental impacts and possible mitigation measures associated with the project and provides opportunities for public involvement.

Potential human and environmental impacts must be analyzed before the Commission can decide whether to issue a pipeline routing permit. This process is called environmental review.

On February 6, 2023, the Commission ordered that an EIS pursuant to Minnesota Rule 4410 be completed for the project.[3] EERA staff is conducting the environmental review for the project on behalf of the Commission by preparing this draft EIS. As part of the review, public and evidentiary hearings are held and an ALJ report is prepared that includes findings of fact, conclusions of law, and recommendations. The Commission then considers the entirety of the record and holds a meeting to make a final decision regarding the routing permit application. **Figure 3-1** illustrates a simplified EIS process.

Figure 3-1 Summary of Environmental Review Process



Note: Shaded steps are complete; * = public comment opportunity; # = public meeting opportunity.

3.2.1 Scoping Process

Scoping is the first step in the environmental review process. It helped focus this EIS on the most relevant information needed by the Commission to make an informed pipeline routing permit decision.

EERA and Commission staff initiated the EIS scoping process on April 10, 2023, when the Commission filed a scoping EAW for the project pursuant to Minnesota Rule 4410.1400(B).[4] Commission staff sent notice to the project contact list.[5] The notice was available on the Minnesota Environmental Quality Board (EQB) and the Commission webpages on April 18, 2023.[6] The notice was published in the Wahpeton *Daily News* on April 18, 2023, and the Fergus Falls *Daily Journal* on April 19, 2023.[7]

A 30-day public comment period extended from April 18 to May 18, 2023, giving an opportunity for the public to provide comments identifying issues, mitigation measures, alternatives, and alternative routes and route segments for consideration in the scope of the EIS. During this period, EERA and Commission staff, accompanied by the applicant, held a total of three in-person public information and EIS scoping meetings: one on May 2 at 6:00 p.m. in Breckenridge, Minnesota; two on May 3 at 1:00 p.m. and 6:00 p.m. in Fergus Falls; and one virtual meeting held on May 4 at 6:00 p.m.

The purpose of the meetings was to provide information about the proposed project and the state's pipeline routing permit process, provide the public an opportunity to participate in developing the scope of the EIS, and answer questions. EERA, Commission, and applicant staff provided multiple handouts, including a process summary and comment form.[8] A court reporter was present to document the meeting presentations and public comments. A total of 37 commenters provided input at these meetings. In addition to the comments received at the public meetings, 119 commenters provided comments to EERA staff during the scoping period. Comments were received both for and against the project. Scoping comments are available to view or download on eDockets.[9]

3.2.2 Final Scoping Decision

The final scoping decision identified the topics studied in this EIS.

EERA staff provided a summary of the scoping process to the Commission and recommended a final scope for the EIS. The Commission concurred with the EERA staff's recommendations. On September 26, 2023, the Commission issued an Order approving the scope of the EIS.[10] In the Order, the Commission specifically requested that EERA staff coordinate with the Minnesota Office of Pipeline Safety along with other state agencies and Tribal governments to ensure that their expertise is reflected in the EIS and to ensure that the environmental review process benefits from their expertise. Comments received from the Tribes and agencies on a preliminary draft of this EIS are included in **Appendix J**.

On September 27, 2023, EERA staff filed the EIS preparation notice required under Minnesota Rule 4410.2100, subpart 9.[11] This notice was also published in the *EQB Monitor* on September 26, 2023;[12] the Wahpeton *Daily News* on September 26, 2023; and the Fergus Falls *Daily Journal* on September 27, 2023.[13] On October 6, 2023, EERA staff also sent a letter to newly affected landowners informing them that a route or route segment alternative identified in the Final Scoping Decision has the potential to impact their property.

3.2.3 Public Meetings and Hearings

Public meetings and public hearings will be held. You can provide comments at the meetings and hearings or submit written comments during the associated comment periods.

Minnesota Rule 4410.2600 describes the process and steps that will be taken during the public comment process. After the draft EIS is issued in January 2024, in-person and virtual public meetings will be held in February 2024, and a comment period will open to accept comments on the draft EIS. Prior to these public meetings, a notice will be issued indicating the place and time of each meeting. Interested parties will have the opportunity to speak, ask questions, and submit comments. EERA staff will respond to questions and collect comments about the draft EIS at the public meetings. EERA staff will also respond to timely substantive comments received during the comment period on the draft EIS, and those responses will be included in the final EIS. The final EIS is expected to be issued in spring 2024, and a comment period on the adequacy of the final EIS will follow. The Commission will hold a meeting on the adequacy of the EIS after the comment period has closed. The deadline for the Commission decision on the EIS adequacy is July 2, 2024.

After the public comment period on EIS adequacy closes, public and evidentiary hearings concerning the project will be held in late spring 2024, and a public comment period will open at this time. An ALJ will preside over the public hearings. Interested parties will have the opportunity to speak at the hearings, ask questions, and submit comments.[14] The ALJ will provide the Commission with a written report summarizing the public hearing and comment period, and any spoken or written comments received. Comments received during the public meetings and hearings, and the associated comment periods, become part of the project record. The ALJ will also provide the Commission with proposed findings and a recommendation whether to issue a routing permit in summer 2024. The record developed during the environmental review process—including all public input received during the public hearing and comment period—will be considered by the Commission when it makes a routing permit decision.

3.2.4 Commission Decision

The Commission will consider the entirety of the project record, including environmental review completed through the EIS process, and will determine whether to issue a pipeline routing permit. A pipeline routing permit decision for this project is anticipated in the third or fourth quarter 2024.

3.3 What criteria does the Commission use to make decisions?

The Commission will make a pipeline routing permit decision after the public and evidentiary hearings. Applicable Minnesota statutes and rules provide the criteria the Commission must consider when deciding to issue a pipeline routing permit.

The Commission's pipeline routing permit decision must be based on the public hearing record and made in accordance with Minnesota Rule 7852.1900, which states that the Commission shall consider the impact of the pipeline on the following:

A. human settlement, existence and density of populated areas, existing and planned future land use, and management plans;
B. the natural environment, public and designated lands, including but not limited to natural areas, wildlife habitat, water, and recreational lands;
C. lands of historical, archaeological, and cultural significance;
D. economies within the route, including agricultural, commercial or industrial, forestry, recreational, and mining operations;
E. pipeline cost and accessibility;
F. use of existing rights-of-way and right-of-way sharing or paralleling;
G. natural resources and features;
H. the extent to which human or environmental effects are subject to mitigation by regulatory control and by application of the permit conditions contained in [Minnesota Rule] 7852.3400 for pipeline right-of-way preparation, construction, cleanup, and restoration practices;
I. cumulative potential effects of related or anticipated future pipeline construction; and
J. the relevant applicable policies, rules, and regulations of other state and federal agencies, and local government land use laws including ordinances adopted under [Minnesota Statute] 299J.05, relating to the location, design, construction, or operation of the proposed pipeline and associated facilities.

"In determining the route of a proposed pipeline, the Commission shall consider the characteristics, the potential impacts, and methods to minimize or mitigate the potential impacts of all proposed routes so that it may select a route that minimizes human and environmental impact."[15] The "'environment' means physical conditions existing in the area that may be affected by a proposed pipeline and associated facilities. It includes land, air, water, minerals, flora, fauna, ambient noise, energy resources, natural features, or artifacts of historic, archaeological, geologic, or aesthetic significance."[16] The Commission shall make a specific written finding with respect to each of the criteria.[17]

3.4 What does the Commission approve?

If the Commission decides to issue a routing permit for the project, it will include approval for the pipeline route, and construction and operation of the project.

If the Commission decides to issue a pipeline routing permit for the construction of a pipeline and associated facilities, the Commission will designate "a route for the pipeline type and maximum size specified in the application, conditions for right-of-way preparation, construction, cleanup, and restoration."[18] A "'route' means the proposed location of a pipeline between two end points. A route may have a variable width…up to 1.25 miles."[19]

The pipeline routing permit would also include approval of an anticipated alignment and would authorize the permittee to obtain an operational ROW (also referred to as the permanent ROW). ROW "means the interest in real property used or proposed to be used within a route to accommodate a pipeline and associated facilities."[20]

The pipeline routing permit can also include approval of temporary construction ROW or workspaces that might be needed to construct a project, which can extend outside of the operational ROW. These features are shown schematically in **Figure 3-2**.

Figure 3-2 Hypothetical Route Width, Construction Workspace, and Right-of-Way Illustration

3.5 Can the applicant use eminent domain?

No, the applicant cannot exercise the power of eminent domain for the project.

3.6 How is the project regulated by PHMSA? What is PHMSA's role?

The project is regulated by PHMSA under 49 CFR Parts 190, 195-199 for engineering, design, construction, safety, and operation.

PHMSA is a federal agency within USDOT. PHMSA has statutory authority over CO_2 pipeline safety[21] and establishes federal regulations governing pipeline safety (see **Appendix G** for more detail). PHMSA announced in May 2022 that it was initiating rulemaking to update its CO_2 pipeline safety standards. PHMSA plans to publish a Notice of Proposed Rulemaking in June 2024 but has not set a date for a final rule.[22] While not yet formally published in the *Federal Register*, the Notice of Proposed Rulemaking was submitted to the Office of the Secretary of Transportation in December 2023, and approval of the notice from the Office of Management and Budget is anticipated on March 29, 2024.[23]

In its September 26, 2023, Order approving the scope of the EIS for the project, the Commission stated it shared concerns with commenters over pipeline safety and agreed that pipeline safety is of paramount importance.[24] The Commission noted that PHMSA is currently conducting rulemaking proceedings on proposed amendments to its pipeline safety rules.[25] The Commission stated that if PHMSA identifies any updated mitigation strategies or safety guidelines during the routing proceeding, it would be prudent for EERA staff and the applicant to take that information into account even if the updates have not been finalized as amended federal rules by the time the EIS is completed. As of January 12, 2024, no new information is available.

The Commission requested that EERA staff follow PHMSA rulemaking proceedings concerning CO_2 pipelines and include a discussion of mitigation strategies and measures to ensure public safety (to include, at a minimum, measures consistent with the most current proposed and final federal rules that are available at the time of EIS preparation and issuance). As noted above, the PHMSA Notice of Proposed Rulemaking for CO_2 pipelines is expected to be published in the *Federal Register* in 2024.[26]

3.7 Are other permits or approvals required?

Yes, other permits and approvals would be required for the project.

The issuance of a pipeline routing permit is the only Commission approval required to construct the project. The pipeline routing permit supersedes and preempts all zoning, building, or land use rules, regulations, or ordinances promulgated by regional, county, local, or special purpose governments;[27] that is, the Commission's pipeline routing permit determines where a pipeline would be located. However, the Commission can and does consider impacts on zoning and land use when reviewing routing permit applications.

Various federal, Tribal, state, and local approvals might be required for activities related to construction and operation of the project. These subsequent permits (commonly referred to as "downstream" permits) must be obtained prior to construction.[28] **Table 3-1, Table 3-2**, and **Table 3-3** list permits, approvals, and consultations that might be required for the project pipeline facilities and describes applicable agency role(s). The applicant would be responsible for obtaining and complying with all permits and approvals required to construct and operate the project regardless of whether they appear in these tables.

Table 3-1 Potential Federal Permits, Approvals, and Consultations – Pipeline Facilities

Agency	Type	Description
United States Army Corps of Engineers – St. Paul District	Section 404 Clean Water Act – Dredge and Fill	The United States Army Corps of Engineers (USACE) "regulates the discharge of dredged or fill material into waters of the United States, including wetlands."[29] Dredged or fill material, including material that moves from construction sites into these waters, could impact water quality. A permit is required from USACE if the potential for significant adverse impacts exists. USACE is also charged with coordinating with Native American Tribes regarding potential impacts on traditional cultural properties.
	Section 10 Rivers and Harbor Act	USACE regulates impacts on navigable waters and protects water quality through authorized crossings of navigable waters. Permit coverage is also required for trenchless crossings of Section 10 navigable waters.
	33 United States Code 408 (Section 408) Permission	Section 408 permission is required for the crossing of a USACE Civil Works project. Section 408 allows another party (such as a company or individual) to seek permission to alter a USACE Civil Works project.
United States Fish and Wildlife Service	Section 7 Threatened and Endangered Species Act consultation for federally listed threatened or endangered species	Consultation will occur with the United States Fish and Wildlife Service (USFWS) to determine whether any adverse impacts on federally listed species are anticipated or unavoidable because of a project, and to avoid, minimize, and mitigate impacts on federally listed species. Section 7 establishes conservation measures and authorizes, as needed, the take of federally protected species. A permit is required from USFWS for the incidental taking[30] of any threatened or endangered species or destruction or adverse modification to designated critical habitat.
United States Department of Transportation	Highway Crossing Permit	The United States Department of Transportation regulates crossings of federal highways through issuance of a Highway Crossing Permit.

Table 3-2 Potential State Permits, Approvals, and Consultations – Pipeline Facilities

Agency	Type	Description
Public Utilities Commission	Pipeline routing permit	A pipeline routing permit is required from the Public Utilities Commission for approval of the pipeline route, as well as construction and operation of the project, including approval of a defined ROW in which the proposed pipeline project would be located and also temporary construction areas (or workspaces) that might be needed to construct a project.
Department of Public Safety – Office of Pipeline Safety	Operational pipeline infrastructure safety standards	The Minnesota Office of Pipeline Safety (MNOPS) acts as a regulatory agency ensuring that Minnesota's pipeline infrastructure is in compliance with applicable pipeline safety standards. Although no permits will be issued for this project by MNOPS, MNOPS maintains an agreement with PHMSA annually to inspect interstate pipelines as requested.
Department of Natural Resources	Public Waters Work Permit – Public Water Wetlands on Private Lands	Potential impacts on state lands and waters, as well as fish and wildlife resources, are regulated by the Department of Natural Resources. Licenses are required to cross state lands or waters.[31] Projects affecting the course, current, or cross-section of lakes, wetlands, and streams that are public waters might require a Public Waters Work Permit.[32] This permit protects water quality and quantity through authorized work in public water wetlands.
	Utility License to Cross Public Waters	A Utility License to Cross Public Waters protects water quality and quantity through authorized crossings of public water.
	Water Appropriation Permit for Trench Dewatering	This permit protects water quality and quantity through authorized trench dewatering activities.
	Water Appropriation Permit for HDD/Hydrostatic Testing	This permit protects water quality and quantity through authorized HDD/hydrostatic testing.
	Water Appropriation Permit for Dust Suppression	This permit protects water quality and quantity through authorized dust suppression activities.
	Natural Heritage Information System (NHIS) consultation; NHIS Review and Avoidance Plan	NHIS consultation will occur to protect state rare plants, animals, native plant communities, and other rare features.

Agency	Type	Description
Pollution Control Agency	Section 401 Water Quality Certification	The Pollution Control Agency (MPCA) regulates various water resources within the state, as described here. Section 401 Water Quality Certification protects water quality by applying state water quality standards to projects.
	Individual National Pollutant Discharge Elimination System (NPDES) / State Disposal System (SDS) Permit – Hydrostatic Testing	This permit protects water quality through regulation of water treatment and disposal systems.
	NPDES/SDS Construction Stormwater Permit (CSW Permit) – Pipeline (General Permit MNR100001)	The CSW Permit protects water quality from pollutants associated with construction activities through authorized discharge. Construction projects that disturb 1 acre or more of land require a general CSW Permit from MPCA. This permit is issued to "construction site owners and their operators to prevent stormwater pollution during and after construction."[33] The CSW Permit requires use of BMPs; development of a Stormwater Pollution Prevention Plan; and adequate stormwater treatment capacity once the project is complete. Projects with net increases of 1 acre or more to impervious surface must be designed so that stormwater discharged after construction does not violate state water quality standards.
Department of Agriculture	Minnesota Agricultural Protection Plan	The Department of Agriculture (MDA), Agricultural Marketing and Development Division assists farmers, ranchers, and agribusinesses in adopting practices and technologies to address current challenges and global issues. The Minnesota Agricultural Protection Plan protects wetlands, waterbodies, and agricultural areas through BMPs to mitigate and minimize construction impacts. It also assists in developing the project Agricultural Impact Mitigation Plan. MDA comments and advises on development of the required Agricultural Impact Mitigation Plan for a project.

Agency	Type	Description
State Historic Preservation Office and Office of the State Archaeologist	Minnesota Statutes Chapter 138 (Minnesota Field Archaeology Act and Minnesota Historic Sites Act)	The State Historic Preservation Office (SHPO) and Office of the State Archaeologist are charged with preserving and protecting cultural resources within the state. Consultation with SHPO is completed to review potential impacts on properties listed in the National or State Register of Historic Places, or State Historic Sites Network. Consultation with SHPO and the Office of the State Archaeologist is completed if a project has the potential to impact known or suspected archaeological sites. The consultation aids in determining strategies to avoid, minimize, or mitigate such impacts. Additionally, SHPO is charged with preserving and protecting national historic properties (properties listed in or eligible for listing in the National Register of Historic Places). If applicable, the federal agency providing the permit or approval consults with SHPO pursuant to Section 106 of the National Historic Preservation Act to identify historic properties and to avoid or minimize impacts on these resources. There may also be consultation with Tribes or the Tribal Historic Preservation Office, facilitated by SHPO.
Department of Transportation	Utility Accommodation on Trunk Highway Right of Way and Miscellaneous Work on Trunk Highway Right of Way Permits	A permit from the Minnesota Department of Transportation is required for construction, placement, or maintenance of utility lines adjacent to or across state roads/trunk highway ROW.[34] Coordination would be required to construct access roads or driveways from trunk highways.[35] These permits are required to ensure that use of the ROW does not interfere with free and safe flow of traffic, among other reasons.[36]
Department of Labor and Industry	Electrical permitting	The Minnesota Department of Labor and Industry requires permits for electrical work in the state to ensure that projects meet minimum safety requirements.
Board of Water and Soil Resources	Notification of Use of the Utilities Exemption	The Board of Water and Soil Resources oversees implementation of Minnesota's Wetland Conservation Act. The Wetland Conservation Act is implemented by local government units. The Notification of Use of the Utilities Exemption allows utility projects to impact wetlands without replacement if impacts are less than 0.5 acre and overall impacts are minimized.

Table 3-3 Potential Local Permits, Approvals, and Consultations – Pipeline Facilities

Agency	Type	Description
Wilkin County	Floodplain Permit	This permit ensures adequate consideration of portions of the project that would be constructed within designated floodplains.
Otter Tail County	Ditch Crossing Permit	This permit protects drainage systems by authorizing ditch crossings.
County and Township	Road Crossing Coordination	Collaboration and consultation will be required with counties and townships within which roads will be crossed by a project. This coordination authorizes crossings of county- and township-owned roads.
County and Township	Overweight/Oversize Loads	Coordination and approval might be required to move overweight and/or oversize loads on county or township roads.
Bois de Sioux and Buffalo Red River Watershed Districts	Watershed District/Drainage Permits	Construction activities might cause discharge into water belonging to the Bois de Sioux and the Buffalo Red River Watershed Districts. Prior to construction, a permit must be obtained from each watershed affected in order to protect water quality and quantity from pollutants. These permits protect water quality and quantity of specific rivers from pollutants associated with construction activities through authorized discharge.

Table 3-4 lists permits and approvals that might be required for the capture facility proposed at the ethanol plant. The applicant would be responsible for obtaining and complying with all permits and approvals required to construct and operate the project regardless of whether they appear in this table.

Table 3-4 Potential Permits and Approvals Required – Capture Facility

Agency	Type	Description
	State	
Pollution Control Agency	Air Quality Permit Applicability Determination	This determines which air quality permits the project needs. It is required to determine whether the capture facility and the ethanol plant will be considered a single source with respect to air permitting, and to determine whether the capture facility is required to obtain an air quality permit.

Agency	Type	Description
	Air Quality Permit – Option D Registration Permit	This permit protects air quality by authorizing emissions and is required for projects with potential emissions above certain thresholds or subject to certain regulation.
	Construction Stormwater NPDES General Permit (MNR10000)	This permit protects water quality from pollutants associated with construction activities through authorized discharge. It is required for projects with at least 1 acre of ground disturbance.
	Industrial Stormwater NPDES General Permit MNR050000 (new or modification of existing ethanol facility coverage)	This permit protects water quality by monitoring and managing stormwater on properties where stormwater might contact harmful pollutants. It is required for discharge of stormwater from various sectors of industrial activities.
	Individual Industrial Wastewater NPDES Permit (modification of existing discharge ethanol facility permits, or stand-alone new permit)	This permit protects water quality by regulating a treatment and disposal system that discharges pollutants into surface water. It is required for discharge of industrial wastewater to waters of the state.
Department of Natural Resources	Water Appropriation Permit	This permit protects water quality and quantity through authorized water use activities. It is required for use of water in excess of regulatory thresholds.
Department of Labor and Industry	Electrical permitting	Electrical permitting ensures that the capture facility meets minimum safety requirements.
Local		
Otter Tail County	Building/Structure Permit	This permit ensures that the construction of the capture facility meets minimum safety and aesthetic requirements.

[1] Minn. Stat. 216B.2421, subd. 2.

[2] Commission. January 18, 2023. Sample Pipeline Routing Permit. eDockets No. 20231-192263-01.

[3] Commission. February 6, 2023. *Order Accepting Application, Requiring Environmental Impact Statement, and Denying Petition; Notice of and Order for Hearing*. eDockets No. 20232-192950-01.

[4] Commission. April 10, 2023. Otter Tail to Wilkin Scoping Environmental Assessment Worksheet. eDockets Nos. 20234-194669-01, 20234-194669-02, 20234-194669-03, 20234-194669-04, 20234-194669-05, 20234-194669-06, 20234-194669-07, 20234-194669-08, 20234-194669-09, 20234-194669-10, 20234-194670-01, and 20234-194670-02.

[5] On April 18, 2023, Commission staff filed Notice of Application Acceptance, Public Information and Scoping Meetings, and Availability of Scoping EAW and Draft Scoping Decision to eDockets.

[6] Minnesota Environmental Quality Board. April 18, 2023. Otter Tail to Wilkin Carbon Dioxide Project: EIS Scoping EAW and Draft Scoping Decision. Minnesota Environmental Quality Board (state.mn.us); Minnesota Public Utilities Commission. April 18, 2023. Carbon Pipelines: Otter Tail to Wilkin Carbon Dioxide Pipeline. Carbon Pipelines / Public Utilities (mn.gov)

[7] Public Utilities Commission. Affidavit of Publication – Scoping Meeting Affidavit. eDockets No. 20234-195360-01, and Public Utilities Commission. Affidavit of Publication – Scoping Meeting Affidavit. eDockets No. 20234-195360-02.

[8] Public Utilities Commission. May 2, 2023. Public Information and Scoping Meeting Handouts. eDockets No. 20235-195493-01.

[9] Department of Commerce. August 2, 2023. Scoping Summary. eDockets Nos. 20238-197948-01, 20238-197948-02, 20238-197948-03, 20238-197948-04, 20238-197948-05, and 20238-197948-06.

[10] Commission. September 26, 2023. *Order Approving Scope of Environmental Review and Denying Stay*. eDockets No. 20239-199149-01.

[11] Department of Commerce. December 22, 2023. Other – Notice of Environmental Impact Statement Preparation. eDockets No. 202312-201500-01.

[12] Department of Commerce. September 27, 2023. Other – EIS Prep Notice. eDockets No. 20239-199177-01.

[13] Department of Commerce. December 22, 2023. Confirmation of newspaper publication of the Notice of Environmental Impact Statement Preparation. eDockets No. 202312-201500-01.

[14] Minn. R. 216G.02, subp. 3.

[15] Minn. R. 7852.1900, subp. 2.

[16] Minn. R. 7852.0100, subp. 13.

[17] Minn. R. 7852.1900, subp. 1.

[18] Minn. R. 7852.3200, subp 1.

[19] Minn. R. 7852.0100, subp. 31.

[20] Minn. R. 7852.0100, subp. 30.

[21] 49 CFR Parts 190, 195–199, see eCFR :: 49 CFR Part 190 -- Pipeline Safety Enforcement and Regulatory Procedures

[22] PHMSA. 2023. *PHMSA Announces New Safety Measures to Protect Americans From Carbon Dioxide Pipeline Failures After Satartia, MS Leak*. May 26. Accessed November 2023. https://www.phmsa.dot.gov/news/phmsa-announces-new-safety-measures-protect-americans-carbon-dioxide-pipeline-failures.

[23] PHMSA. 2023. *Protecting Our Infrastructure of Pipelines and Enhancing Safety Act of 2020 Web Chart*. December. Accessed December 28, 2023. https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2023-12/2023%20December%20PIPES%20Act%20Chart.pdf.

[24] Commission. September 26, 2023. *Order Approving Scope of Environmental Review and Denying Stay*. eDockets No. 20239-199149-01.

[25] Docket No. PHMSA–2023–0013; See Pipeline Safety: Carbon Dioxide Pipeline Safety Public Meeting | PHMSA (dot.gov) (accessed Oct. 26, 2023), and PHMSA Public Meetings and Documents: CO_2 Safety Public Meeting 2023 (dot.gov) (accessed Nov. 6, 2023).

[26] PHMSA. 2023. *PHMSA Announces New Safety Measures to Protect Americans From Carbon Dioxide Pipeline Failures After Satartia, MS Leak*. May 26. Accessed November 2023. https://www.phmsa.dot.gov/news/phmsa-announces-new-safety-measures-protect-americans-carbon-dioxide-pipeline-failures.

[27] Minn. Stat. 216G.02, subd. 4.

[28] Appendix H, Sample Route Permit, Section 4.5.2 (stating the permittee “shall obtain all required permits for the project and comply with the conditions of those permits”).

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[29] United States Environmental Protection Agency (October 27, 2015) Section 404 Permit Program. http://www.epa.gov/cwa-404/section-404-permit-program.

[30] 16 U.S.C. 1532(19) (defining "take" to mean to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct).

[31] Minn. Stat. 84.415.

[32] Department of Natural Resources. n.d. Requirements for Projects Involving Public Waters Work Permits. http://www.dnr.state.mn.us/waters/watermgmt_section/pwpermits/requirements.html.

[33] Pollution Control Agency. November 19, 2015. Stormwater Program for Construction Activity. http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/construction-stormwater/index.html.

[34] Minn. R. 8810.3300, subp. 1.

[35] Department of Transportation. n.d. Land Management. https://www.dot.state.mn.us/utility/forms.html.

[36] Department of Transportation. n.d. MnDOT Policies. http://www.dot.state.mn.us/policy/operations/op002.html.

Chapter 4 Alternatives

The Commission issued a final scoping decision that details the alternatives to be studied in this EIS. The scoping decision was based on public comment and identified the following alternatives:

- No action
- Alternative routes
- Alternative technologies
- Modified designs or layouts (pipe diameter)
- Modified scale or magnitude (reduced throughput)
- Alternatives incorporating reasonable mitigation measures

The scoping decision states that the EIS will analyze whether an alternative pipe diameter or reduced throughput "is feasible to the extent that it would result in a significant environmental benefit over the project." EERA staff, through its consultants, analyzed whether these alternatives are feasible and concluded that these alternatives would not result in a significant environmental benefit over the project. Therefore, the EIS does not study in detail a modified design or layout or a modified scale or magnitude.

The following sections describe each of these alternatives in more detail and explains why modified designs or layouts and modified scale or magnitude were not carried forward for detailed study in the EIS.

4.1 No Action Alternative

Under the no action alternative, the Commission would not issue a pipeline routing permit and the project would not be constructed. Impacts associated with construction and operation of the project would not occur. The following assumptions were used when analyzing the no action alternative:

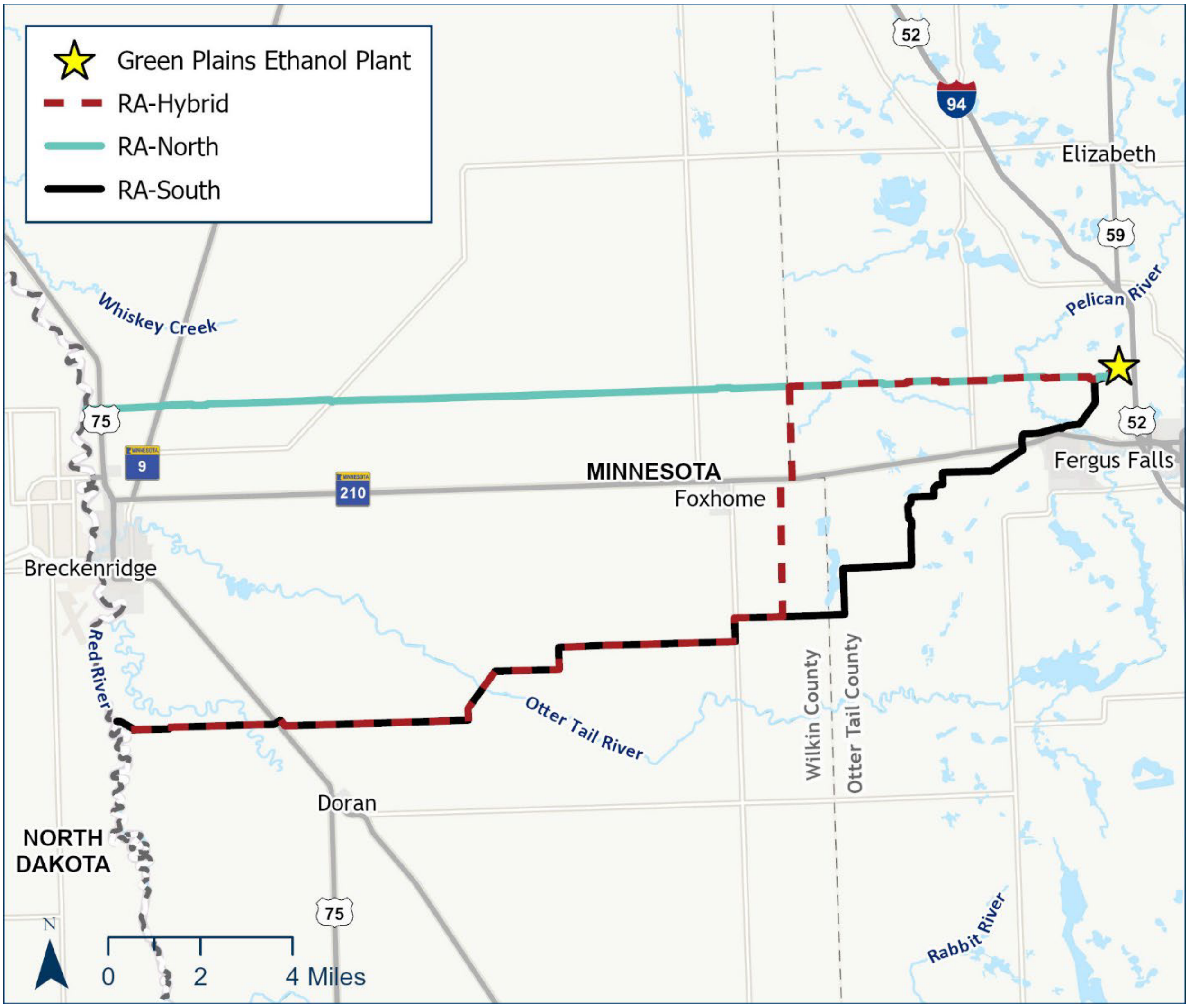
- The ethanol plant would continue to produce ethanol for the foreseeable future.
- The output of the ethanol plant could increase or decrease, or remain the same.
- Corn would continue to be the feedstock for the ethanol plant, as designed.
- The source of electricity provided by Lake Region Electric Cooperative is expected to shift toward including more renewable energy.

The effects of implementing the no action alternative as well as potential impacts are described in Chapter 7.

4.2 Alternative Routes

In addition to the applicant's proposed route, this EIS studies two alternative routes. An alternative route represents an alternative path for the pipeline between the ethanol plant and the Minnesota-North Dakota border near Breckenridge. The Commission is free to select any of these routes should it choose to issue a pipeline routing permit. Therefore, three alternative routes are studied in this EIS. These three alternative routes are shown in **Figure 4-1** and described below. Detailed route maps can be found in **Appendix B**. Potential impacts associated with these route alternatives are described in Chapter 5.

Figure 4-1 Proposed Alternatives



4.2.1 Route Alternative – North

Route Alternative – North (RA-North) is 23.0 miles long. RA-North starts at the ethanol plant, crosses Viking Trail Road, and travels west along County Road 116 to County Highway 11. Then RA-North follows 240th Street into Wilkin County where it turns into 320th Street before continuing to the Minnesota-North Dakota border.

As described in Section 1.2, the project would connect to a larger CO_2system called the MCE Project. RA-North would not connect to the applicant's proposed MCE Project route in North Dakota; however, the connection point remains undefined because the applicant has not obtained a permit for the pipeline in North Dakota.

4.2.2 Route Alternative – Hybrid

Route Alternative – Hybrid (RA-Hybrid) is 29.1 miles long. RA-Hybrid starts at the ethanol plant, crosses Viking Trail Road, and then travels west along County Road 116 and County Highway 11, continuing onto 240th Street. The route then turns south along 100th Avenue until turning west on State Highway 210, then turning south again along 330th Avenue. Continuing south, the route turns west at County Road 162, then south at County Road 19 before turning west again midway between County Roads 162 and 160. The route then turns south and travels west along County Road 160 before turning southwest toward County Road 158. The route continues west along County Road 158 to the Minnesota-North Dakota border.

4.2.3 Route Alternative – South, Applicant's Proposed Route

Route Alternative – South (RA-South) is 28.1 miles long. RA-South begins at the ethanol plant, crosses Viking Trail Road, and travels southwest, crossing County Road 210. The route continues southwest until turning west on County Road 162, then turns south on County Road 19 and west again midway between County Road 162 and 160. The route then continues southwest until turning west at County Road 158 and continuing along County Road 158 to the Minnesota-North Dakota border.

4.3 Alternative Technologies

The Commission identified two alternative technologies to be studied in the EIS: (1) a suite of agricultural practices and (2) a suite of energy use and efficiency changes. These technologies are not selectable alternatives but would aid the Commission's decision-making. These actions would be implemented by the ethanol plant and farmer producers.

The ethanol plant could require farmers selling corn as feedstock for ethanol production to implement certain agricultural practices, which could reduce the carbon intensity of the ethanol produced at the ethanol plant. These practices could include no-till/reduced tillage, cover cropping, fertilizer reduction, and retaining corn stover/residues. Avoiding emissions is functionally the same as capturing and permanently sequestering carbon that would otherwise be released to the air. These agricultural practices would reduce the carbon intensity of the ethanol produced.

The ethanol plant could also implement a suite of energy use and efficiency changes—alone or in combination with the suite of agricultural practices described above—that could reduce the carbon intensity of the ethanol produced at the ethanol plant to a level consistent with the project's purpose. Energy efficiency strategies could include insulating steam pipes, cleaning-in-place heat exchangers, tuning up boilers, using variable frequency drive for motors, using light emitting diode (LED) lighting, using alcohol mechanical vapor recompression, and using a low-pressure let-down steam turbine. Alternative energy sources for natural gas could include an anaerobic digester, synthetic methane, solar thermal, and electricity. Grid electricity alternatives could include on-site combined heat and power, on-site solar photovoltaics, on-site wind turbines, and a renewable power purchase agreement. An alternative energy source that could be used for both natural gas and grid electricity is geothermal. These energy use and efficiency changes would be undertaken by the ethanol plant itself and could be implemented by farmers selling corn to the ethanol plant.

These alternative technologies are analyzed in further detail in Chapter 6.

4.4 Modified Designs or Layouts

As directed by the scoping decision, EERA staff worked with the applicant to define an alternative pipeline diameter, consistent with PHMSA regulations, that could result in a significant environmental benefit over the proposed project. Staff considered a larger (6-inch) or smaller (3-inch) diameter pipeline.

The impacts of constructing a 6-inch-diameter or a 3-inch-diameter pipeline would be essentially the same as the impacts associated with constructing a 4-inch-diameter pipeline. Although a slightly shallower trench would be needed for the smaller pipeline and a slightly deeper trench would be needed for the larger pipeline, these differences would be negligible because there would be little difference in the depth of the trench and the volume of soil excavated. The duration of construction would be the same, and the construction workspace would be the same except for slight adjustments in the lengths of HDD boreholes. The operational ROW would be 50 feet wide for any of these pipeline diameters.

The operational parameters of a 6-inch-diameter pipeline would be substantially different than a 4-inch-diameter pipeline; however, the normal operating procedures would be the same. The design pressure (2,183 psi) would remain the same, but for a 6-inch-diameter pipeline, the operating pressure would be approximately 1,320 psi, compared to approximately 1,750 psi for a 4-inch-diameter pipeline. EERA staff, in consultation with its subcontractor Allied Solutions, Inc. (Allied), determined that at the design pressure, the impacted distance from the pipeline during a potential rupture would increase by approximately 33 percent if the diameter of the pipeline increases from 4 inches to 6 inches.

The operational parameters of a 3-inch-diameter pipeline also would be substantially different than a 4-inch-diameter pipeline. At the current design pressure, a 3-inch-diameter pipeline would not be capable of transporting the volume of CO_2 that would be captured at the ethanol plant. To transport the same volume of CO_2 from the ethanol plant, the design pressure would have to be greater than 3,200 psi for a 3-inch-diameter pipeline. EERA staff, in consultation with Allied, determined that at 3,200 psi the impacted distance from the pipeline during a potential rupture would decrease by approximately 24 percent if the diameter of the pipeline decreases from 4 inches to 3 inches.

In addition, in-line inspection technology, in other words, smart pigs, is not as well developed for pipelines less than 4 inches in diameter. Consequently, the pipeline industry typically has fewer options when choosing a smart pig for inspecting a pipeline less than 4 inches in diameter. Generally, at diameters less than 4 inches, there are greater challenges and risks associated with successfully passing inline inspection devices through the pipeline. The likelihood of a tool becoming stuck increases due to the geometry of the fittings and internal diameter changes associated with fittings, valves, and heavier walled pipe. Also, smart pig sensor coverage and battery life become more of an issue because of the need to put the same components in a smaller smart pig.

EERA staff concluded that an alternative pipeline diameter would not result in a significant environmental benefit over the proposed project, and diameters smaller than 4 inches would pose challenges for pipeline inspection. Therefore, this alternative is not analyzed further in the EIS.

4.5 Alternative Scale or Magnitude

As directed by the scoping decision, EERA staff worked with the applicant to determine if the throughput of CO_2 could be reduced to an extent that could result in a significant environmental benefit over the project, such as reducing the risks of a pipeline rupture.

Throughput, or volume of product being transported by a pipeline, is influenced by a number of factors including temperature, pressure, and the diameter and configuration of the pipeline. The throughput is limited by the maximum design capacity, which for the project as proposed by the applicant would be 0.25 MMTPA. The applicant plans a normal throughput for the pipeline of 0.19 MMTPA, which is the equivalent of 524 metric tons per day.

Reductions in throughput would not have any effect on pipeline construction activities, duration, or impacts. During project operation, there may be temporary reductions in throughput on the pipeline based on fluctuations in operations at the ethanol plant, such as temporary shutdowns for maintenance. However, the pipeline and associated equipment have been designed and sized to operate within optimized parameters. For example, a minimum throughput is needed to safely operate the pumps at the capture facility. If the throughput volume is reduced but still high enough for operation of the pumps, the operating pressure and product velocity would be reduced. If the throughput volume is reduced below the required volume for safe operation of the pumps, then the pipeline would be shut in, or isolated, and the MLV at the capture facility would be closed. During this shut-in period, there would still be CO_2 in the pipeline at a pressure typically above 1,200 psi.

Permanent reductions in throughput would result in changes in operational parameters that could impact the ability to safely operate the pipeline. Permanent reductions in throughput could also hamper the ability to perform in-line pipeline integrity inspections because the inspection tool could not move at its designed rate to optimally inspect the pipeline. Relative to the potential for a pipeline rupture, EERA staff, in consultation with Allied, determined that if the throughput is reduced by 75 percent, the impact distance from the pipeline during a potential rupture would decrease by only 3 percent. This is because the volume added via throughput is dwarfed by the volume already in a given valve segment. For instance, a 4-inch-diameter pipeline segment that is 13.9 miles long would be about 6,405 cubic feet in volume. Meanwhile, the throughput for that same pipeline segment would be about 706 cubic feet per hour based on operational data provided by the applicant. Therefore, in the time it would take for the valves to close in case of an emergency (25 minutes according to the applicant), the throughput volume would be equal to about 5 percent of the volume already in the 13.9-mile-long pipeline segment. Because the throughput volume is so small compared to the valve segment volume, changes in throughput velocity have a limited impact on the potential rupture release volume. Furthermore, the likelihood of a rupture happening would not decrease with a decreased throughput.

If a section of pipeline is pressured down to the point where the CO_2 vaporizes, that section would need to be purged before operations could resume. If the operator were to pressure up a pipeline with vaporized CO_2 in it, the result would be a two-phase product—part gas and part liquid—which would pose problems for the operator because the CO_2 sequestration process requires supercritical CO_2 for injection, not a two-phase substance.

Based on these considerations, EERA staff determined that a reduced throughput would likely not have significant environmental benefit compared to the project as proposed and could affect the ability to safely operate and maintain the pipeline. Therefore, this alternative is not analyzed further in the EIS.

4.6 Alternatives Incorporating Reasonable Mitigation Measures

The EIS must address alternatives incorporating reasonable mitigation measures identified through comments received during comment periods.[1] Mitigation measures suggested by commenters during scoping are summarized as follows:

- The Department of Natural Resources (DNR) recommended using isolated dry trenching crossing methods on all stream crossings and installing the pipeline deep enough to prevent exposure over time. Exploratory borings should be conducted to characterize the shallow subsurface anywhere sheet piling would be used, and results should be submitted to DNR groundwater staff for evaluation. At a minimum, Pennsylvania standards for trench breaker placement should be used; trench breakers should be used at the entrance and exit of every waterbody regardless of slope, except for HDD crossings. DNR requested plans for wildlife escape routes from the pipe trench and for removing wildlife from the open trench, as well as limiting the length of time the trench is open. The Wildlife Action Network tool should be used for mitigation strategies. DNR requested a Vegetation Management Plan to address potential impacts related to pipeline construction, operation, and maintenance. The plan should discuss existing vegetation, reestablishment and restoration, seed mixes, noxious weeds and invasive species, herbicide use, sensitive plant communities, and other topics identified during coordination with the Vegetation Management Plan Working Group. DNR requested an assessment of additional shut-off valves to reduce the magnitude of fish or aquatic organism mortality associated with a CO_2 release into a waterbody.

- MPCA requested a discussion of alternative methods to be used instead of flowing (and nonflowing) open cuts such as the flume or dam and pump dry crossing methods. MPCA notes that Minnesota Statute 115.061, paragraph (a) requires recovery as rapidly and thoroughly as possible of discharges to a waterbody such as an inadvertent return of drilling fluid during an HDD. MPCA requested discussion of measures to prevent excessive crowning or subsidence over the pipeline, a requirement for a winter construction plan “at the front” of the project, clarification of whether independent environmental monitors would be required, and plans for excess soil and drilling fluid disposal.
- Measures that would be required by MnDOT at crossings of MnDOT ROW include meeting depth and casing requirements, restrictions on boring pit locations, avoiding intersections with other roads with MnDOT ROW, and setbacks for existing utilities and structures. The applicant should coordinate project construction activities, including plans for hauling oversized loads, with MnDOT staff and should stay current on MnDOT’s highway construction activities that could affect project construction.
- MDA stated that mitigation measures need to be required to minimize the potential impacts of any leak but did not identify specific mitigation measures.
- Clean Up the River Environment (CURE) suggested investigating the adequacy of the applicant’s proposed revegetation goal of 70 percent density compared to background and that revegetation goals be maintained for the life of the project.
- Relative to pipeline decommissioning, Bold Alliance suggested mitigation techniques from the Canadian Association of Petroleum Producers[2] that include, but are not limited to, hazardous materials mitigation, pipe removal, pipe filling, plug installation, ground stabilization, and temporary maintenance through cathodic protection and monitoring. Bold Alliance requested a discussion of mitigation options other than removal or abandonment in place, such as segmentation, filling with grout, and partial removal. Bold Alliance further suggested that landowners should have the power to select which mitigation options are appropriate for their lands.
- Commenter suggested installing MLVs at the Pelican River and burying the pipeline deeper than 4.5 feet so that it would be below the frost line and drain tiles.
- Commenter suggested including a permit condition to ensure that landowners are not by default liable for post-abandonment mitigation costs.
- Several commenters recommended measures related to public health and safety, including:
    - the applicant should provide landowners along the pipeline with education, pipeline markers, and instructions in case of rupture;

- the applicant should be required to obtain adequate insurance to cover all costs of a potential pipeline rupture;
- the pipeline should be routed more than 50 feet from residences to mitigate risks from a potential pipeline rupture;
- the pipeline should be buried deeper;
- there should be shut-off valves at every stream;
- redundant monitoring of the amount of moisture in the high pressure CO_2 is needed;
- the pipeline should be inspected with smart pigs at least annually;
- odorant should be added to the CO_2 in the pipeline;
- the Commission should require a detailed safety plan from the applicant and detailed plans on the type of system to be used to detect leaks.

Suggested mitigation measures are addressed in more detail in Chapter 5 under the relevant resource sections and in Chapter 8.

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[1] Minn. R. 4410.2300(G).

[2] Canadian Association of Petroleum Producers (CAPP). 1996. *Pipeline Abandonment, A Discussion Paper on Technical and Environmental Issues.* https://www.cer-rec.gc.ca/en/applications-hearings/pipeline-abandonment/pipelineabandonment-discussion-paper-technical-environmental-issues.html.

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Chapter 5 Potential Impacts and Mitigation for Alternative Routes

Chapter 5 defines how potential impacts and mitigative measures are described. It discusses the environmental setting, and highlights topics dismissed from detailed analysis. This chapter details potential human and environmental impacts and mitigative measures for the three route alternatives: RA-North, RA-Hybrid, and RA-South.

Potential impacts associated with pipeline removal would be similar to those described for construction because the removal is essentially pipeline installation in reverse order followed by restoration. Potential impacts for pipeline abandonment-in-place would be negligible, as described in Chapter 2. Operational impacts on all resources described in Chapter 5 would not occur once decommissioning of the project is complete.

5.1 Describing Potential Impacts

Potential impacts are measured on a qualitative scale based on an expected impact intensity level; the impact intensity level takes mitigation into account.

A potential impact is the anticipated change to an existing condition caused either directly or indirectly by the construction and operation of a proposed project. Potential impacts can be positive or negative and short- or long-term. Impacts vary in duration and size, by resource, and across locations. In certain circumstances, potential impacts can accumulate incrementally, meaning that impacts from the project would be in addition to on-the-ground impacts already occurring.

Direct impacts are caused by the proposed action and occur at the same time and place. An indirect impact is caused by the proposed action but is further removed in distance or occurs later in time. This EIS considers direct and indirect impacts that are reasonably foreseeable, which means a reasonable person would anticipate or predict the impact. Cumulative potential effects are the result of the impacts of the proposed action in addition to other projects in the environmentally relevant area. Cumulative impacts are analyzed in Chapter 10.

5.1.1 Potential Impacts and Mitigation

To provide appropriate context, the following terms and concepts are used to describe and analyze potential impacts:

- **Duration.** Impacts vary in length. Short-term impacts are generally associated with construction. Long-term impacts are associated with the operation of the project. Permanent impacts extend beyond project decommissioning and reclamation.
- **Size.** Impacts vary in size. To the extent possible, potential impacts are described quantitatively; for example, the number of impacted acres or the percentage of affected individuals in a population.
- **Uniqueness.** Resources are different. Common resources occur frequently, while uncommon resources are not ordinarily encountered.
- **Location.** Impacts are location dependent. For example, common resources in one location might be uncommon in another.

The context of an impact—in combination with its anticipated on-the-ground effect—is used to determine an impact intensity level, which can range from highly beneficial to highly harmful. Impact intensity levels are described using a qualitative scale, which is explained below. These terms are not intended as value judgments, but rather a means to ensure common understanding among readers and to compare potential impacts among alternatives. Impact intensity levels are as follows:

- **Negligible** impacts do not alter an existing resource condition or function and are generally not noticeable to an average observer. These short-term impacts affect common resources.
- **Minimal** impacts do not considerably alter an existing resource condition or function. Minimal impacts might, for some resources and at some locations, be noticeable to an average observer. These impacts generally affect common resources over the short- or long-term.
- **Moderate** impacts alter an existing resource condition or function and are generally noticeable to the average observer. Impacts might be spread out over a large area making them difficult to observe but can be estimated by modeling. Moderate impacts might be long-term or permanent to common resources, but generally short- to long-term to uncommon resources.
- **Significant** impacts alter an existing resource condition or function to the extent that the resource is impaired or cannot function. Significant impacts are likely noticeable or predictable to the average observer. Impacts might be spread out over a large area making them difficult to observe but can be estimated by modeling. Significant impacts can be of any duration and affect common or uncommon resources.

Also discussed are opportunities to mitigate potential impacts through **mitigation**. Mitigation means:

- avoiding impacts altogether by not undertaking a certain project or parts of a project;
- minimizing impacts by limiting the degree of magnitude of a project;
- rectifying impacts by repairing, rehabilitating, or restoring the affected environment;
- reducing or eliminating impacts over time by preservation and maintenance operations during the life of the project;
- compensating for impacts by replacing or providing substitute resources or environments; or
- reducing or avoiding impacts by implementing pollution prevention measures.

Some impacts can be avoided or minimized; some might be unavoidable but can be minimized; others might be unavoidable and unable to be minimized but can be rectified (corrected). The level at which an impact can be mitigated might change the impact intensity level.

When referring to construction practices or mitigation measures, this EIS uses the convention of describing these as actions by the applicant, even if the action would be carried out by the applicant's contractor.

5.1.2 Regions of Influence

Potential impacts on human and environmental resources are analyzed within specific geographic areas called regions of influence (ROI). The ROI is the geographic area where the project might exert some influence and is used as the basis for assessing potential impacts. ROIs vary by resource. As necessary, the EIS discusses potential impacts and mitigation measures beyond the identified ROI to provide appropriate context. Direct impacts within the ROI might cause indirect impacts outside the ROI.

This EIS uses the following ROIs:

- **Construction Workspace** – Includes the capture facility and workspaces required for the proposed pipeline. RA-South: as proposed by applicant; RA-North and RA-Hybrid: estimated, including valve locations and potential additional temporary workspace
- **Route Width** – RA-South: as proposed by applicant; RA-North and RA-Hybrid: 500 feet centered on the centerline with exceptions where more width would be needed for construction
- **Local Vicinity** – All route alternatives: area within 1,600 feet of the route width
- **Project Area** – All route alternatives: area within 1 mile of the route width
- **Otter Tail and Wilkin Counties**

The ROIs include the proposed CO_2 capture facility. **Table 5-1** summarizes the ROIs used in this EIS by resource element.

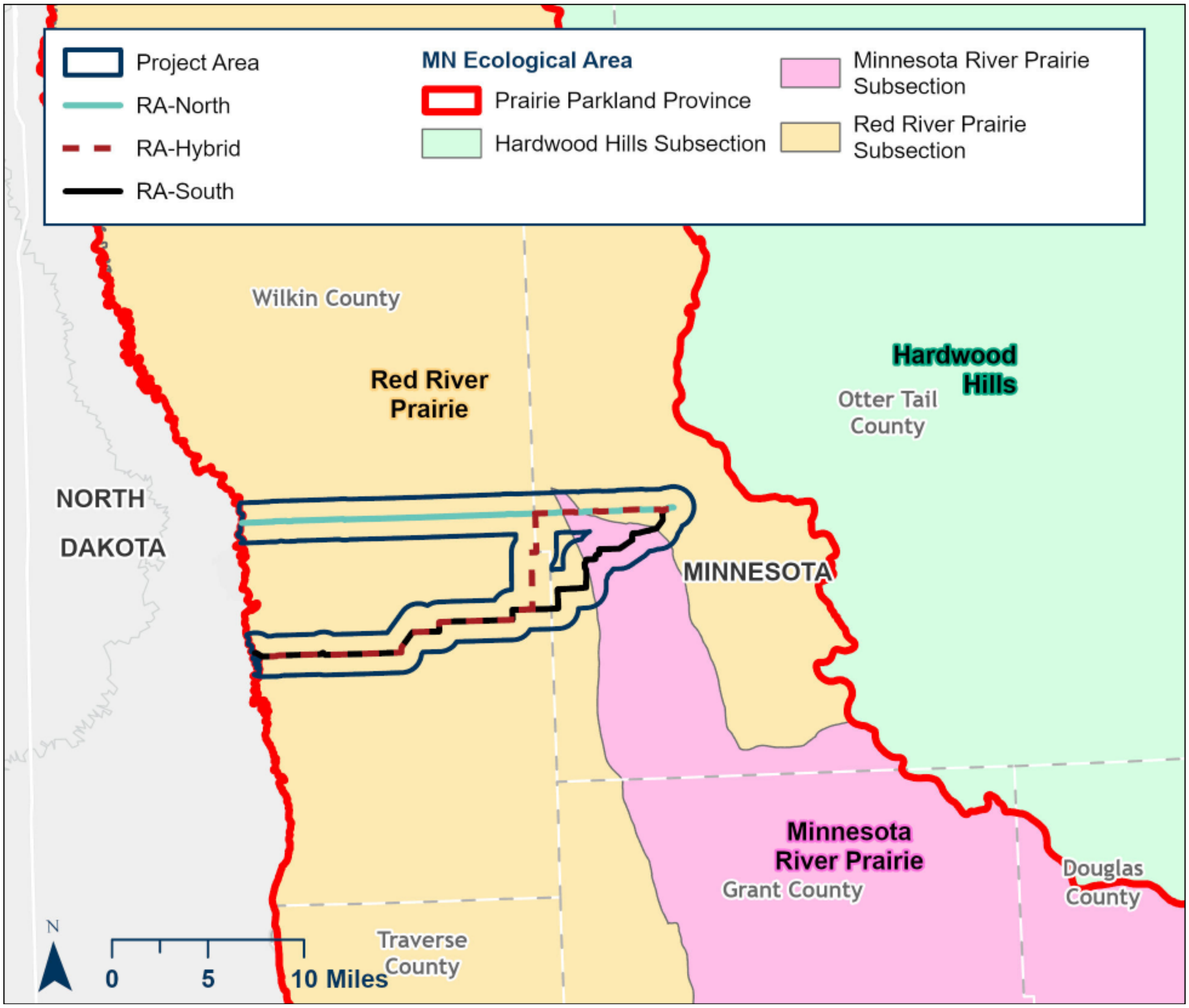
Table 5-1 Regions of Influence

Resource Type	Resource Element	Region of Influence
Human Settlement	Land Use and Zoning	Route Width
	Environmental Justice	Census Tracts crossed by the Route Width
	Aesthetics, Noise, Property Values, Recreation, Public Services, Populated Areas	Local Vicinity
	Cultural Resources, Tribal Treaty Rights	Project Area
	Public Health and Safety, Public Infrastructure, Socioeconomics	Otter Tail and Wilkin Counties
Land-based Economies	Agriculture, Commercial, Forestry, Industrial, Mining	Route Width
	Tourism	Local Vicinity
Archaeological and Historic Resources		Project Area
Natural Environment	Geology, Soils, Vegetation	Construction Workspace
	Public and Designated Lands, Floodplains, Wildlife and their Habitats	Route Width
	Rare and Unique Resources, Surface Waters, Groundwater	Project Area
	Air Quality, Climate Change	Otter Tail and Wilkin Counties

5.2 Environmental Setting

The environmental setting includes the geological and vegetative character of the landscape surrounding the project in addition to the built human environment. Route alternatives RA-North, RA-Hybrid, and RA-South all traverse Otter Tail and Wilkin Counties in western Minnesota. The counties intersect the Prairie Parkland Province and the Minnesota River Prairie and Red River Prairie subsections as defined by the DNR Ecological Classification System.[1] The provinces and subsections are shown in **Figure 5-1** and described below.

Figure 5-1 Minnesota Ecological Areas in the Vicinity of the Project



5.2.1 Prairie Parkland Province

The Prairie Parkland Province extends north to south across western Minnesota and stretches northwest into Manitoba, west into North Dakota and South Dakota, and south and southeast into Iowa and beyond, covering much of the midwestern United States. The province coincides with the portion of the state dominated by tallgrass prairie prior to European settlement and cultivation. Glacial ice crossed the province several times during the Wisconsin glaciation, heavily influencing the province's landscape by depositing a mantle drift 100 to 600 feet deep in most places. The province is also largely defined by the deep-water sediments deposited by Glacial Lake Agassiz at the northern end of the province, and by the Minnesota River valley that cut through the southern part of the province by Glacial River Warren. Both provincial geological features extend beyond Otter Tail and Wilkin Counties.[2]

5.2.2 Minnesota River Prairie Subsection

All route alternatives cross a small portion of the Minnesota River Prairie subsection at the subsection's northernmost tip. The subsection is bounded by large plains of glacial till flanking the Minnesota River and is largely characterized by 60 miles of gently rolling ground moraine. Shale, sandstone, and clay bedrock is topped by well to moderately drained loamy soils throughout most of the subsection.[3] Pre-European contact vegetation was largely tallgrass prairie with islands of wet prairie and forests along the Minnesota River. Agriculture is the dominant land use today, and small stands of remnant native tallgrass prairie can be found spotting the subsection.[4]

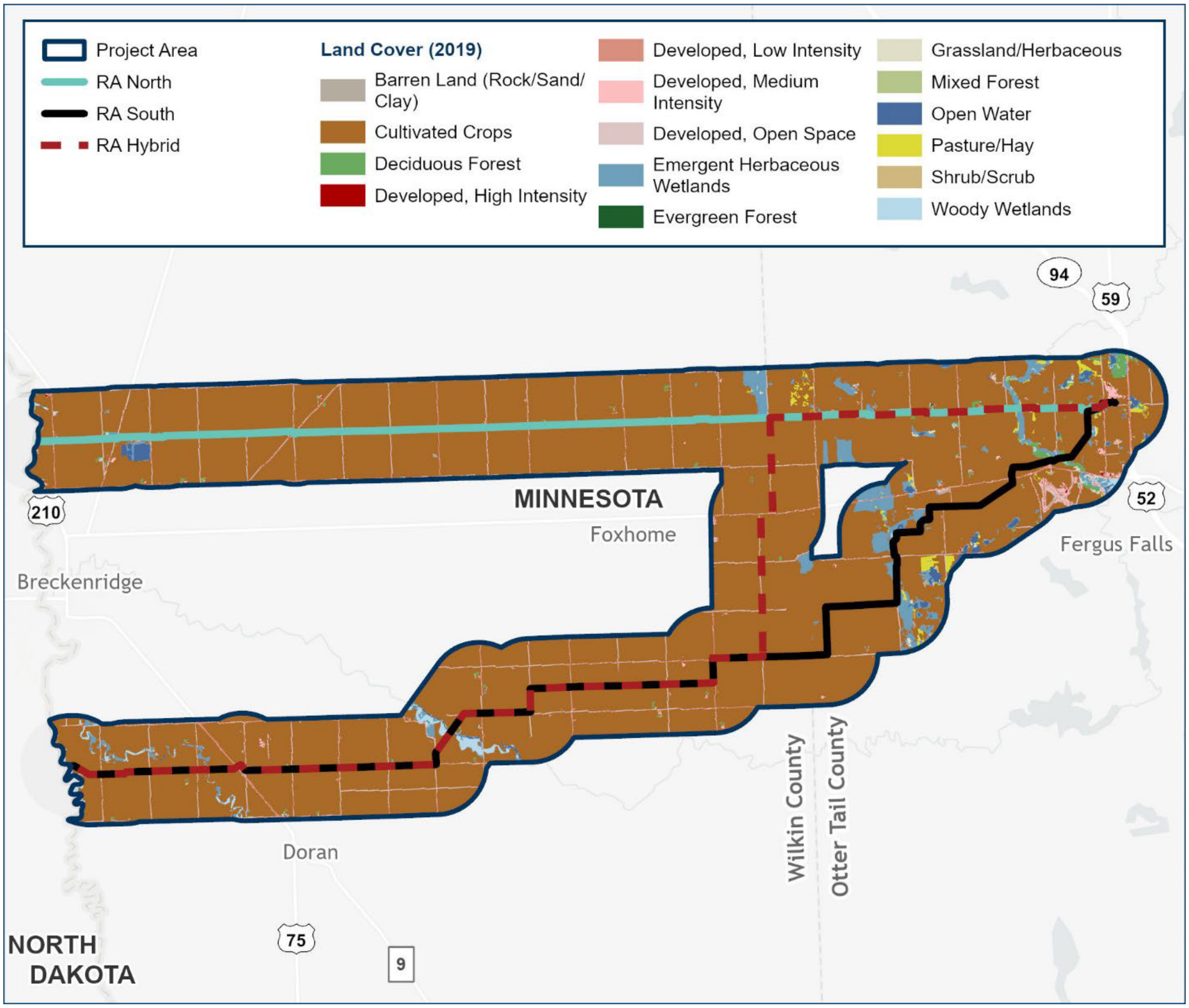
5.2.3 Red River Prairie Subsection

All route alternatives cross the Red River Prairie subsection toward the subsection's southern end. Most of the subsection to the north of the route alternatives is defined by the deep-lake deposits of Glacial Lake Agassiz. It includes poorly to moderately well drained silty, sandy, and clayey lacustrine deposits overlaying sedimentary bedrock. The major landform of the subsection and of the project area is the remaining large lake plain. Topography across the area is level to gently rolling. The subsection and its defining lake plain have been extensively ditched for agriculture with few small fragments of native prairie remaining.[5] Pre-European contact vegetation was largely composed of tallgrass prairie and wet prairie with narrow stretches of forest along streams and rivers.[6] Agriculture is the dominant land use today, and small stands of remnant native tallgrass prairie can be found spotting the area.[7] According to 2019 National Land Cover Database (NLCD) data,[8] land use is relatively consistent among the route alternatives and is mostly composed of cultivated land with some small, scattered sections of woody herbaceous wetland, pasture/hay field, deciduous forest, and few areas of developed spaces. The closest cities within Minnesota are Fergus Falls in Otter Tail County to the southeast of the capture facility, and Breckenridge in Wilkin County. Breckenridge is on the east side of the Red River and is south of the western end of RA-North and north of the western ends of RA-Hybrid and RA-South. The city of Wahpeton, North Dakota, is adjacent to Breckenridge on the west side of the Bois de Sioux River.

5.2.4 Project Area

Each route alternative would parallel existing road ROW, mostly through agricultural fields, and would occasionally cross agricultural fields, rivers, and the wetlands and wooded areas along river edges. All three routes cross the Pelican River at the eastern end of the project. The RA-Hybrid and RA-South routes cross the Otter Tail River toward the west-central end of the project. As shown in **Figure 5-2**, the NLCD classifies most land cover in the areas crossed by all three route alternatives as cultivated crops.

Figure 5-2 Land Cover Types in Project Area



5.3 Impacts Anticipated to be Negligible

Impacts for three resource categories—commercial economies, forestry, and mining—are expected to be negligible. The ROI for each of these resources is the local vicinity (area within 1,600 feet of the route width) for each route alternative.

Commercial economies include property used for businesses such as grocery stores, offices, and manufacturing shops. No commercial properties are located within the three route alternatives.

Forestry is defined as land used for forestry operations such as commercial timber harvest. The landowner list does not include commercial timber companies. No forestry operations are located within the ROIs for the three route alternatives. RA-North, RA-Hybrid, and RA-South do not cross significant forested areas. Thus, commercial timber harvest is not expected in the route width. The applicant indicates that landowners may keep any timber cut for clearing during construction, and easement agreements can compensate for impacts on personal use harvest of wood products. These agreements are outside the scope of this EIS.

Mining is defined as operations to obtain surface or subsurface minerals and aggregates. The Aggregate Source Information System maintained by MnDOT shows no aggregate sources along any of the proposed routes.[9]

5.4 Human Settlement

5.4.1 Aesthetics

The ROI for aesthetics is the local vicinity (area within 1,600 feet of the route width). Aesthetic impacts are subjective. Thus, potential impacts are unique to the individual and can vary widely. Potential impacts along each route alternative are expected to be minimal to moderate during construction. RA-North would have several more residents with at least a partial view of the construction workspace compared to RA-Hybrid. RA-South would have several fewer residents with at least a partial view of the construction workspace compared to RA-Hybrid. The pipeline would be underground and not visible during project operation. MLVs would create long-term aesthetic impacts within a small viewshed. The capture facility would be located at the ethanol plant and its impact would be incremental to the viewshed. Aesthetic impacts from project operation would be negligible to minimal, with no noticeable difference among the route alternatives.

5.4.1.1 Existing Conditions

Aesthetics refer to the visual quality of an area as perceived by a viewer and forms the impression a viewer has of an area. Aesthetics are subjective, meaning their relative value depends on the perception and philosophical or psychological responses unique to individuals. Impacts on aesthetics are equally subjective and depend on an individual's sensitivity and exposure. How an individual values aesthetics, as well as perceived impacts on a viewshed, can vary greatly.

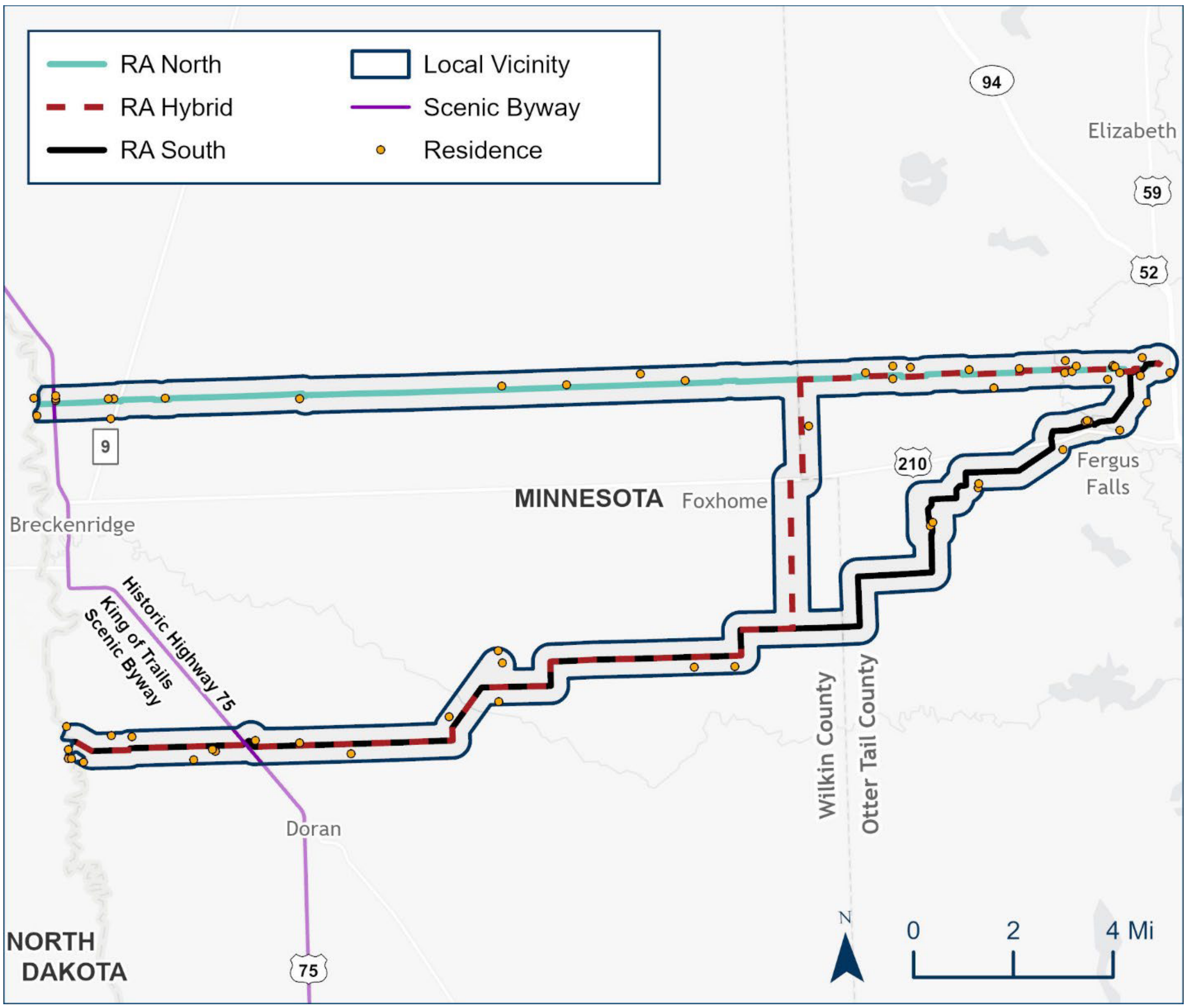
Viewer sensitivity is an individual's interest or concern for the quality of a viewshed and varies depending on the activity viewers are engaged in, their values and expectations related to the viewshed, and their level of concern for potential changes to the viewshed. Viewer exposure refers to variables associated with observing a viewshed and can include the number of viewers, frequency and duration of views, and view location. Viewer exposure would typically be highest for views experienced by high numbers of people, frequently, and for long periods. These variables, as well as other factors, such as viewing angle or time of day, all affect the aesthetic impact. Aesthetic impacts are subjective, unique to the individual, and can vary widely.

A viewshed includes the natural landscape and built features visible from a specific location. Natural landscapes include wetlands, surface waters, distinctive landforms, and vegetation patterns. Homes, businesses, roads, bridges, cell towers, and power lines are examples of built features. Generally, an intact and harmonious viewshed is considered by many to be more aesthetically pleasing.

Viewsheds within the local vicinity of each route alternative and the capture facility are defined largely by transportation and agriculture, with the majority of the viewshed within the local vicinity for all three route alternatives being composed of cultivated fields. Large sections of each route alternative would parallel existing road ROW. RA-North would parallel existing roadways along its entire route, except for the westernmost 0.3 mile where it crosses an agricultural field between US Highway 75 and the Red River at the Minnesota-North Dakota border. Both RA-Hybrid and RA-South would diverge from road ROW to cross agricultural fields at several locations before rejoining a different road ROW. All three route alternatives would cross the Pelican River near the eastern end of the project. RA-Hybrid and RA-South would cross the Otter Tail River toward the west-central end of the project. All three routes would cross one scenic byway, the historic US Highway 75 King of Trails Scenic Byway, in Wilkin County. All three routes would also cross historical trails to Abercrombie and Breckenridge.[10] There are no scenic overlooks, parks, trails, or documented cultural landscapes[11] within the local vicinity of the route alternatives.

No schools, churches, or similar gathering places are within the local vicinity of the route alternatives. There are 33 residences within the local vicinity of RA-North, 39 residences within the local vicinity of RA-Hybrid, and 34 residences within the local vicinity of RA-South. The locations of these residences, as well as the King of Trails Scenic Byway, are shown in **Figure 5-3**.

Figure 5-3 Residences and Scenic Byway within the Local Vicinity for each Route Alternative



5.4.1.2 Potential Impacts

Construction related aesthetic impacts would be short-term and primarily include vegetation removal, trenching, dirt piles, equipment laydown areas, increased traffic, and presence of construction vehicles, machinery, and equipment. These short-term visual impacts would be greatest for residents living within the local vicinity. Residents would likely be accustomed to seeing similar heavy equipment used for farming (tractors, combines, etc.) during agricultural operations. The route alternative with the most residences in the local vicinity is RA-Hybrid with 39 residences, followed by RA-South with 34 residences, and RA-North with 33. **Tables 5-6**, **5-7**, and **5-8** in Section 5.4.5 list the residences within the local vicinity and their distance from the pipeline centerline for each route.

Potential impacts along each route alternative are expected to be minimal to moderate during construction for those residents with at least partial visibility of the construction workspace. Construction related impacts would decrease greatly as segments are completed and restored. Impacts would generally be short-term and localized.

Based on review of satellite imagery, about 16 residences within the local vicinity of RA-North have vegetation, typically a shelter belt or wind break, that would block their view of the construction workspace, whereas 24 residences within each of the local vicinities for RA-Hybrid and RA-South would have their views of the construction workspace blocked by dense vegetation. The remaining residences along each alternative route would have at least partial visibility of short-term construction activities occurring near their residence. The approximate number of residences within the local vicinity with at least partial views would be 17 for RA-North, 15 for RA-Hybrid, and 10 for RA-South. Based on this desktop analysis, RA-South would have the fewest residents exposed to short-term construction related aesthetic impacts. However, impacts are expected to be short-term and minimal for all route alternatives.

All residents with homes located within the local vicinity for each route would likely see construction activities while driving to and from their residences. Limited removal of trees and shrubby vegetation would be required for pipeline installation and maintenance.

Construction activities would be visible for a short distance to travelers along the King of Trails Scenic Byway. All three route alternatives would use HDD technology to cross this highway. Travelers on the scenic byway would briefly see the drilling equipment and other construction activities at the pipeline crossing location. RA-Hybrid and RA-South would parallel the King of Trails Scenic Byway for about 0.15 mile, resulting in greater visual impacts during construction compared to RA-North. As shown in the maps in **Appendix B**, there are few trees and little shrubby vegetation within view of the scenic byway where it would be crossed by RA-Hybrid or RA-South. On RA-North, trees along the Red River may be visible from the scenic byway, but these trees would not be removed by the project because the Red River would be crossed using HDD methods.

After construction, the applicant would generally maintain the 50-foot-wide operational ROW over the pipeline by mowing and removing woody vegetation taller than 15 feet in non-cultivated areas. Exceptions include the area between HDD entry and exit points where the vegetation would not be maintained and at riparian buffers adjacent to waterbodies where only a 10-foot-wide corridor would be maintained. Travelers along the scenic byway could notice portions of the maintained operational ROW where it does not blend in with the surrounding vegetation. Because the surrounding area is largely farmland, the maintenance of an herbaceous state during operation would result in minimal impact.

Aesthetic impacts from project operation would be minimal. Because the capture facility would be located at the ethanol plant, it would not introduce a new visual element to the viewshed—its impact would be incremental. In the area of the capture facility, there are two houses within the local vicinity of the project, about 1,300 and 1,500 feet away. Views of the capture facility at both houses would be obstructed by shelter belts. Although the capture facility would be visible to travelers along 240th Street and 170th Avenue, it would generally blend with the existing industrial setting of the ethanol plant.

During project operation, the pipeline would be buried underground and not visible. Aboveground facilities along the length of the pipeline would include MLVs and both temporary and permanent access roads. The pipeline pig/inspection tool launcher would be located within the capture facility. The MLVs would be installed with minor aboveground components that would be about 9.5 feet tall. These features would create long-term aesthetic impacts within a small viewshed.

The nearest aboveground structure to the King of Trails Scenic Byway associated with RA-North would be an MLV over 1 mile east of the crossing. The nearest MLVs to the King of Trails Scenic Byway associated with RA-Hybrid and RA-South are over 2 miles away. Therefore, no aboveground facilities would be visible from the King of Trails Scenic Byway for any of the route alternatives.

Aesthetic views would be impacted by vegetation removal required for pipeline installation at various points along each route alternative. Vegetation in workspaces outside the operational pipeline easement would be allowed to grow back. Within the 50-foot-wide operational ROW, the applicant would maintain vegetation by mowing and trimming woody vegetation greater than 15 feet tall in areas outside of agricultural production.

Post-construction vegetation maintenance would be limited adjacent to waterbodies to promote the growth of the riparian buffer. At these locations, the applicant would limit vegetation maintenance along a 10-foot-wide corridor centered over the pipeline to facilitate visual inspection of the pipeline and allow for corrosion and leak surveys. Vegetation between HDD entry and exit points, which would not be cleared during construction, would not be cleared or mowed routinely during project operation. Therefore, visual impacts from vegetation clearing at the Pelican, Otter Tail, and Bois de Sioux Rivers would be minimized.

5.4.1.3 Mitigation

Commission Sample Routing Permit

The sample routing permit, provided in **Appendix H**, includes the following mitigation measures for aesthetics:

- “Care shall be used to preserve the natural landscape, minimize tree removal, and prevent any unnecessary destruction of the natural surroundings in the vicinity of all pipeline construction and restoration activities.”
- “The Permittee shall clear the permanent right-of-way and temporary right-of-way preserving to the maximum extent practicable windbreaks, shelterbelts, living snow fences, and vegetation in areas such as trail and stream crossings where vegetative screening may minimize aesthetic impacts, to the extent that such actions do not impact the safe operation, maintenance, and inspection of the pipeline and are in compliance with all applicable laws and regulations.”

Additionally, the routing permit states that “the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations.”

Applicant-Proposed Mitigation

The applicant proposes to use the HDD method to cross the Pelican River, Otter Tail River, Bois de Sioux River, and King of Trails Scenic Byway. Because vegetation would not be cleared between the HDD entry and exits, aesthetic impacts at these locations would be minimized.

No mitigation specific to aesthetics is proposed for the capture facility.

Mitigation Proposed During Scoping

No mitigation specific to aesthetics was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.4.2 Cultural Resources

The ROI for cultural resources is the project area (area within 1 mile of the route width), though this discussion also provides a greater context for Otter Tail and Wilkin Counties. Cultural resources contribute to the principles that form the foundation for community unity. These principles can pull from heritage, local resources, and common experiences/events and can include work and leisure pursuits, land use, Tribal identified cultural resources, and native Minnesota plants and wildlife of Tribal significance. Cultural resources impacts are subjective. Thus, potential impacts are unique to the individual or community and can vary widely. Agricultural operations, which can have contemporary cultural value, would be impacted temporarily along each of the route alternatives, but the project would not remove cultivated land from production. The project could temporarily impact hunting activities and the habitats of plants and wildlife of Tribal cultural interest during construction and until restoration of disturbed areas is complete. Overall, potential impacts on cultural resources during construction and operation of the project are anticipated to be minimal and would be similar for all route alternatives.

5.4.2.1 Existing Conditions

Cultural resources contribute to the principles that form the foundation for community unity. These principles can pull from heritage, local resources, and common experiences/events. The project area has been home to various peoples and cultures over time. During the period of European contact (1650 to 1837 AD) into the Post-Contact Period (1837 AD to Present), the Dakota people (historically known by Euro-American settlers as the Sioux) and the Ojibwe (historically known by Euro-American settlers as the Chippewa) occupied the land within the local vicinity of the project area. In the 1825 Treaty of Prairie du Chien,[12] the Ojibwe relinquished their claims to the area. The land was ceded by the Dakota in two 1851 treaties at Traverse des Sioux and Mendota (see Section 5.4.12).[13, 14]

According to the United States Department of Housing and Urban Development Tribal Directory Assessment Tool, contemporary Tribes with historic cultural interest or ancestral ties in the project area include the:

- Apache Tribe of Oklahoma;
- Cheyenne and Arapaho Tribes of Oklahoma;
- Flandreau Santee Sioux Tribe of South Dakota;
- Sisseton-Wahpeton Oyate of the Lake Traverse Reservation of South Dakota;
- Fort Belknap Indian Community of the Fort Belknap Reservation of Montana;
- Iowa Tribe of Kansas and Nebraska;
- Lac Vieux Desert Band of the Lake Superior Chippewa Indians of Michigan;
- Leech Lake Band of the Minnesota Chippewa Tribe;
- Lower Sioux Indian Community of Minnesota;

- Prairie Island Indian Community of Minnesota;
- Minnesota Chippewa Tribe;
- Menominee Indian Tribe of Wisconsin;
- Santee Sioux Nation of Nebraska;
- Sisseton-Wahpeton Oyate of the Lake Traverse Reservation of South Dakota.[15]

No contemporary or historic Tribally owned reservation or trust land bounds are located within Otter Tail and Wilkin Counties.[16] Bodies of water of Tribal significance include Otter Tail River, Otter Tail Lake, Bois de Sioux River, and Pelican River. These rivers and lakes are described by the Mille Lacs Band of Ojibwe using Ojibwe toponymy as follows. Otter Tail River is known in Ojibwe as Nigigwaanowe-ziibi (Otter Tail River) due to the long sandbar at the river's outlet into Otter Tail Lake, which results in Fergus Falls being called Nigigwaanowe gakaabikaans (Little falls of the Otter Tail), Bois de Sioux as Gaa-edawayi'ii-maamiwang-ziibi (River from which it [Lake Traverse] flows out from both ends) due to the lake's location within Glacial Lake Agassiz and now is a basin divide, and Pelican River as Zhede-zaaga'iganiwi-ziibi (River that of Pelican lake) due to Lakes Lizzie and Lida, known as Zhede-zaaga'igan aazhawaakwaa (Pelican lake beyond the woods) and Zhede-zaaga'igan (Pelican lake) respectively, being a habitat for American white pelican (*Pelecanus erythrorhynchos*).[17]

Native Minnesota plants of significance to Tribes can include northern white cedar, sugar maple, wild rice, sage, and sweetgrass. According to the United States Department of Agriculture (USDA) PLANTS database,[18] northern sweetgrass (*Hierochloe hirta*) and white sage (*Artemisia ludoviciana*) are native to both Otter Tail and Wilkin Counties, while northern white cedar (*Thuja occidentalis*) and sugar maple (*Acer saccharum*) are native only to Otter Tail County. There are a number of recorded wild rice lakes within Otter Tail County, though none are located within the project area.[19] There are no wild rice lakes in Wilkin County.[20] The project area is heavily cultivated with minimal intact areas of native prairie—habitat where sweetgrass and white sage might grow. See Sections 5.7.7 and 5.7.10 for further information on vegetation.

Native Minnesota wildlife of Tribal significance can include bison, deer, elk, moose, black bear, wolf, lynx, grouse, furbearing mammals, waterfowl, and various species of fish, depending on the region. During the Contact Period, European hunting and habitat conversion resulted in the loss of many species in this area. Today, no wild bison herds exist in Minnesota and no managed bison herds exist within the project area.[21] White-tailed deer (*Odocoileus virginianus*) are present within the project areas.[22] Elk (*Cervus canadensis*),[23] moose (*Alces alces*),[24] black bear (*Ursus americanus*),[25] gray wolf (*Canis lupus*),[26] and Canada lynx (*Lynx canadensis*)[27] no longer occur naturally within the project area. Sharp-tailed grouse (*Tympanuchus phasianellus*) and ruffed grouse (*Bonasa umbellus*) might occasionally be found within the project area.[28] Various species of seasonal waterfowl and fish might be found along the Pelican and Otter Tail Rivers, or in one of the several National Waterfowl Production Areas at the eastern end of the project area. Furbearing mammals can include mink (*Neovison vison*),[29] fisher (*Pekania pennanti*),[30] beaver (*Castor canadensis*),[31] river otter (*Lontra canadensis*),[32] and muskrat (*Ondatra zibethicus*).[33] All species, with the exception of the fisher, might be found along the riverbanks of the Pelican and Otter Tail Rivers, and possibly within the National Wildlife Production Areas to the eastern end of the project area. See Section 5.7.10 for further information on wildlife.

During the Contact Period, the first Europeans in Otter Tail and Wilkin Counties were French and British fur traders. By 1870, the European population was composed mostly of Norwegian, Swedish, German, and English settlers.[34] Later, as railroads were built through the counties, towns were built along the rail lines. Lumber and agriculture became the major industries of each county. Fergus Falls became the major lumber city of the area.

As wheat evolved into the dominant crop of the late 1800s, Otter Tail County became known for its milling. One of the most famous mills, Phelps Mill, has been preserved as part of a county park and is now a popular historic and recreation site.[35] Phelps Mill Park is located outside of the project area. Historic logging throughout both Otter Tail and Wilkin Counties largely cleared most wooded areas in both counties.

Today, agricultural land use comprises nearly all of Wilkin County and about half of Otter Tail County[36] (see Section 5.4.4 for more information on land usage within the route width). The contemporary cultural value of local agriculture is exhibited and celebrated at the Wilkin County Fair[37] and the East and West Otter Tail County fairs each year.[38]

Otter Tail County contains numerous outdoor community resources available to residents and visitors, such as a large chain of recreational boating and fishing lakes, three county parks (historic Fort Juelson Park, historic Phelps Mill Park, and the in-development Echo Bay Park), two county hiking trails (Glacial Edge Trail and Heart of the Lakes Trail),[39] the Fergus Falls Fish & Game Club's Orwell property, and two state parks (Maplewood State Park[40] and Glendalough State Park[41]). All of these community resources are located outside the project area, except for the Fergus Falls Fish & Game Club's Orwell property, which is within the route width for RA-South.

The City of Fergus Falls is the largest city within either county. The city supports an active art community with the local organizations and attractions of A Center for the Arts, Kaddatz Galleries, Kaddatz Artist Lofts, Springboard for the Arts, and the Lake Region Arts Council.[42] Major events in Fergus Falls include the annual Summerfest and the West Otter Tail County Fair.

Breckenridge is the largest city in Wilkin County and is directly across the Bois de Sioux River from Wahpeton, North Dakota. The city's Headwaters Park and Boat Landing and Welles Memorial Park mark the joining of the Bois de Sioux and Otter Tail Rivers to form the Red River. The Bois de Sioux Public Golf Course is known as the only public golf course in the United States to house nine holes in two different states. The Wilkin County Fair is held annually in Breckenridge.[43]

The highest employing industries in the region encompassing Otter Tail and Wilkin Counties are health care, manufacturing, retail, public administration, education, and accommodation and food services.[44] However, contemporary cultural resources are centered around the agricultural industry and the appreciation of the natural features of the region.

5.4.2.2 Potential Impacts

The value residents put on the character of the landscape within which they live is subjective, meaning its relative value depends upon the perception and philosophical or psychological responses unique to individuals. Because of this, construction of the project might—for some residents—change their perception of the area's character, thus potentially eroding their sense of place or connection to the landscape.

This tension between infrastructure projects and rural character creates real tradeoffs. Some stakeholders view the project as harmful or unhelpful (for example, "not proven to reduce emissions – small effect on global," "farmland takes more than 3 years to come back and is disruptive," "long-term impact on land, animals, water, and humans basically unknown").[45] Other stakeholders see it as beneficial (for example, environment and climate benefits [by reducing CO_2 emissions], decarbonizing/removing CO_2 and associated health benefits, local community and socioeconomic benefits, agriculture industry benefits). This document cannot resolve these issues but can acknowledge they exist.

This might be the case for the landowners directly within the construction ROW who are concerned about damage to their agricultural lands. The remaining resources defining the contemporary culture of the residents of Otter Tail and Wilkin Counties are located largely outside of the project area and would not be directly impacted by the project.

Potential impacts on cultural resources, including Tribal identified cultural resources and native Minnesota plants and wildlife of Tribal significance, within the project area for RA-North, RA-Hybrid, and RA-South would be similar for all three route alternatives. The project would temporarily impact the habitats of plants and wildlife of Tribal significance during construction until restoration of disturbed areas is complete. Land that would be affected within the construction ROW is mostly agricultural (see **Table 5-4** in Section 5.4.4) and would be limited to the temporary, direct impacts on agricultural lands within the construction ROW. The project is not anticipated to impact or alter the work and leisure pursuits or land use of residents within the project area of any route alternative in such a way as to impact the current underlying culture of the area. The project would impact agricultural operations temporarily, but because the project would not remove cultivated land from long-term production, no long-term impacts on agricultural activities are expected.

The project would impact hunting activities temporarily during construction, due to the removal of vegetation in construction workspaces and higher levels of noise from construction vehicles and equipment (see Section 5.4.5 for more details on noise). The project would not result in temporary closures of hunting areas. RA-South would pass through the Fergus Falls Fish & Game Club's Orwell property. The applicant would continue to communicate with the club to minimize visual and noise impacts during construction. The pipeline would be underground during operation and would not cause visual or noise impacts on hunting areas. Overall, impacts on hunting activities are anticipated to be short-term and minimal. Impacts on hunting are also influenced greatly by construction timing; that is, if construction overlaps an active hunting season.

5.4.2.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to cultural resources. The sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant has proposed mitigation for specific types of cultural resources, including agricultural, vegetation, and wildlife resources. See applicant-proposed mitigation for agricultural resources in Section 5.5.1, for vegetation in Section 5.7.7, and for wildlife in Section 5.7.10.

Mitigation Proposed During Scoping

No mitigation specific to cultural resources was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended. Recommended mitigation for agricultural lands is discussed in Section 5.5.1 and in Sections 5.7.7 and 5.7.10 for vegetation and wildlife and their habitats, respectively. Because minimal impacts on these types of cultural resources are anticipated, no further mitigation is recommended.

5.4.3 Environmental Justice

The ROI for environmental justice (EJ) includes the census tracts intersected by the route widths of the route alternatives. An EJ assessment identifies disadvantaged communities that have been historically marginalized and overburdened by pollution and evaluates if a project would disproportionally affect these communities. Census Tract 9609, which is in the ROI for all alternatives, was identified by the MPCA screening tool as an EJ area of concern. Potential impacts along each of the route alternatives are expected to be minimal for EJ communities during construction. Local roadways would experience a short-term minimal increase in traffic during construction activities. Construction would use HDD and boring techniques at road crossings to limit impacts on local traffic. Residents within Census Tract 9609 and the other census tracts crossed by the project might experience intermittent, short-term noise from construction equipment for up to 30 days. Operation of the capture facility and pipeline facilities would not generate noticeable noise. The project would not result in significant impacts on air quality during construction or operation. Overall, EJ impacts from construction and operation of the project would not result in disproportionate adverse impacts for EJ areas of concern within the ROI.

5.4.3.1 Minnesota Pollution Control Agency Areas of Concern

MPCA maintains the MPCA EJ Proximity Analysis Tool, which is an online mapping tool that "allows users to identify census tracts where additional consideration or effort is warranted to ensure meaningful community engagement and to evaluate the potential for disproportionate adverse impacts."[46]

This tool identifies EJ areas of concern using the following four criteria:

- At least 35 percent of people reported income less than 200 percent of the federal poverty level
- 40 percent or more minority population
- Federally recognized Tribal areas
- At least 40 percent of people have limited English proficiency

Using these criteria, Census Tract 9609 within Otter Tail County was identified as an MPCA EJ area of concern within the ROI because 43 percent of the population has a reported income that is less than 200 percent of the federal poverty level. The Council on Environmental Quality's Climate and Economic Justice Screening Tool also identified Census Tract 9609 as a disadvantaged community due to a legacy pollution and being above the 65th percentile for low income.[47] The legacy pollution for Census Tract 9609 is related to its proximity to Risk Management Plan facilities, which are located within 3.1 miles.[48] These facilities use extremely hazardous substances and are therefore required under the United States Environmental Protection Agency (EPA) Clean Air Act to develop a Risk Management Plan to identify the potential effects of a chemical accident, steps to prevent an accident, and emergency response procedures in case of an accident.[49]

5.4.3.2 Existing Conditions

EPA defines EJ as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income in the development, implementation, and enforcement of environmental laws, regulations, and policies," and the EPA's EJ guidelines are intended to ensure that all people benefit from equal levels of environmental protection and have the same opportunities to participate in decisions that might affect their environment or health.[50]

An important step in an EJ assessment is identifying whether an EJ community is present within the project's ROI. The term "environmental justice community" includes disadvantaged communities that have been historically marginalized and overburdened by pollution. Environmental justice areas of concern include, but may not be limited to, minority populations, low-income populations, or indigenous peoples.

EJScreen, an interactive screening and mapping tool developed by the EPA, provides a nationally consistent dataset and approach for combining EJ environmental and demographic indicators. An EJScreen search showed that all negative environmental indicators within the ROI are below the state average except for ozone and the lead paint indicator (percentage of pre-1960s housing). The project would not emit ozone (see Section 5.7.1) or use lead paint. There are no superfund sites or hazardous waste treatment, storage, and disposal facilities located directly within the ROI. The full EJScreen Report is provided in **Appendix K**.

For the purposes of this analysis, EJ populations within the ROI were identified using the MPCA EJ Proximity Analysis Tool and United States census data for low-income and minority populations, as discussed below.

Low Income and Minority Populations

Using United States census data, a demographic assessment of the affected communities in the ROI was conducted to identify low-income and minority populations that might be present (see **Table 5-2**). Statistics for census tracts were compared to their respective county statistics to determine the level of low income and minority populations. The following guidelines were used in the comparison:

- Low-income and minority populations were determined to be present in an area when the percentage of minority group or low-income population exceeded 50 percent of the county population or was "meaningfully greater" than the general population of the county.
- A difference of 10 percentage points or more was used to determine whether the percentage of a minority or low-income group in a census tract in the ROI was "meaningfully greater" than that group's percentage in the respective county.
- Minority populations were calculated as the populations excluding those persons who self-reported as being white (and no other race) and not Hispanic or Latino. The remainder includes persons who self-reported as Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, some other race, having two or more races, or being of Hispanic or Latino origin.

As shown in **Table 5-2**, a meaningfully greater low-income or minority population does not exist for census tracts within the ROI for any of the route alternatives. When compared to the populations of Otter Tail and Wilkin Counties, the percentage of people living in poverty or not self-identifying as white alone were either: (1) not greater than 50 percent, or (2) not 10 percentage points or more than the percentage of the same population in Otter Tail and Wilkin Counties.

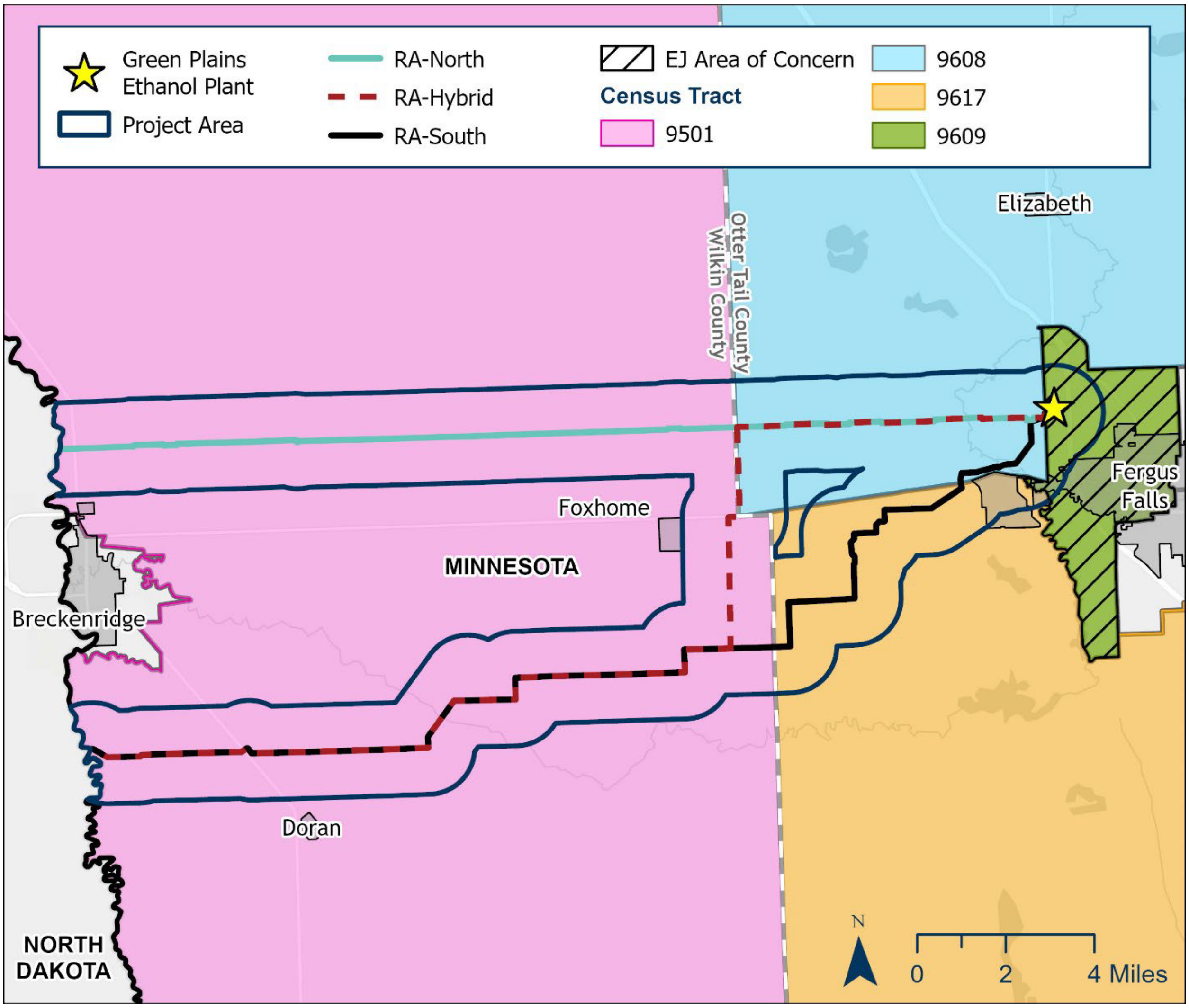
Table 5-2 Environmental Justice Data for Census Tracts Crossed by All Route Alternatives[51, 52, 53]

Area	Population	Percent Below Poverty Level	Percent Total Minority[a]
Minnesota	5,706,494	9.3	23.7
Otter Tail County	60,081	8.8	9.5
Wilkin County	6,506	13.5	9.0
Region of Comparison	**66,587**	**9.3**	**9.5**
Otter Tail			
Census Tract 9608	3,149	5.2	6.2
Census Tract 9609	5,853	12.1	11.0
Census Tract 9617	3,234	4.0	5.9
Wilkin			
Census Tract 9501	3,080	7.6	6.2

Note: Minority or low-income populations exceeding the established thresholds are indicated in bold type.
[a] "Minority" refers to people who reported their ethnicity and race as something other than non-Hispanic White.

The nearest residence to project facilities in Census Tract 9609 is about 1,500 feet southeast of the capture facility and each of the three route alternatives. **Figure 5-4** shows the census tracts crossed by the three route alternatives.

Figure 5-4 Census Tracts Crossed by the Project



Community Engagement in Identified EJ Areas of Concern

As described in Chapter 3, several public meetings have been held and notices have been published in Fergus Falls, which includes Census Tract 9609, and upcoming meetings are scheduled to be held near this EJ area of concern, as follows:

- The applicant hosted open houses in Fergus Falls on October 13, 2021; January 25, 2022; April 8, 2022; and June 23, 2022. Prior to the open houses, the applicant sent invitations to landowners and public officials along its proposed route.
- EERA and Commission staff initiated the EIS scoping process on April 10, 2023. Commission staff sent notice to the project contact list. The notice was available on the Minnesota EQB and the Commission webpages on April 18, 2023. The notice was published in the Fergus Falls *Daily Journal* and on the EERA website on April 19, 2023.
- A 30-day public comment period extended from April 18 to May 18, 2023, giving the public an opportunity to provide comments identifying issues, mitigation measures, alternatives, and route alternatives/route segments for consideration in the scope of the EIS. During this period,

EERA and Commission staff, accompanied by the applicant, held a total of three in-person public information and EIS scoping meetings in 2023: two were held in Fergus Falls on May 3 at 1:00 p.m. and 6:00 p.m., and one virtual meeting was held on May 4 at 6:00 p.m.

- On September 27, 2023, EERA staff filed the EIS preparation notice required under Minnesota Rule 4410.2100, subpart 9. This notice was also published in the *EQB Monitor* on September 26, 2023.
- On October 6, 2023, EERA staff sent a letter to newly affected landowners informing them that a route or route segment alternative identified in the Final Scoping Decision has the potential to impact their property.

Meetings that are scheduled to be held in Fergus Falls include:

- After the draft EIS is issued in January 2024, in-person and virtual public meetings will be held in February 2024, and a comment period will open to accept comments on the draft EIS. Prior to these public meetings, a notice will be issued indicating the place and time of each meeting.
- Public hearings will be held in late spring 2024, and a public comment period will open at this time. Interested parties will have the opportunity to speak at the hearings, ask questions, and submit comments.

5.4.3.3 Potential Impacts

While no census tracts within the ROI for the route alternatives were identified to have a meaningfully greater low-income or minority population when compared to their respective counties, Census Tract 9609 was identified by the MPCA screening tool as an EJ area of concern.

Factors that could affect this EJ area of concern include increased traffic during construction, noise, and air impacts from construction and operation. Because Census Tract 9609 is within the ROI for each of the proposed route alternatives, the impacts described below would apply to all three route alternatives.

Local roadways would experience a short-term, minimal increase in traffic during construction activities. Because the roadway network is adequate to support 200 construction vehicles, and because the applicant proposes to cross all paved roads using HDD or boring techniques, impacts on traffic are anticipated to be minimal during construction and negligible during operation. Traffic impacts are described further in Section 5.4.9.

As discussed in Section 5.4.5.1, construction of the pipeline and the CO_2 capture facility, and the use of construction equipment that generates noise, would occur primarily in rural agricultural areas and primarily during daytime hours. Although most construction activities would occur during the daytime hours, HDD typically requires 24-hour construction. Hydrostatic testing could also extend into nighttime hours. Residences within Census Tract 9609 and 1,600 feet of the construction workspace may experience intermittent, short-term noise from construction equipment for up to 30 days.

The capture facility would be near the ethanol plant and within Census Tract 9609. Operation of the capture facility, pipeline, MLVs, launcher, or cathodic protection system would not generate noticeable noise. Therefore, project operation would not result in disproportionate adverse impacts from noise to EJ areas of concern within the ROI.

As discussed in Section 5.7.1, the Minnesota Statewide Screening of Health Risks from Air Pollution (MnRISKS) tool calculates an air pollution score for all areas in the state. The census tracts crossed by the three route alternatives all have air pollution scores below one, indicating that air pollution levels are below health benchmarks and that health effects are unlikely to result after a lifetime of exposure. Construction emissions, further described in Section 5.7.1, are not expected to cause or significantly contribute to a violation of an applicable ambient air quality standard in any of the census tracts crossed by the three route alternatives.

The project would be required to obtain an air permit from MPCA. As detailed in Section 5.7.1, estimated annual air emissions for the capture facility would be well below the air permit thresholds for all constituents. The project would not result in significant impacts on air quality during construction or operation in Census Tract 9609, or any other census tract crossed by the project. Therefore, construction and operation of the project would not result in disproportionate adverse impacts on air quality for EJ areas of concern within the ROI.

5.4.3.4 Mitigation

The project is not anticipated to have EJ impacts, and no additional mitigation outside of the resource-specific mitigation outlined above is proposed at this time.

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to EJ. The sample routing permit states that “the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations.”

Applicant-Proposed Mitigation

The applicant-proposed mitigation measures for roadways and traffic are listed in Section 5.4.9.2. Measures to reduce air emissions are listed in Section 5.7.1.2, and measures to reduce noise are included in Section 5.4.5.2.

Mitigation Proposed During Scoping

No mitigation measures for EJ were proposed during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.4.4 Land Use and Zoning

The ROI for analyzing impacts on land use and zoning is the route width. Land use is the primary tool used by counties and local jurisdictions to manage growth and development within their limits. Zoning is a regulatory tool used by local governments (cities, counties, and some townships) to promote or restrict certain land uses within specific geographic areas. A routing permit supersedes local zoning, building, and land use rules. However, the Commission’s routing permit decision must be guided, in part, by consideration of impacts on local zoning and land use. Land use in the ROI, and in the area of the project generally, is predominantly agriculture. Land use impacts would be the same across the three route alternatives. Project construction would have a short-term, minimal to moderate impact on land use within the construction workspace. Pipeline operation would have a long-term, minimal impact on land use. An operational ROW would be created, but agriculture (the most prevalent land use) could continue. Landowners could not plant trees or build structures within

the operational pipeline ROW. The project would be compatible with local and regional land use plans. Overall, impacts on land use and zoning are anticipated to be minimal.

5.4.4.1 Existing Conditions

Existing Land Uses and Ownership

Except for road, railroad, and public water crossings, the project is located entirely on privately owned land. This land is used primarily for agriculture, as shown in **Figure 5-2**. Farmsteads, consisting of buildings and service areas adjacent to farms, are scattered throughout the project area. Additionally, there are commercial and industrial land uses in the area, primarily associated with the city of Fergus Falls and the ethanol plant. **Table 5-3** shows the acres of existing land uses and cover types located within the route width of each route alternative. Land cover types were identified using geospatial data. Land use types were grouped into six categories based on the land cover types, including agriculture land, developed land, forested land, open land, open water, and wetlands.

Table 5-3 Land Cover[54]

Land Use	NLCD Cover Types	Acres Within Route Width		
		RA-North	RA-Hybrid	RA-South
Agriculture Land	Cultivated Crops	1,054.7	1,440.4	1,539.2
	Pasture/Hay	2.5	0.6	1.4
	Subtotal	***1,057.2***	***1,441.0***	***1,540.6***
Developed Land	Developed High Intensity	3.1	3.0	2.8
	Developed, Low Intensity	122.9	119.5	70.2
	Developed, Medium Intensity	16.6	15.8	12.7
	Developed, Open Space	170.2	163.0	106.6
	Subtotal	***312.8***	***301.3***	***192.3***
Forested Land	Deciduous Forest	2.6	1.2	3.9
	Subtotal	***2.6***	***1.2***	***3.9***
Open Land	Barren Land (Rock/Sand/Clay)	0.2	0.2	0.1
	Grassland/Herbaceous	0.3	0.0	0.1
	Subtotal	***0.5***	***0.2***	***0.2***
Open Water	Open Water	1.6	1.3	0.0
	Subtotal	***1.6***	***1.3***	***0.0***
Wetlands	Emergent Herbaceous Wetlands	15.6	15.1	81.1
	Woody Wetlands	0.9	1.2	7.4
	Subtotal	***16.5***	***16.3***	***88.5***
	Total	**1,391.2**	**1,762.3**	**1,828.4**

Local and Regional Plans

Otter Tail County is composed mainly of water, wooded areas, and agricultural production with historically more agricultural production in the western part of the county where the route alternatives cross. The Otter Tail County Long-Range Strategic Plan,[55] adopted in 2020, establishes a 20-year vision for the county and provides existing conditions and supporting information for each of the strategic plan's elements.

Of the six plan elements that were identified for inclusion in the strategic plan, one of them includes existing and future use of land. The strategic plan suggests that the county implement a future land use map, county-developed model ordinance, and county-wide zoning as tools to expand regulatory growth management or land use authority. A major goal of the strategic plan is to "continue to support and grow the County's strong and diverse agricultural economy" by supporting farm-to-table programming, such as community farmers markets, to promote the health of the local agricultural economy.

Other goals include the following:

- maintain an environment that supports agriculture at all scales throughout the county
- explore economic development efforts that attract agribusinesses that support agricultural products produces in the county
- ensure that all new development is compatible with the natural and manmade environment
- preserve the scenic quality of the rural landscape by defining the edge of communities and maintaining the rural character of roadways on the edges of communities

Otter Tail County also developed a Local Water Management Plan[56] that identifies existing and potential problems and opportunities for protection, management, and development of water resources and related land resources within the county. The plan also addresses "development patterns and economic growth" related to surface water and groundwater resources.

Wilkin County does not have a county plan but has adopted the Wilkin County Zoning Ordinance to serve many purposes, as outlined below in the discussion about zoning. The county is primarily agricultural with 92 percent of its land use dedicated to cropland.[57] Wilkin County developed a Local Water Management Plan that identifies existing and potential problems or opportunities for protection, management, and development of water resources and land resources in the county. The Local Water Management Plan's goals are to develop and implement a plan of action to promote sound hydrologic management of water and related land resources in the county and to work toward effective environmental protection and management of water and land resources in the county.[58]

The ROI for RA-North would cross the Buffalo Red River Watershed District. The Buffalo Red River Watershed District Comprehensive Watershed Management Plan includes measures to conserve soil and water resources through the implementation of practices, programs, and regulatory controls that effectively control or prevent erosion, sedimentation, and siltation to reduce damages caused by floods, protect the tax base, protect water quality, preserve and conserve natural resources, ensure continued soil productivity, and protect public land and waters.[59]

The ROIs for RA-Hybrid and RA-South would cross the boundaries of the Buffalo Red River Watershed District and the Bois de Sioux Watershed District. The Bois de Sioux Watershed District follows the Joint Comprehensive Watershed Management Plan for the Bois de Sioux and Mustinka Watersheds. This plan outlines environmental programs, conservation districts, and management of erosion, soil, and water conservation programs.

Zoning

Wilkin County adopted the Wilkin County Zoning Ordinance to serve many purposes. This zoning ordinance serves to create compatibility between different land uses, determine appropriate use of land, protect and preserve the economic viability of land, and protect public health, safety, and the general welfare of the people.

The eastern portion of the project would fall within Wilkin County's Agricultural Zoning District. As stated in the Wilkin County Zoning Ordinance, the Agricultural District is intended to:

> Provide a district that would: be protective of agricultural lands of Wilkin County from non-farm influences; foster sound development of farmsteads including the location of farm and non-farm dwellings; retain major areas of natural ground cover for conservation purposes; prevent scattered non-farm growth; secure economy in governmental expenditures for public services, utilities, and schools; deter abuse of water resources and conserve other natural resources of the County.[60]

In addition, the zoning ordinance was enacted generally for the purpose of "protecting and preserving economically viable agricultural land," among other activities.

The Otter Tail County Shoreland District[61] includes all land within certain distances from public waters: 1,000 feet from the ordinary high water level or a lake, pond, or flowage and 300 feet from a river of the landward extent of the floodplain on such river, whichever is greater. The Otter Tail County Shoreland District controls "lakeshore, river, and stream development independent of the other provisions." Among other requirements, development in the district requires performance standards that must be met for public and private facilities. This includes placement and design of roads, driveways, and parking areas; vegetation management; grading and filling; and stormwater management.

The ROI for RA-North intersects the Pelican River. This route alternative is located on land within 300 feet of the Pelican River; therefore, this land is considered shoreland and would be within the Otter Tail County Shoreland District.

The ROIs for RA-Hybrid and RA-South cross the Pelican River and one unnamed public creek. These route alternatives are located on land within 1,000 feet of the unnamed public creek and within 300 feet of the Pelican River; therefore, this land is considered shoreland and would be within the Otter Tail County Shoreland District.

5.4.4.2 Potential Impacts

The project would result in temporary changes to current land uses. Most land uses would be allowed to revert to prior uses following construction—for example, agriculture. Because the project would not impair the counties' ability to manage the orderly development and use of land and water resources, impacts on local zoning due to the project are anticipated to be minimal.

Conversion of Existing Land Uses and Cover

Land cover types are identified by the NLCD. Cover types have been grouped into six categories of land use types to discuss the impacts of each route alternative, as shown in **Table 5-4**, along with the construction (short-term) and operational (long-term) impacts for each route alternative.

Table 5-4 Land Cover and Land Use Impacts by Route Alternative [62]

Land Use	Cover Types	Acres Within Construction Workspace					
		RA-North		RA-Hybrid		RA-South	
		Construction	Operation	Construction	Operation	Construction	Operation
Agriculture Land	Cultivated Crops	194.6	82.7	297.5	137.9	305.5	144.2
	Pasture/ Hay	-	-	-	-	0.3	0.2
	Subtotal	***194.6***	***82.7***	***297.5***	***137.9***	***305.8***	***144.4***
Developed Land	Developed High Intensity	0.4	0.2	0.4	0.2	1.3	0.2
	Developed, Low Intensity	34.4	20.0	25.9	16.5	14.4	10.0
	Developed, Medium Intensity	4.2	2.8	3.7	2.6	4.5	2.0
	Developed, Open Space	54.6	33.1	32.6	18.0	18.5	10.5
	Subtotal	***93.6***	***56.1***	***62.6***	***37.3***	***38.7***	***22.7***
Forested Land	Deciduous Forest	0.3	0.01	0.1	-	0.1	0.1
	Subtotal	***0.3***	***0.001***	***0.1***	***0.0***	***0.1***	***0.1***
Open Land	Barren Land (Rock/Sand/Clay)	0.1	-	0.1	-	-	-
	Grassland/ Herbaceous	-	-	-	-	-	-
	Subtotal	***0.1***	***0.0***	***0.1***	***0.0***	***0.0***	***0.0***
Open Water	Open Water	0.2	0.2	-	-	-	-
	Subtotal	***0.2***	***0.2***	***0.0***	***0.0***	***0.0***	***0.0***
Wetlands	Emergent Herbaceous Wetlands	1.3	0.8	2.1	1.6	4.7	3.3
	Woody Wetlands	-	-	-	-	-	-
	Subtotal	***1.3***	***0.8***	***2.1***	***1.6***	***4.7***	***3.3***
	Total	**290.1**	**139.8**	**362.4**	**176.8**	**349.3**	**170.5**

Agricultural Land

Agricultural land uses include cultivated crop and pasture/hay land cover types. As shown in **Table 5-4**, each route alternative would result in short-term and long-term impacts on agricultural land. Construction activities would temporarily affect active cropland within the construction workspace and may result in a delay, loss, or other impact on planting, the growing season, and/or a harvest effort, depending on the timing of construction. Agricultural land in the construction workspace would generally be taken out of production for one growing season and restored to previous use following construction, resulting in short-term, minimal to moderate impacts. Long-term impacts would result under all the route alternatives from the construction of the capture facility, MLVs, and permanent access roads, and from the conversion of land to operational pipeline easement. Generally, the existence of a pipeline easement is compatible with row crop agricultural practices, and long-term impacts would be minimal after restoration is complete. Section 5.5.1 discusses impacts on agricultural land in greater detail.

Developed Land

Developed land uses include developed high intensity, low intensity, medium intensity, and open space land cover types. As shown in **Table 5-4**, portions of the project would be constructed on developed land uses. While the project would require operational ROW to construct and operate the capture facility, MLVs, and permanent access roads, it would not result in conversion of land use because the existing land use is already developed.

Forested Land

Forested land uses include the deciduous forest land cover type. As shown in **Table 5-4,** the ROI for each route alternative for this resource includes few areas that are classified as forested land. Minimal impacts on forested land are anticipated for each route alternative as there are no active forestry operations occurring in the route width of any route alternative and commercial timber harvest is not expected to occur. Section 5.5.3 discusses impacts on forested land in greater detail.

Open Land

Open land uses include the barren land cover type. As shown in **Table 5-4**, activities associated with the construction of all route alternatives would result in negligible or minimal, temporary impacts on open land use. Following the completion of construction, open land areas would be restored to pre-construction conditions.

Open Water

Construction activities associated with the pipeline have the potential to affect surface water flow and quality. These activities include clearing and grading, dewatering and trenching, access road construction, waterbody crossings, surface water withdrawals and discharges (for example, for hydrostatic test water), fueling and use of hazardous materials, and restoration or reclamation of construction areas.

Impacts on surface waters could typically occur for 2 to 3 years, but could last as long as 5 years following construction as revegetation and restoration methods establish. Impacts on water resources are discussed in greater detail in Section 5.7.8.

Wetlands

Wetlands in the ROI include emergent herbaceous wetland land cover types. Each route alternative would result in short-term and long-term impacts on wetlands. Based on NLCD data, RA-South would affect more areas classified as wetlands than the other two route alternatives. Impacts on wetlands are discussed further in Section 5.7.9.

Compatibility with Local and Regional Plans

The Otter Tail County Long Range Strategic Plan sets broad policies and strategies to direct future growth and development in the areas of land use and other plan elements. Otter Tail County may only regulate lands within its jurisdiction, and land use planning activities are emphasized for lands where the county has authority. Non-jurisdictional areas include incorporated municipalities, state and federal lands, and townships that choose to exercise their own zoning authority. Land use authority has not been exercised for the entire county, resulting in limited authority to work with property owners regarding growth management if the property lies outside of a shoreland area.

The project would be consistent with the goals and objectives for land designated by the Otter Tail County Long Range Strategic Plan for agricultural use because agricultural land cover types would still be available for crop production following project restoration.

The goals of watershed districts are broad and involve all aspects of water within their districts. Goals of watershed districts include improving water quality, managing drainage systems, providing flood protection, enhancing recreational opportunities, and providing for wildlife habitat. The compatibility of project construction with these goals is largely related to the potential impacts of construction on water resources in the watershed.

The Wilkin County Local Water Management Plan expresses concerns about the contamination of groundwater, including gravel mining, improperly sealed abandoned wells, industrial development, major highways, petroleum pipelines, railroads, sewage lagoons, and land use on sensitive groundwater areas. None of these concerns fit the description of the project. The Otter Tail County Local Water Management Plan also expresses concerns about groundwater contamination, including abandoned wells, failing septic systems, agriculture contamination, potential for well contamination, education, effects of land use, hazardous waste dumping, and the natural/artificial contamination from arsenic. Accidental releases of fuels, lubricants, and coolants from project construction equipment could impact soils, as described in Section 5.7.6. Impacts on the local water supply are discussed in Section 5.7.8.

During construction, removal of vegetation in construction work areas and working in and around wetlands and waterbodies may result in temporary impacts on water resources in watersheds, as discussed further in Section 5.7.8. Vegetation in watershed areas acts to slow water runoff, stabilize banks, prevent erosion, and enhance scenic views from the water. Temporary removal of vegetation in and around waterbodies could eliminate or reduce some of these benefits (and associated watershed district goals), which may temporarily reduce the scenic integrity of shoreland areas. With the incorporation of mitigation measures, impacts on water resources from project construction would not interfere with watershed districts' goals of conserving watershed functions and limiting impacts on water quality from development.

Generally, the existence of a pipeline easement can be compatible with future private landowner desires to continue activities on their property. Landowners would be restricted from some activities within the pipeline easement, such as planting trees or building structures. Present agricultural practices could continue during project operation.

To minimize impacts on forest land, the applicant has reduced the width of the construction workspace or has committed to trenchless crossing methods. Where trenchless waterbody crossing methods are used, trees would not be cleared along the operational ROW during construction or operations. Limited hand clearing would occur at these waterbodies, where necessary, to access a water source to withdraw water for the HDD operations, place the HDD guidewires, and/or test the pipe segment. After construction, tree regeneration would be permitted to occur naturally within the portion of the construction workspace that is located outside of the operational ROW. The applicant would maintain the 50-foot-wide operational ROW by mowing and removing woody vegetation taller than 15 feet in non-cultivated areas. Exceptions include the area between HDD entry and exit points where the vegetation would not be maintained and at riparian buffers adjacent to waterbodies where post-construction vegetation maintenance within the operational ROW would be limited to a 10-foot-wide corridor centered over the pipeline.

Zoning

The county land use plans and zoning ordinances discussed above place an emphasis on maintaining and developing strong agricultural economies in the counties affected by the project. Wilkin County has enacted zoning, and Otter Tail County implements shoreland ordinances that accommodate essential service networks and other commercial and industrial uses, such as wind and solar development; biofuel production; oil, gas, sewer and drainage pipelines; electrical transmission and substations; and telecommunication towers. [63, 64]

The route alternatives would cross land zoned as shoreland in both Otter Tail and Wilkin Counties. The applicant would comply with the standards and ordinances set forth in The Shoreland Management Ordinance of Otter Tail County. Impacts on land zoned as shoreland would be minimal, as vegetation buffers and streambanks would be left intact. Generally, construction in the shoreland areas and across streambanks would be compatible with the goals of shoreland overlay districts.

Overall, the impacts in shoreland areas would be minimal because the amount of land along waterbodies that would be affected is small and the post-construction vegetation maintenance procedures described above would be implemented. The impacts would be temporary and limited to the length of the construction and restoration period because vegetation would be allowed to regrow in the operational ROW.

The project would have minimal short-term and long-term impacts on zoning.

5.4.4.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to zoning but includes the following provision that would mitigate impacts on land use and zoning: “the Permittee shall restore the right-of-way, temporary workspaces, access roads, abandoned right-of-way, and other public or private lands affected by construction of the pipeline to the natural conditions that existed immediately before construction of the pipeline and as required by other federal and state agency permits. Restoration must be compatible with the safe operation, maintenance, and inspection of the pipeline. Within 60 days after completion of all restoration activities, the Permittee shall advise the Commission in writing of the completion of such activities.”

Additionally, the sample routing permit states that “the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations.”

Applicant-Proposed Mitigation

The applicant proposed mitigation measures to minimize the impacts on and restoration of agricultural lands, as described in detail in **Appendix E**. The applicant has initiated discussions with the Buffalo Red

River Watershed District and the Bois de Sioux Watershed District regarding permitting needs and would obtain all necessary permits prior to construction. These permits would ensure that project activities are compatible with the plans of the watershed districts.

Mitigation Proposed During Scoping

No mitigation measures for land use were proposed during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

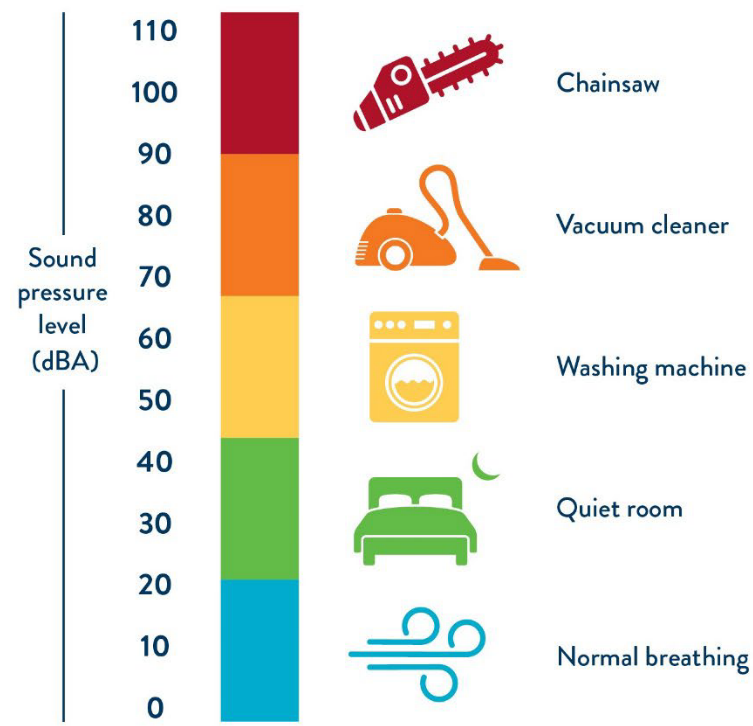
5.4.5 Noise

The ROI for noise is the local vicinity (area within 1,600 feet of the route width). Heavy equipment needed to construct the pipeline would have an intermittent, short-term impact on noise levels in the vicinity of the project. Except for HDDs and some hydrostatic testing activities, construction would be limited to daytime hours. Construction equipment noise would be expected to decrease to levels below state daytime standards within 500 to 1,600 feet. The project is expected to conform to state noise standards. Compared to the other route alternatives, RA-South would have fewer noise sensitive receptors (NSR) close to the construction workspace but more NSRs within 0.5 mile of an HDD entry. Noise from the operation of the capture facility is not expected to result in a perceptible increase in the sound levels experienced at NSRs near the capture facility and would not be distinguishable from the noise already produced at the ethanol plant. Operation of the pipeline facilities would not have a noticeable impact on ambient sound levels. Because the project is expected to conform to state noise standards and the applicant would use barrier walls as needed for mitigating noise from HDDs, potential impacts would be minimal for all route alternatives.

5.4.5.1 Existing Conditions

Noise is measured in decibels (dB) on a logarithmic scale. For reference, MPCA states that the human ear can tell the difference when sound changes by 3 decibels on the A-weighted scale (dBA) although the difference may be subtle. A change of 5 dBA is clearly noticeable,[65] and a 10 dBA change is perceived as a doubling in loudness. How noise travels and is perceived depends upon several factors, such as wind speed, wind direction, humidity, and natural and built features between the noise source and the listener. **Figure 5-5** shows the noise levels associated with common activities and equipment.

Figure 5-5 Common Noise Levels



The Minnesota noise standards provide different permissible noise levels for three different noise classification areas: residential, commercial, and industrial (see **Table 5-5**). The L10 standard cannot be exceeded for more than 6 minutes during a 1-hour period (10 percent of the time), and the L50 standard cannot be exceeded for more than 30 minutes during a 1-hour period (50 percent of the time).

Table 5-5 Minnesota Noise Standards[66]

Noise Classification	Daytime (7 a.m. -10 p.m.) (dBA)		Nighttime (10 p.m. – 7 a.m.) (dBA)	
	L10	L50	L10	L50
Area 1 (Residential)	65	60	55	50
Area 2 (Commercial)	70	65	70	65
Area 3 (Industrial)	80	75	80	75

Noise associated with heavy equipment can range between 80 and 90 dBA at full power 50 feet from the source.[67] Heavy equipment generally runs at full power up to 50 percent of the time.[68] Point source sounds decrease by 6 dBA at each doubling of distance;[69] therefore, a 90 dBA sound at 50 feet is perceived as a 72 dBA sound at 400 feet and a 60 dBA sound at 1,600 feet.

In addition to the state noise standards, both counties crossed by the project have nuisance noise ordinances in place. These municipal noise ordinances prevent noise from becoming a nuisance beyond the property line. No separate or more restrictive quantitative standards exist for these areas; therefore, compliance with local noise ordinances is assured through compliance with the state standard.

Existing noise sources within the local vicinity include the ethanol plant, traffic, railroads, and farm equipment. EPA estimates that day-night average levels for rural residential spaces are about 40 to 45 dBA, with higher baseline levels in more developed areas or when heavy agricultural machinery is in operation.[70] The ethanol plant operates equipment that produces high levels of noise, including compressors, pumps, the distillation system, and dryer.

For this analysis, NSRs include residences and businesses. The closest residence to the CO_2 capture facility workspace is about 1,500 feet to the south. Based on aerial imagery, RA-North has 33 residences and two businesses within the ROI, RA-Hybrid has 39 residences and one business within the ROI, and RA-South has 34 residences and two businesses within the ROI. **Figure 5-6** depicts the number of residences and businesses within the ROI at different distances from the pipeline centerline for each route alternative. These NSRs are listed in **Table 5-6**, **Table 5-7**, and **Table 5-8**, and residences are shown on the maps in **Appendix B**.

Figure 5-6 Noise Sensitive Receptors by Distance from Centerline

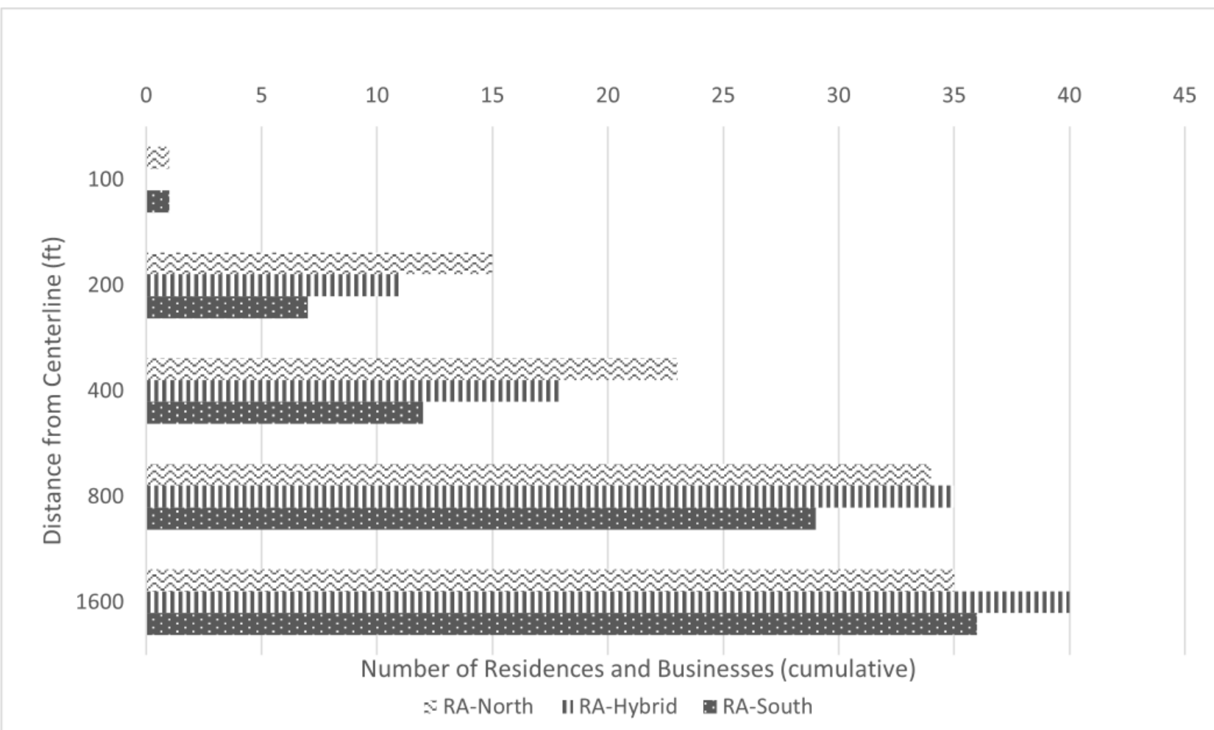


Table 5-6 Noise Sensitive Receptors Within 1,600 Feet of RA-North Route Width

Approximate Milepost [a]	Description	Distance from RA-North Centerline (feet)	Direction from RA-North Centerline
0.01	Residence	1,491	SE
0.15	Business	245	N
0.24	Residence	930	NW
0.42	Residence	721	S
0.97	Residence	417	S
1.06	Residence	267	N
1.10	Residence	420	N
1.12	Residence	262	N
1.21	Residence	1,044	S
1.89	Residence*	295	NE
1.96	Residence*	279	S
2.09	Residence*	920	N
2.11	Residence*	382	S
2.97	Residence	381	NW
3.57	Residence	1,542	S
4.05	Residence	468	N
5.30	Residence	976	N
5.69	Residence	1,008	N
5.69	Residence	353	S
6.24	Residence	367	N
9.92	Residence	306	N
10.82	Residence	1,164	N
12.31	Residence	299	N
13.61	Residence	402	N
17.72	Residence	553	S
20.44	Residence	182	N
21.39	Business	700	S
21.53	Residence	285	N
21.60	Residence	1,824	S
21.63	Residence	258	N
22.68	Residence*	831	N
22.68	Residence*	516	N
22.69	Residence*	305	N
23.02	Residence*	823	NW

Approximate Milepost [a]	Description	Distance from RA-North Centerline (feet)	Direction from RA-North Centerline
23.02	Residence*	1,244	S

[a] Mileposts for RA-North are distances along the centerline from the Green Plains Ethanol Plant.
* Asterisk indicates the NSR is within 0.5 mile of an HDD entry.

Table 5-7 Noise Sensitive Receptors Within 1,600 Feet of RA-Hybrid Route Width

Approximate Milepost [a]	Description	Distance from RA-Hybrid Centerline (feet)	Direction from RA-Hybrid Centerline
0.01	Residence	1,491	SE
0.15	Business	245	N
0.24	Residence	930	NW
0.42	Residence	721	S
0.97	Residence	417	S
1.06	Residence	267	N
1.10	Residence	420	N
1.12	Residence	262	N
1.21	Residence	1,044	S
1.89	Residence	295	NE
1.96	Residence	279	S
2.09	Residence	920	N
2.11	Residence	382	S
2.97	Residence	381	NW
3.57	Residence	1,542	S
4.05	Residence	468	N
5.30	Residence	976	N
5.69	Residence	1,008	N
5.69	Residence	353	S
6.24	Residence	367	N
8.56	Residence	765	E
14.53	Residence	1,147	S
15.33	Residence	1,054	S
19.67	Residence	2,574	N
19.75	Residence	3,837	N
19.76	Residence	1,542	S
20.96	Residence*	973	NW
23.40	Residence	1,047	S
24.43	Residence	262	N

Approximate Milepost [a]	Description	Distance from RA-Hybrid Centerline (feet)	Direction from RA-Hybrid Centerline
25.43	Residence*	493	NE
26.21	Residence	586	S
26.27	Residence	351	S
26.64	Residence	1,403	S
27.87	Residence	1,202	N
28.30	Residence	1,581	N
28.73	Residence*	1,458	SW
28.98	Residence*	1,758	S
29.15	Residence*	1,825	S
29.15	Residence*	866	SW
29.15	Residence*	1,742	N

a Mileposts for RA-Hybrid are distances along the centerline from the Green Plains Ethanol Plant.
* Asterisk indicates the NSR is within 0.5 mile of an HDD entry.

Table 5-8 Noise Sensitive Receptors Within 1,600 Feet of RA-South Route Width

Approximate Milepost [a]	Description	Distance From RA-South Centerline (feet)	Direction from RA-South Centerline
0.01	Residence	1,491	SE
0.15	Business	245	N
0.28	Residence	800	NW
0.49	Residence	571	S
0.68	Residence	1,082	W
0.68	Residence	1,726	NW
1.15	Residence	1,779	E
1.74	Residence*	1,259	SE
2.14	Business	555	SW
2.24	Residence*	367	N
2.28	Residence*	491	N
2.32	Residence*	375	N
3.35	Residence*	1,120	E
4.98	Residence	1,193	S
5.49	Residence	1,312	E
6.94	Residence	229	NE
6.97	Residence	179	SW
13.48	Residence	1,147	S
14.28	Residence	1,054	S

Approximate Milepost [a]	Description	Distance From RA-South Centerline (feet)	Direction from RA-South Centerline
18.62	Residence	2,574	N
18.70	Residence	3,837	N
18.71	Residence	1,542	S
19.91	Residence*	973	NW
22.35	Residence	1,047	S
23.38	Residence	262	N
24.38	Residence*	493	NE
25.16	Residence	586	S
25.22	Residence	351	S
25.59	Residence	1,403	S
26.82	Residence	1,202	N
27.25	Residence	1,581	N
27.68	Residence*	1,458	SW
27.93	Residence*	1,758	SW
28.10	Residence*	1,825	S
28.10	Residence*	866	SW
28.10	Residence*	1,742	N

a Mileposts for RA-South are distances along the centerline from the Green Plains Ethanol Plant.
* Asterisk indicates the NSR is within 0.5 mile of an HDD entry.

5.4.5.2 Potential Impacts

The project is expected to conform to state noise standards.

Construction

Construction of the pipeline and the CO_2 capture facility, and the use of construction equipment that generates noise, would occur primarily in rural agricultural areas. The human ear can usually tell the difference when sound changes by 3 dBA, and a 5 dBA change is clearly noticeable.[71] Heavy equipment needed to construct the pipeline would have an intermittent, short-term impact on noise levels in the vicinity of the project. Typical pipeline construction equipment (for example, bulldozers, loaders, backhoes, and side boom tractors) generates between 70 and 90 dB at 50 feet from the equipment when operating at full load.[72] Members of the public would not be expected to experience this level of noise due to their distance from operating equipment.

During construction, residences within the ROI may experience intermittent, short-term noise from construction equipment for up to 30 days. Construction equipment noise would be expected to decrease to levels below state daytime residential standards (less than 60 dBA) within 500 to 1,600 feet, depending on the initial source level. Although most construction activities would occur during daytime hours, HDDs typically require 24-hour construction. Hydrostatic testing could also extend into nighttime hours.

As shown in **Figure 5-6**, RA-North would have the most NSRs within 400 feet of the pipeline centerline, followed by RA-Hybrid. RA-Hybrid would have the most NSRs within 800 feet, followed by RA-North. RA-South would have fewer NSRs within these distances than the other route alternatives.

The applicant would use HDD methods for some waterbody, road, and railroad crossings. Typically, drilling equipment operates at these crossings for 5 to 6 days; however, more time may be needed depending on the length and depth of the drill. The HDD crossings for the project are in rural locations where existing ambient noise levels are generally low. NSRs within 0.5 mile of an HDD entry (where the drilling rig would be located) are denoted with an asterisk in **Table 5-6**, **Table 5-7**, and **Table 5-8**. RA-North would have 9 NSRs within 0.5 mile of an HDD entry, RA-Hybrid would have 7, and RA-South would have 12.

Table 5-9 lists the closest NSR to each HDD entry and the corresponding distance for the three route alternatives. Except for the HDD at the Red River for RA-North, the closest NSRs would be more than 1,000 feet from the HDD entry.

Table 5-9 Closest NSR to each HDD Entry

HDD	Distance to Closest NSR RA-North (feet)	Distance to Closest NSR RA-Hybrid (feet)	Distance to Closest NSR RA-South (feet)
Pelican River	1,013	1,013	1,252
Otter Tail Valley Railroad/ State Highway 210	Not crossed	Not crossed by HDD	1,303
Otter Tail River	Not crossed	1,052	1,052
BNSF Railway/State Highway 9	BNSF Railway not crossed. State Highway 9 not crossed by HDD	1,278	1,278
Bois de Sioux River or Red River	975	1,086	1,086

Noise attenuation (decrease with distance) would vary by HDD location due to topography and weather conditions. Based on field measurements collected on active HDD operations, the applicant estimates the noise level for a 4-inch pipeline HDD would be less than 60 dB at 1,320 feet, less than 55 dB at 2,640 feet, and not audible at 5,280 feet (1 mile). The Minnesota noise standards are in units of dBA rather than dB. As a general comparison, dB is typically somewhat higher than dBA for a given sound level. Because some NSRs would be less than 1,320 feet from the drilling equipment, the noise standards listed in **Table 5-5** could be exceeded at these locations. If noise mitigation is required, temporary sound dampening barrier walls would be placed around the equipment. The applicant has stated that it would coordinate with nearby landowners prior to starting HDDs and determine the need for noise mitigation and noise monitoring based on feedback received from landowners during construction.

The blowdown process (when the internal pressure is reduced prior to discharge) associated with hydrostatic testing of the pipeline would result in increased noise levels for about 1 hour or less.

The applicant does not anticipate the need for blasting during construction of the project; therefore, no noise impacts from blasting activities would occur.

Operation

The CO_2 capture facility would be at the ethanol plant. The primary noise-generating activities at the CO_2 capture facility would be operation of compressors and pumps. The predicted noise level of the compressors is 95 dBA at 3 feet, and they would be housed inside an insulated building. The applicant states that noise from the CO_2 capture equipment would comply with all local and state requirements.

The ethanol plant operates compressors and pumps that produce noise similar to the noise anticipated from the proposed capture facility equipment. The ethanol plant also operates additional equipment that produces higher levels of noise, including a distillation system and dryer. The CO_2 capture facility would produce less noise than the distillation system at the ethanol plant. Noise from the operation of the CO_2 capture facility is not expected to result in a perceptible increase in the sound levels experienced at NSRs near the capture facility and would not be distinguishable from the noise already produced at the ethanol plant.

Operation of the pipeline, MLVs, launcher, and the cathodic protection system would not generate noticeable noise. Periodic maintenance activities for the operational ROW, MLV, and pipeline could generate temporary and intermittent noise in isolated areas. Overall, these activities are not expected to have a noticeable impact on ambient sound levels.

5.4.5.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following mitigation for noise: “the Permittee shall comply with noise standards established under Minnesota Rules 7030.0100 to 7030.0080, at all times at all appropriate locations during operation of the facility. Construction and maintenance activities shall be limited to daytime working hours to the extent practicable to ensure nighttime noise level standards will not be exceeded.”

Additionally, the sample routing permit states that “the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations.”

Applicant-Proposed Mitigation

The applicant would minimize construction-related noise impacts by limiting pipeline construction activities to daylight hours (except for HDD crossings, which can require 24-hour work to complete the drilling process, and hydrostatic testing), maintaining equipment in good working order, and using manufacturer-supplied silencers, including mufflers when available. Temporary sound dampening barrier walls would be placed around the HDD equipment, if necessary.

Because of negligible noise impacts during operation of the project, the applicant has not proposed any operational noise related mitigation aside from housing the compressors and pumps at the CO_2 capture facility inside buildings.

Mitigation Proposed During Scoping

No mitigation specific to noise impacts was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

EERA staff recommends the applicant provide documentation of coordination with residents located within 1,320 feet of HDD entries. The submittal should document locations of sound dampening barrier walls and include a plan for monitoring noise levels at these locations during HDD operations. The information should be provided 30 days prior to submittal of the Plan and Profile. In its review of a preliminary version of the draft EIS, MDH concurred with this mitigation measure.

5.4.6 Populated Areas

The ROI for populated areas is the local vicinity (area within 1,600 feet of the route width). Populated areas are defined for this analysis as incorporated areas or legal entities and census-designated places (CDP), which are statistical entities and the equivalent of incorporated places. There would be no impacts on populated areas because no populated areas are within the ROI of any of the three route alternatives.

5.4.6.1 Existing Conditions

For this analysis, populated areas, as defined by the United States Census Bureau, consist of incorporated areas or legal entities and CDPs, which are statistical entities.[73] Incorporated places are legally incorporated under state law, have a legally defined boundary, and have an active, functioning governmental structure.[74] Examples of incorporated places include cities, towns, and villages.

CDPs are statistical equivalents of incorporated places and represent unincorporated communities that do not have a legally defined boundary or an active, functioning governmental structure. Examples of CDPs include unincorporated communities, planned communities, military installments, university towns, and resort towns. A single location cannot be part of both an incorporated place and a CDP.[75]

None of the three route alternatives cross a CDP or an incorporated place.

The average population density of Otter Tail County is 30.5 people per square mile, and the average population density of Wilkin County is 8.7 people per square mile. Neither county exceeds the Minnesota average population density of 71.7 people per square mile, reflecting the rural landscape surrounding the project. Otter Tail County saw a population increase of 0.7 percent in the last 2 years, and Wilkin County saw a population decrease of 2.5 percent in the last 2 years.[76]

Populations range from 6,350 (Wilkin County) to 60,519 (Otter Tail County). The project generally avoids population centers, although the nature of its partnership with an ethanol producer necessitates proximity to the ethanol plant. The ethanol plant is near, but not within, the incorporated city of Fergus Falls. Fergus Falls is the only municipality within 0.5 mile of any of the three route alternatives. The city of Breckenridge is located about 1 mile south of RA-North and about 2 miles north of RA-Hybrid and RA-South. Wahpeton, North Dakota, is located about 1 mile south of RA-North and about 2 miles north of RA-Hybrid and RA-South and is outside the ROI for populated areas.

5.4.6.2 Potential Impacts

There would be no impacts on populated areas because no populated areas are within the ROI of any of the three route alternatives.

5.4.6.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to populated areas. The sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant did not propose any mitigation measures specific to populated areas.

Mitigation Proposed During Scoping

No mitigation measures specific to populated areas were received during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.4.7 Property Values

The ROI for property values is the local vicinity (area within 1,600 feet of the route width). A property's value is influenced by a complex interaction of characteristics such as size, location, and improvements. The value of a tract of land is related to many tract-specific variables, including the utilities and services available or accessible, the current land use, and the values of adjacent properties. Construction-specific impacts on property values would be temporary (less than 6 months), and the applicant would be responsible for any construction-related damages. Potential impacts on property values would be similar for all three route alternatives. The presence of the pipeline would not be expected to affect the value of residential properties during project operation. Overall, impacts on property values are anticipated to be minimal and dissipate quickly with distance from the pipeline. However, impacts on specific properties could vary widely.

5.4.7.1 Existing Conditions

A total of 33 single-family residences are located within the ROI for RA-North, 39 single-family residences are located within the ROI for RA-Hybrid, and 34 single-family residences are located within the ROI for RA-South. Distances from aboveground facilities to the closest residences range from 400 feet to 1,650 feet.

Table 5-10 lists the median value of owner-occupied housing units for the affected counties.

Table 5-10 Housing in Counties Crossed by All Route Alternatives[77, 78, 79]

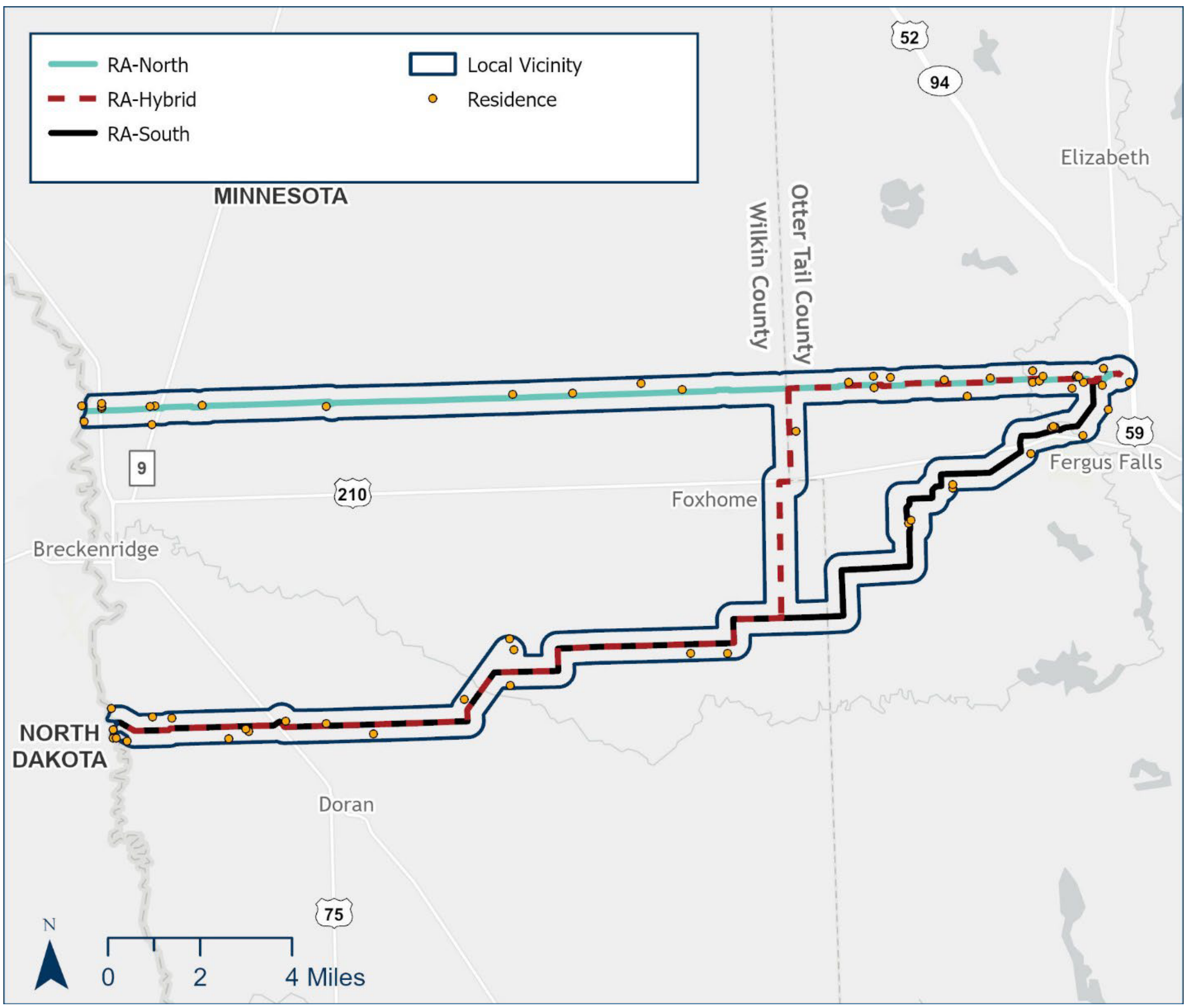
State/ County	Occupied Housing Units	Median Household Income	Median Monthly Housing Costs	Median Value of Owner-Occupied Housing Units
Minnesota	2,229,100	$77,706	$1,195	$250,200
Otter Tail County	24,838	$63,587	$862	$209,100
Wilkin County	2,680	$57,907	$754	$154,400

Land values are determined by appraisals that consider the objective characteristics of a property. Most of these factors are parcel specific—condition, size, improvements, acreage and neighborhood characteristics; the proximity to schools, parks, and other amenities; and the presence of existing infrastructure (for example, highways, railways, or power lines). In addition to property-specific factors, local and national market trends, as well as interest rates, can affect a property's value. The value of a tract of land is related to many tract-specific variables, including the utilities and services available or accessible, the current land use, and the values of the adjacent properties. The valuations generally do not consider subjective aspects, such as the potential effect of a pipeline.

5.4.7.2 Potential Impacts

Figure 5-7 shows the number of single-family residences within the ROI of all route alternatives. The presence of a home does not necessarily translate into greater potential for impacts on a property's value; property value impacts can occur whether a home is present or not.

Figure 5-7 Residences Within the ROI of each Route Alternative



For homeowners who would be affected by construction, the applicant would be responsible for any construction-related damages and for returning affected property to its original condition, which would help maintain property value. Impacts on property values during construction would be temporary but could be significant for landowners attempting to sell their properties during construction. Specific changes to a property's value are difficult to predict. The construction period would be relatively short (less than 6 months), so the number of landowners in this situation would likely be small.

Generally, the existence of a pipeline easement can be compatible with private landowner desires to continue activities on their property. Landowners would be restricted from some activities within the pipeline easement, such as planting trees or building structures.

Although no studies related to the impacts of CO_2 pipelines on property values have been identified, there are several studies that assess the effects of natural gas pipelines and compressor stations on property values. While research demonstrates that property value impacts vary, most studies indicate that the presence of an underground natural gas transmission pipeline does not affect the sales price or value of residential properties.[80, 81] **Table 5-11** summarizes reviewed literature that focuses on the relationship of property values to the presence of a pipeline facility.

Table 5-11 Summary of Review of Property Values Literature

Citation	Description	Conclusions
INGAA Foundation 2016	The Interstate Natural Gas Association of America (INGAA) Foundation retained Integra Realty Resources to study how natural gas transmission pipelines affect the value of real estate.	Integra Realty Resources concluded that proximity to a natural gas pipeline had no measurable impact on the sales price or insurability of a property and that the presence of a pipeline does not affect any specific type of property more or less than any other property type.
Wilde et al. 2014	Hedonic regression models were used to study the effects of proximity to a natural gas pipeline on residential property values in a master-planned community in Clark County, Nevada.	No effects associated with proximity to the natural gas pipeline were found, either at or after the time of the initial takings, after a later change in the allowable pressure on the pipeline, or after the 2010 incident in San Bruno, California.
Wilde et al. 2012	A literature review by Gnarus Advisors on the effects of pipelines on property values. Published in Journal of Real Estate Literature.	Gnarus Advisors found, "There is no credible evidence based on actual sales data that proximity to pipelines reduces property values."
Disken et al. 2011	A study on the effect of natural gas pipelines on residential value. The study analyzed sales data from about 1,000 residential properties in Arizona to determine whether proximity to a natural gas pipeline affected real estate sales prices.	The study was unable to identify a systematic relationship between proximity to a pipeline and sales price or property value.

Citation	Description	Conclusions
Palmer 2008	A study to determine the effect of natural gas pipelines on property values by locating sales of properties influenced by a natural gas pipeline and comparing that sale with sales of comparable, non-influenced properties.	There is no measurable long-term impact on property values resulting from natural gas pipelines for the particular pipeline project studied.

These studies do not indicate a conclusive, quantitative relationship between property values and proximity to natural gas pipelines. Therefore, it would not be feasible to quantify the potential for impacts of the project on property values, both in general or specifically to any parcels or areas. It is reasonable to expect that property values may be impacted differently based on the setting and characteristics of each property. However, there is no conclusive evidence indicating that the project would have a significant negative impact on property values. Overall, impacts on property values are anticipated to be minimal and dissipate quickly with distance from the pipeline. However, impacts on specific properties could vary widely.

The applicant filed a decommissioning plan with its routing permit application. The plan includes provisions for the applicant to provide financial assurance to the Commission in the amount of total net decommissioning costs. The decommissioning costs would be updated every 5 years, starting 10 years after the Project was commissioned. This would ensure that the pipeline would be properly decommissioned at the end of its useful life, and facilities would be removed or properly abandoned in place. A copy of the decommissioning plan was included in the applicant's routing permit application.

Based on the factors discussed above, no significant impacts on property values are anticipated from construction and operation of the project. EERA staff note that every landowner has a unique relationship and sense of value associated with their property. Thus, a landowner's assessment of potential impacts on their property's value is often a deeply personal comparison of the property "before" and "after" a proposed project is constructed. However, these judgements do not necessarily influence the market value of a property. Rather, appraisers assess a property's value by looking at the property "after" a project is constructed. Moreover, potential market participants likely see the property independent of the changes brought about by a project; therefore, they do not take the "before" and "after" into account in the same way the current landowner might. EERA staff acknowledge this section does not and cannot consider or address the fear and anxiety felt by landowners when facing the potential for negative impacts on their property's value.[82]

5.4.7.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) contains the following mitigation related to property values: "the Permittee shall negotiate agreements with landowners that would give the landowners access to their property; minimize the impact on planned future development of the property; and to assume any additional costs for such development that may be the result of installing roads, driveways, and utilities that must cross the right-of-way. The Permittee shall not unreasonably deny a landowner's request to cross the easement to access the landowner's property."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant would be responsible for any construction-related damages and for returning affected property to its original condition, which would help maintain property value.

Mitigation Proposed During Scoping

A commenter proposed that the EIS include post-abandonment mitigation for the project, including a permit condition to ensure that landowners are not liable by default for post-abandonment mitigation costs.

Mitigation Recommended by EERA Staff

None currently recommended.

5.4.8 Public Health and Safety

The ROI for public health and safety is Otter Tail and Wilkin Counties. Construction of the project would have negligible impacts on public health and safety. The presence of construction personnel and equipment could temporarily increase demand for local public services. As with any major construction project, worker health and safety concerns exist. Normal operation of the project would not impact public health and safety. Operational impacts to health and safety would be a concern primarily in the event of an accidental release of CO_2, when public health and safety impacts are expected to be minimal to significant (depending on the extent and where a release occurs). Potential impacts on public health and safety are expected to be similar for all three route alternatives. Accident conditions are discussed in Chapter 8.

Section 5.4.8 analyzes and discusses potential human health and safety impacts of construction and normal operation of the project. Chapter 8 includes a summary of potential impacts associated with a pipeline release. A detailed analysis of pipeline release scenarios is provided in **Appendix G**. Emergency planning and response, as well as a range of mitigative techniques, are discussed in Chapter 8.

5.4.8.1 Existing Conditions

PHMSA regulates safety of pipelines that transport hazardous liquids, including CO_2, according to regulations in 49 CFR Part 195. It develops safety regulations and other approaches to risk management to ensure safety in the design, construction, testing, operation, maintenance, and emergency response associated with pipeline facilities. Many of the regulations are written as performance standards that set the level of safety to be attained and require the pipeline operator to use various technologies to achieve safety. This work is shared with state agency partners and others at the federal, state, and local levels.

Section 5.4.9 describes the public services that currently provide emergency response for Otter Tail and Wilkin Counties and would provide emergency services, as needed, for the project. **Table 5-12** lists emergency services in the counties crossed by the project, which include law enforcement agencies, ambulance services, hospitals, and professional and volunteer fire departments.

5.4.8.2 Potential Impacts

Construction Health and Safety

As with any major construction project, the presence of construction personnel and equipment could temporarily increase demand for local public services, including the potential need for local emergency services to respond to emergencies associated with construction of the project and the temporary increase in population. Traffic would increase in the vicinity of the project. It is anticipated that impacts on local facilities would be minimal and that local healthcare facilities would be able to manage minor increases to healthcare needs during construction, as the number of construction workers expected at peak construction phase would be about 150 workers. The health and safety procedures and policies of the applicant and its contractor(s) would seek to prevent workplace injuries, which would limit the need to use local healthcare facilities during the temporary presence of construction workers.

Local law enforcement agencies, ambulance services, hospitals, and professional and volunteer fire departments are anticipated to be adequate for the minimal impacts on public health and safety associated with construction of the project.

Operations Health and Safety

Most potential impacts on health and safety that would be caused by operation of the project would occur primarily during unexpected and abnormal operating conditions associated with an unplanned release of CO_2. These impacts are discussed in Chapter 8. Normal operations and maintenance of the project would not impact public health and safety.

Beneficial Impacts for Health and Safety

The completed project would capture and transport 524 metric tons of CO_2 per day, or 0.19 MMTPA. CO_2 is a leading contributor to climate change, which has been identified by the World Health Organization as a health threat. The Centers for Disease Control has identified the following health-related impacts of climate change in the Midwest, including in Minnesota: temperature-related death and illness, air quality impacts, extreme events, vector-borne diseases, water-related illness, and high risks for certain populations of concern.[83] The project would reduce greenhouse gases in the atmosphere and contribute to reducing the effects of climate change.

5.4.8.3 Mitigation

Many commenters have raised questions about safety and hazards associated with CO_2 pipelines. EERA staff reiterates that the Commission cannot set safety standards. More information on PHMSA safety standards is provided in **Appendix G**.

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following measures specific to public health and safety:

- "Minnesota Statute 216G.07, subdivision 1, requires the pipeline trench to be excavated to a depth that sufficiently allows for at least 54 inches (4.5 feet) of backfill from ground surface to the top of pipeline in all areas where the pipeline crosses the right-of-way of any public drainage facility or any county, town, or municipal street or highway and where the pipeline crosses agricultural land. Where the pipeline crosses the right-of-way of any drainage ditch the pipeline shall be installed with a minimum level cover of not less than 54 inches (4.5 feet) below the authorized depth of the ditch, unless waived in the manner provided in Minnesota Statute 216G.07, subdivisions 2 and 3."

- "In agricultural land, the Permittee may seek a depth requirement waiver from the affected landowners to install the pipeline at the same depth as required by U.S. Department of Transportation regulation 49 CFR 192.327. In all cases, the pipeline trench shall be excavated to a depth that sufficiently allows for at least 36 inches (3 feet) of backfill from ground surface to the top of pipeline."
- "The Permittee shall provide all affected landowners with complete information about the project keeping them informed throughout the initial survey, right-of-way acquisition, right-of-way preparation, construction, restoration, and future operation and maintenance. As provided by applicable laws and regulations the Permittee shall provide educational materials about the project and any restrictions or dangers associated with the project to landowners within the route whose land is crossed by the pipeline and, upon request, to any interested persons."
- "The Permittee shall file with the Commission the name, address, email, phone number, and emergency phone number of the field representative 14 days prior to commencing construction. The Permittee shall provide the field representative's contact information to affected landowners, residents, local government units and other interested persons 14 days prior to commencing construction. The Permittee may change the field representative at any time upon notice to the Commission, affected landowners, residents, local government units and other interested persons."
- "The Permittee will install temporary gates or similar barriers, as needed, to prohibit public access to the right-of-way during construction."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant would take measures to prevent unexpected and abnormal conditions that could result in an accidental CO_2 release. The applicant would also train and coordinate with emergency managers and educate the public on the dangers of a CO_2 release and what residents should do if one were to occur. These measures are described in Chapter 8.

Mitigation Proposed During Scoping

No mitigation specific to public health and safety during construction or normal operation of the project was proposed by commenters during scoping. See Chapter 8 for additional mitigation related to an accidental CO_2 release.

Mitigation Recommended by EERA Staff

See Chapter 8 for mitigation considered reasonable by EERA staff regarding the event of an accidental CO_2 release.

5.4.9 Public Services and Infrastructure

The ROI for public services is the counties and the ROI for infrastructure is the local vicinity (area within 1,600 feet of the route width). Public services and infrastructure include emergency services, hospitals, school districts, and public utilities that serve residents and business. Public services and infrastructure impacts are anticipated to be short-term, negligible to minimal, and similar across the

three route alternatives. The presence of additional construction personnel could affect law enforcement agencies, fire protection services, and health care facilities in the communities adjacent to the project for all route alternatives. Local emergency services would be able to manage these minor increases during the 6 months of construction. There are no anticipated impacts on schools, public transit, or railroads. Impacts on roads would be minimal and primarily from increased construction traffic. A temporary increase of water use, sewage, and solid waste is anticipated due to the influx of construction workers and materials. The existing utilities would be sufficient to handle the temporary increase. During operation, electrical service would be supplied to the capture facility through existing service lines, and the project is not anticipated to require additional power generation capacity.

5.4.9.1 Existing Conditions

Emergency Services

There are 9 local law enforcement agencies, 4 ambulance services, 4 hospitals, and 24 professional and volunteer fire departments in the counties crossed by the project. These services currently provide emergency response for Otter Tail and Wilkin Counties and would provide services for the project, as needed. **Table 5-12** summarizes emergency services in the counties crossed by the project.

Table 5-12 Emergency Services in Counties Crossed by the Project

Service	Name	City	County
Ambulance	Ambulance-Pelican Rapids	Pelican Rapids	Otter Tail
Ambulance	Parkers Prairie Ambulance	Parkers Prairie	Otter Tail
Ambulance	Ringdahl Ambulance Service	Fergus Falls	Otter Tail
Ambulance	Ambulance Service, Inc	Breckenridge	Wilkin
Hospital	Lake Region Healthcare Corp	Fergus Falls	Otter Tail
Hospital	Perham Health	Perham	Otter Tail
Hospital	Perham Memorial Hospital	Perham	Otter Tail
Hospital	CHI St. Francis Health	Breckenridge	Wilkin
Fire Department	Battle Lake Fire Department	Battle Lake	Otter Tail
Fire Department	Bluffton Fire Department	Bluffton	Otter Tail
Fire Department	Candor-Dora-Hobart-Vergas Fire and Rescue Department	Vergas	Otter Tail
Fire Department	Dalton Fire Department	Perham	Otter Tail
Fire Department	Dalton Fire Hall	Dalton	Otter Tail
Fire Department	Deer Creek Fire and Rescue	Deer Creek	Otter Tail
Fire Department	Dent Fire Department	Dent	Otter Tail
Fire Department	Elizabeth Fire Department	Elizabeth	Otter Tail
Fire Department	Elizabeth Volunteer Fire Department	Elizabeth	Otter Tail
Fire Department	Fergus Falls Fire Department	Fergus Falls	Otter Tail
Fire Department	Henning Volunteer Fire Department	Henning	Otter Tail

Service	Name	City	County
Fire Department	New York Mills Fire Department	New York Mills	Otter Tail
Fire Department	Ottertail Fire and Rescue	Ottertail	Otter Tail
Fire Department	Parkers Prairie Fire Department	Parkers Prairie	Otter Tail
Fire Department	Parkers Prairie Volunteer Fire Department	Parkers Prairie	Otter Tail
Fire Department	Pelican Rapids Volunteer Fire Department	Pelican Rapids	Otter Tail
Fire Department	Perham Fire Department	Perham	Otter Tail
Fire Department	Underwood Fire Department	Underwood	Otter Tail
Fire Department	Vining Fire Department	Vining	Otter Tail
Fire Department	Breckenridge Fire Department	Breckenridge	Wilkin
Fire Department	Campbell Volunteer Fire Department	Campbell	Wilkin
Fire Department	Foxhome Fire Department	Foxhome	Wilkin
Fire Department	Rothsay Fire Department	Rothsay	Wilkin
Fire Department	Wolverton Fire Department	Wolverton	Wilkin
Law Enforcement	Battle Lake Police Department	Battle Lake	Otter Tail
Law Enforcement	Fergus Falls Police Department	Fergus Falls	Otter Tail
Law Enforcement	Henning Police Department	Henning	Otter Tail
Law Enforcement	New York Mills Police Department	New York Mills	Otter Tail
Law Enforcement	Otter Tail Sheriff's Office	Fergus Falls	Otter Tail
Law Enforcement	Parkers Prairie Police Department	Parkers Prairie	Otter Tail
Law Enforcement	Pelican Rapids Police Department	Pelican Rapids	Otter Tail
Law Enforcement	Perham Police Department	Perham	Otter Tail
Law Enforcement	Breckenridge Police Department	Breckenridge	Wilkin

Schools and Public Transit

The 13 public school districts within the counties crossed by the project are summarized in **Table 5-13**.

Table 5-13 Public School Districts in the Counties Crossed by the Project

Name	City	County	Number of Schools	Number of Students
Battle Lake Public School District	Battle Lake	Otter Tail	2	402
Fergus Falls Area Special Education Cooperative	Fergus Falls	Otter Tail	3	73
Fergus Falls Public School District	Fergus Falls	Otter Tail	10	2993
Henning Public School District	Henning	Otter Tail	2	377
New York Mills Public School District	New York Mills	Otter Tail	2	785

Name	City	County	Number of Schools	Number of Students
Parkers Prairie Public School District	Parkers Prairie	Otter Tail	2	544
Pelican Rapids Public Schools	Pelican Rapids	Otter Tail	4	867
Perham-Dent Public School District	Perham	Otter Tail	4	1572
Region 4-Lakes Country Service Coop	Fergus Falls	Otter Tail	3	47
Underwood Public School District	Underwood	Otter Tail	3	581
Breckenridge Public School District	Breckenridge	Wilkin	4	638
Campbell-Tintah Public Schools	Campbell	Wilkin	2	142
Rothsay Public School District	Rothsay	Wilkin	2	309

There are no public transit routes within the local vicinity of the three route alternatives. The Otter Express provides local bus service within Fergus Falls and Perham in Otter Tail County and Breckenridge in Wilkin County.

Telecommunication, Electric, and Natural Gas Utilities

Electric and natural gas service is provided to the project area and surrounding municipalities by Ottertail Tail Power Company, Lake Region Electric Cooperative, and Great Plains Natural Gas Company. Electricity for the ethanol plant and proposed capture facility would be provided by Lake Region Electric Cooperative.

It is assumed that local utilities, such as telephone and cable television, are buried in the project area. These utilities, along with fiber optic cables, are often buried along roads and might intersect the route width of any routing alternative.

The route alternatives would cross electric transmission lines and natural gas and refined product pipelines. Other electric transmission lines are located near the project but would not be crossed by any of the alternatives. Identified utilities that would be crossed by the project are listed in **Table 5-14**.

Table 5-14 Utility Lines Crossed by the Route Alternatives

Route Alternative	County	Utility Line Type	Milepost
RA-North	Otter Tail	Refined Product Pipeline	0.7
RA-North	Otter Tail	Refined Product Pipeline	1.5
RA-North	Otter Tail	230 kV Electric Transmission Line	4.9
RA-Hybrid	Otter Tail	Refined Product Pipeline	0.7
RA-Hybrid	Otter Tail	Refined Product Pipeline	1.5
RA-Hybrid	Otter Tail	230 kV Electric Transmission Line	4.9
RA-Hybrid	Wilkin	Natural Gas Pipeline	9.3
RA-Hybrid	Wilkin	230 kV Electric Transmission Line	9.6
RA-South	Otter Tail	Refined Product Pipeline	0.7
RA-South	Otter Tail	230 kV Electric Transmission Line	1.1
RA-South	Otter Tail	Refined Product Pipeline	1.4

Route Alternative	County	Utility Line Type	Milepost
RA-South	Otter Tail	Natural Gas Pipeline	1.6
RA-South	Otter Tail	230 kV Electric Transmission Line	6.3

kV = kilovolt

Transportation

RA-North would not cross any railroads. RA-Hybrid and RA-South would each cross two active railroads. The locations where the pipeline would cross active railroads are listed in **Table 5-15**.

Table 5-15 Active Railroads Crossed by the Route Alternatives

Route Alternative	County	Railroad	Milepost
RA-North	None		
RA-Hybrid	Otter Tail Valley Railroad (OTVR)	Wilkin	9.9
RA-Hybrid	BNSF Railway	Wilkin	25.6
RA-South	Otter Tail Valley Railroad (OTVR)	Otter Tail	3.2
RA-South	BNSF Railway	Wilkin	24.5

The ethanol plant is on the outskirts of Fergus Falls and close to Interstate 94 (I-94), County Road 116, and State Highway 210. None of the route alternatives would cross I-94. All three route alternatives would cross County Road 116. RA-Hybrid and RA-South would cross State Highway 210 using the HDD method. **Table 5-16** lists roads crossed by the three route alternatives.

Table 5-16 Roads Crossed by the Route Alternatives

Route Alternative	Road Name	Milepost
RA-North	Otter Tail T 1019	0.3
RA-North	Otter Tail CR 116	0.4
RA-North	Otter Tail T 1018	1.4
RA-North	Otter Tail T 1001	2.5
RA-North	Otter Tail CSAH 21	3.5
RA-North	Otter Tail T 988	4.6
RA-North	Otter Tail CSAH 11	5.5
RA-North	Otter Tail T 1017	5.6
RA-North	Otter Tail T 1016	6.7
RA-North	Wilkin T 241	8.6
RA-North	Wilkin T 70	9.2
RA-North	Wilkin CSAH 19	9.7
RA-North	Wilkin T 237	10.7
RA-North	Wilkin CSAH 15	12.7
RA-North	Wilkin T 226	13.6

Route Alternative	Road Name	Milepost
RA-North	Wilkin CR 169	14.6
RA-North	Wilkin T 218	15.6
RA-North	Wilkin T 212	16.6
RA-North	Wilkin CSAH 16	17.6
RA-North	Wilkin T 206	17.6
RA-North	Wilkin T 196	19.6
RA-North	Wilkin T 187	20.6
RA-North	Wilkin T 69	20.7
RA-North	MN 9	21.4
RA-North	Wilkin T 184	21.7
RA-North	King of Trails Scenic Byway (US Highway 75)	22.7
RA-Hybrid	Otter Tail T 1019	0.3
RA-Hybrid	Otter Tail CR 116	0.4
RA-Hybrid	Otter Tail T 1018	1.4
RA-Hybrid	Otter Tail T 1001	2.5
RA-Hybrid	Otter Tail CSAH 21	3.5
RA-Hybrid	Otter Tail T 988	4.6
RA-Hybrid	Otter Tail CSAH 11	5.5
RA-Hybrid	Otter Tail T 1017	5.6
RA-Hybrid	Otter Tail T 1016	6.7
RA-Hybrid	Otter Tail T 1034	8.6
RA-Hybrid	MN 210	9.6
RA-Hybrid	Wilkin T 79	10.8
RA-Hybrid	Wilkin T 86	11.8
RA-Hybrid	Wilkin CSAH 19	13.9
RA-Hybrid	Wilkin CR 162	13.9
RA-Hybrid	Wilkin T 96	15.4
RA-Hybrid	Wilkin T 162	16.4
RA-Hybrid	Wilkin CR 169	17.4
RA-Hybrid	Wilkin T 261	18.7
RA-Hybrid	Wilkin CSAH 17	19.7
RA-Hybrid	Wilkin T 92	20.1
RA-Hybrid	Wilkin T 91	21.4
RA-Hybrid	Wilkin T 311	22.4
RA-Hybrid	Wilkin T 100	23.4
RA-Hybrid	Wilkin CR 159	24.4
RA-Hybrid	Wilkin T 94	25.4

Route Alternative	Road Name	Milepost
RA-Hybrid	King of Trails Scenic Byway (US Highway 75)	25.6
RA-Hybrid	MN 9	25.6
RA-Hybrid	Wilkin CR 158	26.4
RA-Hybrid	Wilkin T 127	27.4
RA-Hybrid	Wilkin CSAH 9	28.5
RA-Hybrid	Wilkin T 93	29
RA-South	Otter Tail T 1019	0.3
RA-South	Otter Tail CR 116	0.4
RA-South	Otter Tail T 1018	2.2
RA-South	MN 210	3.2
RA-South	Otter Tail T 1050	4.8
RA-South	Otter Tail T 1063	6.9
RA-South	Wilkin CSAH 19	12.8
RA-South	Wilkin CR 162	12.8
RA-South	Wilkin T 96	14.3
RA-South	Wilkin T 162	15.3
RA-South	Wilkin CR 169	16.3
RA-South	Wilkin T 261	17.7
RA-South	Wilkin CSAH 17	18.7
RA-South	Wilkin T 92	19.1
RA-South	Wilkin CR 158	20.3
RA-South	Wilkin T 91	20.3
RA-South	Wilkin T 311	21.3
RA-South	Wilkin T 100	22.3
RA-South	Wilkin CR 159	23.3
RA-South	Wilkin T 94	24.3
RA-South	King of Trails Scenic Byway (US Highway 75)	24.5
RA-South	MN 9	24.5
RA-South	Wilkin T 127	26.4
RA-South	Wilkin CSAH 9	27.4
RA-South	Wilkin T 93	27.7

Fergus Falls Municipal Airport-Einar Mickelson Field is located south of the project and within the ROI of RA-South. This airport is owned by the city of Fergus Falls, operated by Sky Crew Services LLC, and open to the public on weekdays from 8:00 a.m. to 5:00 p.m. and on Saturdays from 9:00 a.m. to 2:00 p.m., seasonally.[84] No regularly scheduled commercial flights are based out of the airport.[85]

Sewer, Water, and Waste Management

A summary of waste management, sewer, and water public services in the municipalities around the project area is provided in **Table 5-17**. Farmsteads are assumed to use private wells and septic systems.

Table 5-17 Sewer, Water, and Waste Management in the Project Area

Service	Name	County	Municipality or Region
Waste Management	Otter Tail Solid Waste Department	Otter Tail	Fergus Falls
	Waste Management	Wilkin	Breckenridge
	T&G Sanitation	Wilkin	Breckenridge
Sewer and Water	Fergus Falls Public Works Department	Otter Tail	Fergus Falls
	Breckenridge Public Utilities	Wilkin	Breckenridge

5.4.9.2 Potential Impacts

Emergency Services

Construction and normal operation of the project is not expected to cause a significant increase in emergency health and safety events that would impact local emergency services. The presence of additional construction personnel would have the potential to affect law enforcement agencies, fire protection services, and health care facilities in the communities adjacent to the project, including the potential need to respond to emergencies associated with construction of the project and the temporary increase in population. However, it is anticipated that these impacts would be negligible to minimal. Local emergency services would be able to manage these minor increases during construction and normal operations.

Impacts on emergency services in the event of a pipeline rupture are discussed in Chapter 8.

Schools and Public Transit

Because of the relatively small size of the temporary workforce (125 construction workers are anticipated to arrive from outside of Otter Tail and Wilkin Counties [see Section 5.4.11]) and the relative short construction period (less than 6 months), there are no anticipated impacts on schools or public transit.

Telecommunication, Electric, and Natural Gas Utilities

The Lake Region Electric Cooperative substation, which would be the capture facility's power source, is located adjacent to the ethanol plant and the capture facility. The project's operational needs, about 38,501,733 kilowatt hours (kWh) per year, are not anticipated to require the addition of power generation capacity. Lake Region Electric Cooperative intends to install fans on an existing transformer or install an additional transformer within the existing substation footprint to meet the project's electricity needs and does not anticipate any additional work would be needed to support the project. Underground cables would bring 12.47 kilovolts of electricity from the substation to the capture facility area and connect to the capture facility. The project is anticipated to have negligible impacts on telecommunication, electric, and natural gas utilities.

Transportation

Impacts on railroads would be negligible as the applicant proposes to install the pipeline under all railroads, well beneath the surface of the tracks, using HDD or bore methods. These trenchless construction methods would not disturb the railroads and would allow the railroads to operate normally during and after construction. In addition, the applicant would need to obtain a permit from the railroads to be sure the pipeline crossing is conducted in accordance with each railroad's standards.

RA-North would cross 26 roads, RA-Hybrid would cross 32 roads, and RA-South would cross 25 roads. All three routes cross MnDOT ROW in three places. RA-North would cross State Highway 9 and US Highway 75, and RA-Hybrid and RA-South would cross State Highway 210 and US Highway 75. At these crossings, the applicant would coordinate with MnDOT regarding work within MnDOT ROW and follow MnDOT mitigation suggestions regarding pipeline and boring pit locations and depth.

The existing road network is anticipated to be able to accommodate vehicles accessing the proposed capture facility during construction and operation of the project, including I-94, State Highway 210, and County Road 116. The applicant would conduct pre-construction surveys to document pre-existing roadway conditions. Local roadways would experience a temporary increase in traffic during construction activities. This increase would be more noticeable on some of the lesser travelled roads crossed by the project, but the increase would be for less than 30 days in most locations. Traffic levels would return to pre-construction conditions quickly after construction activities conclude. Although traffic levels would increase during construction as compared to baseline conditions, the additional traffic from 200 vehicles would not result in notable impacts.

Construction is expected to take 6 months or less, with construction crews generally working 6 days per week from 7:00 a.m. to 10:00 p.m. The project would require about 200 vehicles to support construction. Vehicles would include stringing trucks, welding rigs, water trucks, fuel trucks, mechanic trucks, flatbed and lowboy trailer trucks, graders, hydrostatic equipment trucks, and construction staff vehicles. The construction vehicles would generally be spread over the pipeline route, with more concentrated activities in some areas depending on the type of activities occurring. Construction would generally progress in a linear fashion, with levels of traffic rising when work is in each area and falling as the progress of construction moves on. The daily commute of construction workers and the delivery of equipment and materials to the project would add an incremental increase in the traffic found along existing transportation networks at specific locations, such as intersections and locations where the pipeline crosses a road. Increased vehicle traffic would be encountered during morning and evening peak times corresponding to normal workday hours. Major roads would be able to handle the minor and temporary increase of vehicles. The temporary increase in traffic during construction activities would be more noticeable on some of the lesser travelled roads. The increase would occur for fewer than 30 days in most locations.

Construction workers would drive personal or company vehicles directly to the project area and park in designated areas, such as along the construction workspace or on landowner property with landowner permission. The need for parking and the decision of where workers park would vary over time depending on the location and accessibility of the work area and the space available on the construction workspace. Workers who support construction of the capture facility would park on-site at the ethanol plant. There would be no long-term parking needs along the construction workspace for any of the route alternatives. If maintenance work is required, adequate parking space would be available for workers to temporarily park along the operational ROW or in safe locations, as agreed to with local landowners.

The CO_2 capture facility would be located at the existing ethanol plant, which already experiences daily vehicle and truck traffic from employees, vendors, and farmers with corn deliveries. The CO_2 capture facility is anticipated to take about 6 to 7 months to construct, with crews working 6 days per week.

Workers commuting for the project would increase the number of vehicles on principal roadways, generally prior to peak morning and after peak afternoon/evening workday rush-hour times.

Materials and equipment delivery traffic would be dispersed throughout normal workday hours. The local road network would be able to accommodate construction traffic. The applicant would construct a permanent access road to the CO_2 capture facility to allow for efficient travel to the construction site and daily access to the CO_2 capture facility during operation of the project. Construction equipment could track sediment onto paved roads when leaving the construction workspace.

The applicant plans to HDD or bore all paved roads to minimize impacts on traffic. This construction technique should prevent the need for road closures and allow traffic to operate normally.

Fergus Falls Municipal Airport-Einar Mickelson Field is within the ROI for RA-South, but outside the route width, and would not be impacted by construction or operation of the project.

Sewer, Water, and Waste Management

A minor, temporary increase in water and sewer use is anticipated due to the influx of construction workers using temporary housing, such as hotels/motels, recreational vehicle parks, and campgrounds. The existing water and sewer capacity of local community water and sewer utilities would be sufficient for the influx of temporary construction workers. Water supply for operation of the capture facility is discussed in Section 5.7.8.

Solid waste would be generated by the construction of the project, including excess soils and rocks, timber slash, garbage generated by construction crews, timber mat debris, erosion control measures no longer in use, and other construction-related materials, such as cardboard, plastic, and other packaging materials. The applicant would remove waste from the construction workspace on a daily basis and dispose of it using a licensed waste hauler, as required by applicable permits and regulations. Wastewater generated by use of portable toilets during construction would be transported via truck to a licensed facility for proper disposal.

5.4.9.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following mitigation for public services and infrastructure:

- "During construction, the Permittee shall minimize any disruption to public services or public utilities. To the extent disruptions to public services or public utilities occur these would be temporary, and the Permittee will restore service promptly. Where any impacts to utilities have the potential to occur the Permittee will work with both landowners and local agencies to determine the most appropriate mitigation measures if not already considered as part of this permit."
- "The Permittee shall cooperate with all entities that have existing easements or infrastructure within the pipeline route to ensure minimal disturbance to existing or planned developments."
- "The Permittee shall advise the appropriate governing bodies having jurisdiction over all state, county, city or township roads that will be used during the construction phase of the project."
- "Where practical, existing roadways shall be used for all activities associated with construction of the facility. Oversize or overweight loads associated with the facility shall not be hauled across public roads without required permits and approvals."

- “The Permittee shall construct the least number of site access roads it can. Access roads shall not be constructed across streams and drainage ways without the required permits and approvals. Access roads shall be constructed in accordance with all necessary township, county or state road requirements and permits.”
- “The Permittee shall promptly repair private roads or lanes damaged when moving equipment or when accessing construction workspace, unless otherwise negotiated with the affected landowner.”
- “The Permittee shall be responsible for compliance with all laws applicable to the generation, storage, transportation, clean up and disposal of all wastes generated during pipeline construction and restoration of the right-of-way. All waste and scrap that is the product of construction shall be removed from the right-of-way and all premises on which construction activities were conducted and properly disposed of upon completion of each task. Personal litter, including bottles, cans, and paper from construction activities shall be removed on a daily basis.”

Additionally, the sample routing permit states that “the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations.”

Applicant-Proposed Mitigation

The applicant would coordinate with Gopher State One Call to determine the locations of existing underground utilities before beginning any ground-disturbing activity.

Use of the HDD or bore method to install the pipeline beneath railroads would avoid impacts on the railroad.

The applicant has met with county engineers and other road authorities to discuss crossing methods, construction traffic, use and repair of roadways, and similar issues. The applicant indicates it will develop and enter into road agreements with each county to address these issues. Additionally, the following measures would be implemented to mitigate impacts on roadways during and after construction:

- Assigning traffic control personnel in areas of temporary lane closures (for example, when construction equipment is pulling off the construction workspace and onto a public road) or heavy traffic.
- Restoring road surfaces damaged by construction to pre-existing conditions or better.
- Removing access points installed to facilitate ingress/egress to the construction workspace and restoring affected areas.
- Reducing equipment and vehicle access to the construction workspace where practicable and installing rock access pads or construction pads in accordance with permits and by federal, state, and/or local specifications.
- Crossing all paved roads by HDD or bore techniques to minimize impacts on traffic by preventing the need for road closures and allowing traffic to operate normally.

No mitigation measures specific to sewer, water, and waste management were proposed by the applicant.

Mitigation Proposed During Scoping

MnDOT would require mitigation at crossings of MnDOT ROW, as noted during scoping. These measures would include depth and casing requirements, restrictions on boring pit locations, avoiding intersecting other roads with MnDOT ROW, and setbacks for existing utilities and structures. MnDOT noted that the applicant should coordinate project construction activities, including plans for hauling oversized loads, with MnDOT staff and should stay current on MnDOT's highway construction activities that could affect project construction.

Mitigation Recommended by EERA Staff

None currently recommended.

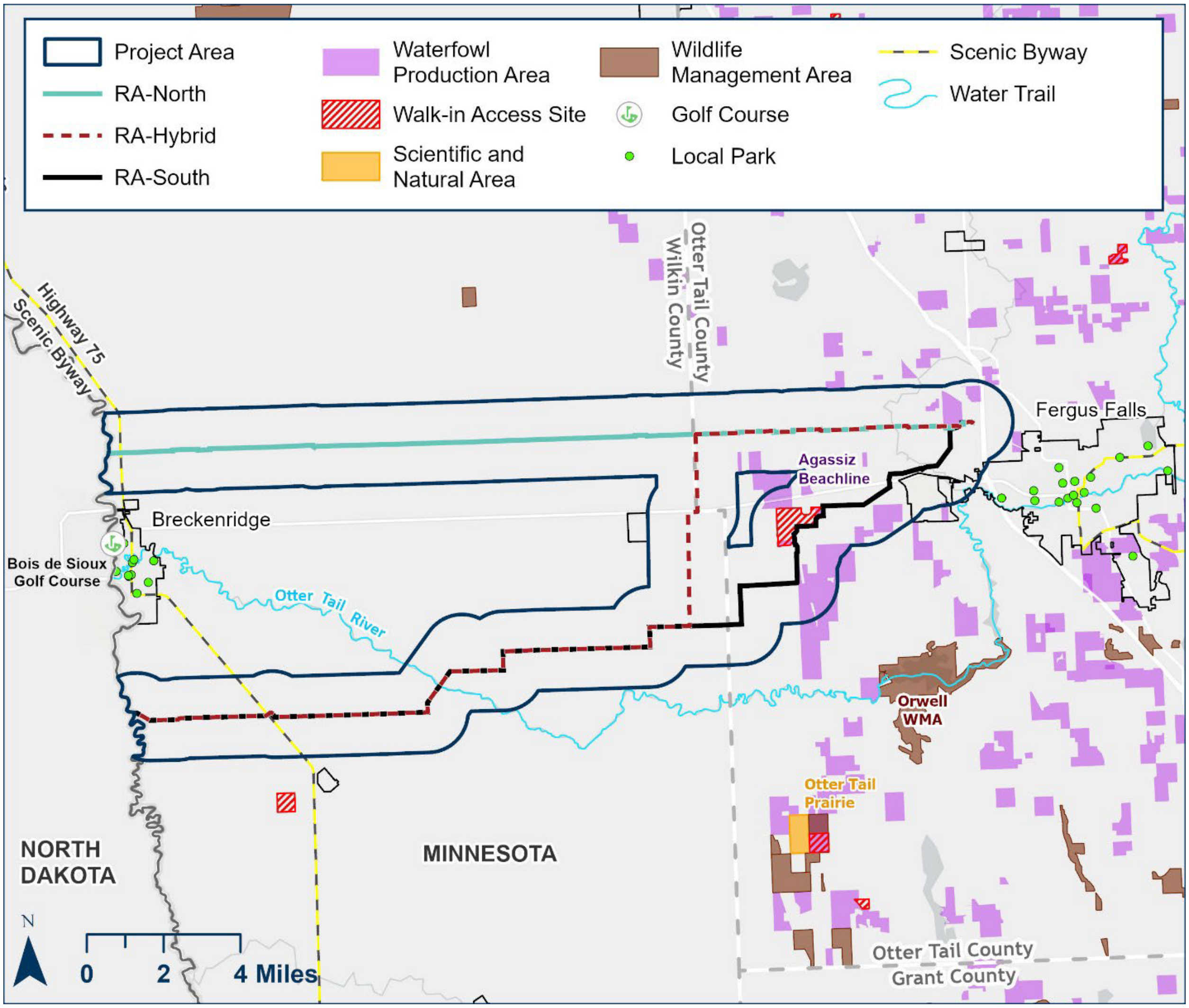
5.4.10 Recreation

The ROI for recreation is the local vicinity (area within 1,600 feet of the route width). Recreational facilities could be affected by construction-related impacts on aesthetics, noise, and air quality. Recreation impacts are anticipated to be short-term and minimal to moderate. All three route alternatives would cross the King of Trails Scenic Byway (US Highway 75). RA-Hybrid and RA-South would cross the Otter Tail River, a state-designated water trail. The project could temporarily impact these recreational resources during construction due to the presence of equipment in the viewshed, generation of dust, removal of vegetation in the viewshed, and increased noise. RA-South would pass through the Fergus Falls Fish & Game Club's Orwell property. The applicant would continue to communicate with the club to minimize visual and noise impacts during construction. RA-North would not cross the Otter Tail River or the Orwell property, and would be anticipated to have fewer impacts on recreation than the other two route alternatives. Operation of the project would not cause visual or noise impacts on recreational resources.

5.4.10.1 Existing Conditions

Recreational spaces and opportunities are present within Otter Tail and Wilkin Counties. Recreational opportunities within the counties include nature preserves, hiking trails, biking trails, fishing, hunting, snowmobiling, boating, canoeing, kayaking, and swimming. The recreational activities in the area are typically associated with various natural resources, such as lakes (fishing, boating, etc.) and parks (hiking, biking, etc.). All proposed routes for the project pass through primarily rural/agricultural land, avoiding proximity to available recreational spaces. Recreational facilities in the vicinity of the project are shown in **Figure 5-8.**

Figure 5-8 Recreational Facilities in the Project Vicinity



Note: Walk-in Access Sites are open to individuals with a Walk-In Access validation for hunting from September 1 to May 31 during legal hunting hours and open seasons from a half-hour before sunrise to a half-hour after sunset with no landowner contact necessary.

5.4.10.2 Potential Impacts

RA-North and RA-Hybrid would be near, but more than 1,600 feet away from, the Agassiz Beachline Waterfowl Production Area, which is a nature preserve.

RA-Hybrid and RA-South cross the Otter Tail River, a state-designated water trail, which is the location of a Buffalo-Red River Watershed District and USACE-sponsored stream restoration project. All three routes would also cross the King of Trails Scenic Byway (US Highway 75). The pipeline would be installed underneath both the Otter Trail River and the scenic byway using HDD techniques, which would avoid vegetation clearing between the HDD entry and exit points. After construction, the applicant would generally maintain the 50-foot-wide operational ROW over the pipeline by mowing and removing woody vegetation taller than 15 feet in non-cultivated areas. Exceptions include the area between HDD entry and exit points where the vegetation would not be maintained and at riparian buffers adjacent to waterbodies where only a 10-foot-wide corridor would be maintained.

RA-South would pass through the Fergus Falls Fish & Game Club's Orwell property. Short-term, minimal to moderate impacts on aesthetics and noise would occur during construction. RA-North would not cross the Otter Tail River or the Orwell property and would be anticipated to have fewer impacts on recreation than the other two route alternatives.

The project may have short-term, minimal to moderate impacts on recreational resources and recreational activities, such as fishing and hunting, during construction due to the presence of equipment in the viewshed and increased noise while equipment is operating.

During construction, vehicles and equipment would produce noise (see Section 5.4.5) and dust that would be perceptible to nearby users. The removal of vegetation in construction workspaces and placement of construction vehicles and equipment would alter the viewshed temporarily. The project would not result in temporary closures of recreational areas.

Aside from the presence of the maintained operational ROW, which generally would not be noticeable in cultivated areas, the project would not cause visual or noise impacts on recreational resources once construction is complete. After restoration is complete, operation of the project would not result in visual impacts on users of the recreational areas because the pipeline facilities would be mostly underground. Aboveground facilities along the length of the pipeline would include MLVs and both temporary and permanent access roads.

5.4.10.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to recreation. However, the following measures to mitigate aesthetics and noise would also mitigate impacts on recreation:

- "Care shall be used to preserve the natural landscape, minimize tree removal, and prevent any unnecessary destruction of the natural surroundings in the vicinity of all pipeline construction and restoration activities."
- "The Permittee shall clear the permanent right-of-way and temporary right-of-way preserving to the maximum extent practicable windbreaks, shelterbelts, living snow fences, and vegetation in areas such as trail and stream crossings where vegetative screening may minimize aesthetic impacts, to the extent that such actions do not impact the safe operation, maintenance, and inspection of the pipeline and are in compliance with all applicable laws and regulations."
- "The Permittee shall comply with noise standards established under Minnesota Rules 7030.0100 to 7030.0080, at all times at all appropriate locations during operation of the facility. Construction and maintenance activities shall be limited to daytime working hours to the extent practicable to ensure nighttime noise level standards will not be exceeded."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant states that it would continue to communicate with the Fergus Falls Fish & Game Club to minimize visual and noise impacts during construction.

Mitigation Proposed During Scoping

No mitigation specific to recreation was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

Should the Commission elect to issue a pipeline routing permit along RA-South, EERA staff recommends the applicant provide documentation of coordination with the Fergus Falls Fish & Game Club.

5.4.11 Socioeconomics

The ROI for socioeconomics is Otter Tail and Wilkin Counties. Socioeconomics assesses overall social and economic character of an area and the project's effects on the well-being of current and future residents of the affected community. Socioeconomic impacts are anticipated to be minimal, short-term to long-term, and similar across the three route alternatives. Most impacts would be beneficial. Construction would result in a temporary increase in local population associated with the workers and associated spending from lodging, transportation, and food. The nearby cities have adequate housing and infrastructure to support the additional workers for all three route alternatives. Local labor would also be used, increasing employment in the surrounding area. The applicant estimates the total cost for the project to be $69.75 million for RA-North, $70.12 million for RA-Hybrid, and $66.75 million for RA-South, with a construction payroll of $30,910,000. The project would increase tax revenues, benefiting the counties and state. The applicant estimates that the project would generate property tax revenues of $894,000 in Otter Tail County and $972,000 in Wilkin County during the first year of operation.

5.4.11.1 Existing Conditions

Data from the United States Census Bureau on population and income[86, 87] and data from the Minnesota Department of Employment and Economic Development on labor force and unemployment[88] were reviewed to obtain information regarding the current socioeconomic conditions of the counties. **Table 5-18** summarizes the socioeconomic conditions in the ROI, as well as the state of Minnesota and city of Fergus Falls.

Table 5-18 Population, Income, and Employment

State/ County/City	Population (July 2022)	Population Density (people/square mile, 2020)	Per Capita Income (2017–2021, in 2021 dollars)	Labor Force Participation Rate, 2021 (percent)	2021 Total Labor Force	2021 Unemployment Rate (percent)
Minnesota	5,717,184	72	$41,204	69.2	3,109,419	4.0
Otter Tail County	60,519	31	$34,380	62.6	30,121	4.4
Wilkin County	6,350	9	$34,945	64.0	3,285	4.0
City of Fergus Falls	14,187	982	$31,737	62.1	N/A	N/A
City of Breckenridge	3,430	1,394	N/A	N/A	N/A	N/A

N/A = not available

Between 2010 and 2020, the population of Otter Tail County increased by 4.8 percent, and the population of Wilkin County decreased by 1.1 percent. In 2022, Otter Tail County had a population of 60,519 , and Wilkin County had a population of 6,350. Fergus Falls is the largest city in either county, with a 2022 population of 14,187.[89]

The ethanol plant, the proposed capture facility, and the easternmost point of all three route alternatives are all near Fergus Falls, just north and outside of the Fergus Falls city limits. The city of Breckenridge in Wilkin County, on the Minnesota-North Dakota border, lies between the westernmost point of all three route alternatives. Breckenridge's population in 2020 was 3,430.[90] The City of Foxhome, with a 2020 population of 126,[91] is within 1 mile of RA-Hybrid.

Based on 2021 data, unemployment rates are generally low, ranging from 4.0 percent (Wilkin County) to 4.4 percent (Otter Tail County), and similar to the state average of 4.0 percent. Per capita income, $34,380 in Otter Tail County and $34,945 in Wilkin County, is lower than the state average. Manufacturing and educational, health, and social services are generally the largest economic industries for employment in both counties.[92]

About 80 to 100 construction workers would be necessary to construct the capture facility at the peak construction phase. About 150 construction workers would be necessary to construct the pipeline at the peak construction phase. For the construction of the project, 100 percent of the workforce would be union employees, with 50 percent of the personnel sourced from local union halls (see **Appendix I**). However, due to the comparatively low unemployment rates in Otter Tail and Wilkin Counties, potential local labor shortages, specialized skill needs, and the relatively short construction schedule, additional labor would likely need to be sourced from other areas of the state or other states. For the purpose of this analysis, it is assumed that 125 construction workers could come from outside of the ROI and require temporary housing.

Temporary housing is available in Fergus Falls near the capture facility and the eastern end of the pipeline. As shown in **Table 5-19**, there is sufficient housing available for workers, including 9,596 units available in Otter Tail County, 37 units available in Wilkin County, and 84 units available in the Fergus Falls for seasonal, recreational, or occasional use.[93] A total of 69 hotels and motels are available in Otter Tail and Wilkin Counties, with a minimum of 215 rooms available in Fergus Falls.[94] Additional temporary housing is available in Breckenridge and Wahpeton, North Dakota, near the western end of the project.

Table 5-19 Temporary Housing in Otter Tail and Wilkin Counties[95, 96]

County/ City	Housing Units for Rent	For Seasonal, Recreational, or Occasional Use	For Migrant Workers	Other Vacant	Hotels and Motels	Campgrounds/ Other[a]
Otter Tail County	527	9,596	10	798	67	16
Wilkin County	57	37	1	95	2	0
City of Fergus Falls	228	84	0	137	6	1

[a] Other includes resorts and RV parks.

The applicant estimates the total cost for the project to be $69.75 million for RA-North, $70.12 million for RA-Hybrid, and $66.75 million for RA-South (plus or minus 15 percent). Based on the applicant's current schedule, pipeline construction would occur from March 2025 to July 2025, and the CO_2 capture facility would be constructed from May 2025 to August 2025 (see **Appendix I**).

During operation, the applicant plans to employ three full time employees, two pipeline technicians and one capture facility operator, who may be hired from the project area or elsewhere depending on availability of personnel with specialized skill requirements.

5.4.11.2 Potential Impacts

Construction of the project would result in a temporary increase in local population associated with the workers who would come from outside the ROI. The increase would not have a significant effect on the population of Otter Tail and Wilkin Counties.

The project would temporarily increase employment in the ROI by about 250 jobs during the peak of construction (80 to 100 workers at the capture facility and 150 workers for the pipeline). The applicant estimates a total construction payroll of $30,910,000.[97] The applicant states that half of the workers would come from local unions, so a maximum of 125 workers could come from outside Otter Tail and Wilkin Counties and could require temporary housing. As shown in **Table 5-19** above, adequate temporary housing is available for these workers. Impacts on temporary housing would be beneficial as vacant units are rented by workers. However, impacts could be adverse if increased competition increases rental rates or displaces tourists. The impacts would be short-term and minimal.

In a report commissioned by the applicant in 2022 for the MCE Project, Ernst and Young estimated that total capital expenditures (direct, indirect, and induced impacts, including the applicant's contribution, its contractors' contributions, and suppliers' contributions) would be $39,193,000 in Otter Tail County and $42,631,000 in Wilkin County.[98]

The applicant and its contractors also would purchase some goods and services in the counties crossed by the project during construction and operation, which would have a moderate short-term and negligible to minimal long-term beneficial impact on the local economy. Individual landowners would be compensated for operational pipeline easements as well as for use of temporary construction workspaces.

The project would increase tax revenues in the short- and long-term, resulting in a minimal beneficial impact on the counties. The applicant estimates that the project would generate property tax revenues of $894,000 in Otter Tail County and by $972,000 in Wilkin County during the first year of operation.[99]

5.4.11.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to socioeconomics. The sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant does not propose mitigation measures.

Mitigation Proposed During Scoping

No mitigation specific to socioeconomics was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.4.12 Tribal Treaty Rights

The ROI for Tribal treaty rights is the project area (area within 1 mile of the route width). Lands in the local vicinity of the project were ceded to the United States government in two 1851 treaties, and neither treaty that ceded lands within the project area established government-recognized usufructuary hunting or gathering rights within the ceded lands. Therefore, potential impacts on Tribal treaty rights along each of the route alternatives during construction and operation of the project are expected to be negligible.

5.4.12.1 Existing Conditions

The project area has been home to various peoples and cultures since time immemorial. In the early to mid-1800s, the project area was populated primarily by Dakota Tribes (Sioux) and Ojibwe (Chippewa) until the Ojibwe relinquished their claims to the area in 1825. In 1851, most lands in southern and central Minnesota, including lands in the vicinity of the project, were ceded to the United States government in two treaties: the Treaty with the Sioux-Sisseton and Wahpeton Bands, signed July 23, 1851, and the Treaty with the Sioux-Mdewakanton and Wahpakoota Bands, signed August 5, 1851.

Royce's Schedule of Indian Land Cessions lists land cessions from 1784 to 1894, descriptions of the land ceded, and the names of the tribes affected. The area that was ceded in 1851, which includes the project area, is described under Royce's Schedule of Indian Land Cessions number 289.[100]

The area on the west side of the Bois de Sioux River was ceded under Royce's Schedule of Indian Land Cessions number 538, which occurred under an 1872 treaty in which the Sisseton and Wahpeton Bands of the Sioux ceded claims to all lands outside of permanent reservations (Rev. Stat. 1050).[101] Additionally, the project area is about 30 miles upstream from areas ceded under the 1855 Treaty with the Chippewa-Mississippi and Pillager Bands (10 Stat. 1165), which is described under Royce's Schedule of Indian Land Cessions number 357,[102] and under the 1863 Treaty with the Chippewa-Red Lake and Pembina Bands (13 Stat. 667), which is described under Royce's Schedule of Indian Cessions number 445.[103]

Treaty with the Sioux-Sisseton and Wahpeton Bands (10 Stat. 949)

The Treaty with the Sioux-Sisseton and Wahpeton Bands, signed in 1851, is also commonly referred to as the Treaty with the Dakota at Traverse des Sioux. This treaty ceded all lands of the Sioux-Sisseton and Wahpeton Bands of Dakota in the state of Iowa. It also ceded all lands in the then Minnesota Territory. The area was bounded to the west by the western bank of the Red River (along the Minnesota-North Dakota border) starting at its junction with the Buffalo River (about 12 miles north of Fargo, North Dakota), extending south along the Red River as it transitions into the Bois de Sioux River in Wahpeton, continuing south until reaching the southernmost tip of Lake Traverse, then extending straight west into South Dakota until reaching the junction of Kampeska Lake with the Big Sioux River, then along the western bank of the Big Sioux River running southwest until reaching the northwestern corner of the state of Iowa.[104]

Under this treaty, "the Sisseton and Wahpeton [B]ands of the Dakota ceded 21 million acres for $1,665,000, or about 7.5 cents an acre…. The U.S. government kept more than 80 percent of the money ($1,360,000), with the Dakota receiving only the interest on the amount, at 5 percent for 50 years."[105] This treaty did not establish government-recognized usufructuary hunting or gathering rights within the ceded lands. Instead, it established Dakota reservation lands surrounding the Minnesota River for about 10 miles northeast and southwest of the river, bounded in Minnesota by the Yellow Medicine River to the southeast.[106] This reservation land is not located within the project area.

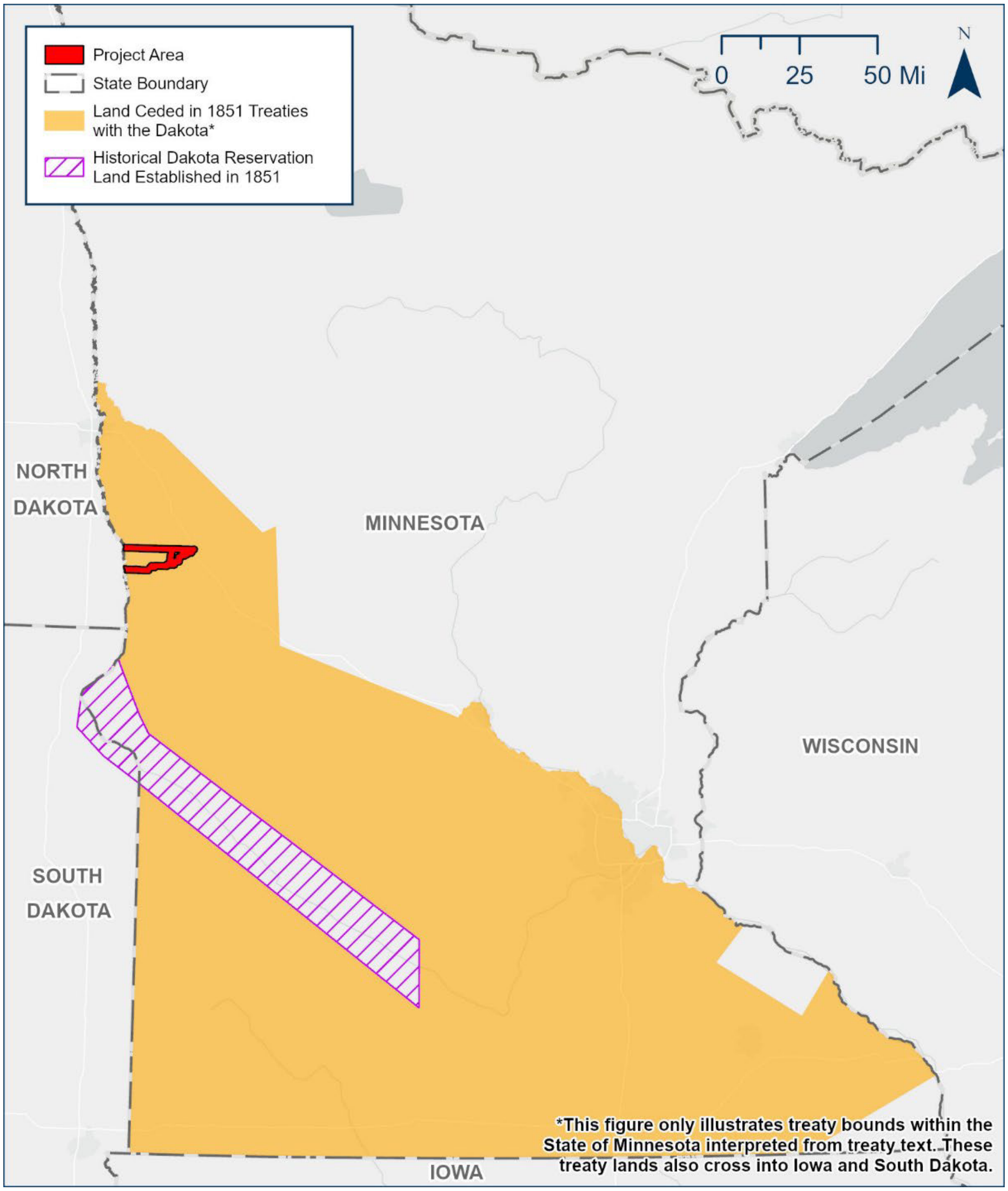
The reservation land within Minnesota was possessed by the United States government in an 1858 Treaty with the Dakota and the 1863 Dakota Expulsion Act. "In 1858, a month after Minnesota became the 32nd state in the union, a group of Dakota leaders were summoned to Washington, DC, where they were detained until they signed another treaty relinquishing all land north and east of the Minnesota River to the United States. Dakota title to a 10-by-150-mile strip of land—a portion of the land designated a reservation in 1851—was acknowledged through this treaty. Authority was given to allot individual claims on this reservation land to Dakota farmers."[107] In 1863, "a federal law, the Dakota Expulsion Act, abrogates all Dakota treaties and makes it illegal for Dakota to live in the state of Minnesota. The act applies to all Dakota, regardless of whether they joined the [U.S.-Dakota] war in 1862."[108] The reservation land within Minnesota was taken back by the United States government and a reservation was established outside of the state boundaries at Crow Creek in the Dakota Territory. This reservation was located along Big Stone Lake northwest of present-day Big Stone City in South Dakota.[109]

Treaty with the Sioux-Mdewakanton and Wahpakoota Bands (10 Stat. 954)

The Treaty with the Sioux-Mdewakanton and Wahpakoota Bands, also signed in 1851, is known as the Treaty with the Dakota at Mendota. This treaty relinquished "all [the Bands'] lands and all their right, title and claim to any lands whether in the Territory of Minnesota, or in the State of Iowa."

Under this treaty "the bands were to receive the interest on $1,410,000 that was to be applied to agricultural implements, provisions, education, and annuities in return for relocating to the Lower Sioux Agency near present-day Morton and ceding much of their remaining territory in southwestern Minnesota. Exasperated, Little Crow and other leaders who initially refused to sign, did so based on promises that funds would be paid from previously unpaid treaty agreements. The treaty was ratified by congress and these promises did not come to pass."[110] The treaty did not establish government-recognized usufructuary hunting or gathering rights within the ceded lands. The bands were given 1 year to move to the same reservation land along the Minnesota River outlined above in the Treaty with the Sioux-Sisseton and Wahpeton Bands.[111] As indicated above, this reservation land within Minnesota was quickly possessed by the United States government through an 1858 Treaty with the Dakota and the 1863 Dakota Expulsion Act, and a reservation was established outside of the state boundaries at Crow Creek in the Dakota Territory.

Figure 5-9 Historical Treaty and Reservation Boundaries



The land covered by these treaties encompasses all three route alternatives. The historical reservation land established in 1851 was not located within the project area.

5.4.12.2 Potential Impacts

Neither treaty that ceded lands within the project area established government-recognized usufructuary hunting or gathering rights within the ceded lands. Therefore, the project is not anticipated to impact usufructuary hunting or gathering rights along any of the route alternatives.

5.4.12.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to Tribal treaty rights. The sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

None proposed.

Mitigation Proposed During Scoping

No mitigation specific to Tribal treaty rights was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.5 Economies

5.5.1 Agriculture

The ROI for agriculture is the local vicinity (area within 1,600 feet of the route width). Short-term agricultural impacts would be minimal across the three route alternatives. Long-term agricultural impacts would also be minimal. Agricultural land, including prime farmland, is found across the three route alternatives in similar acreages. During construction, lands would not be available for agricultural production. Easement agreements can compensate landowners for lost crops due to construction. Following construction of the pipeline, agricultural land would be restored, and agricultural activities could resume. Crop production could be reduced in areas that were disturbed by construction, typically for 2 to 3 years, but potentially up to 5 years, depending on impacts on soils from construction disturbance.

5.5.1.1 Existing Conditions

For the purposes of this analysis, agricultural land is defined as cultivated cropland and grassland and includes activities such as organic farming, crop harvesting, livestock grazing, and dairy production. It can include prime farmland, which is land with areas of soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, as defined by the USDA Natural Resources Conservation Service and described in more detail below. Prime farmland definitions are based on soil types; therefore, this land can include agricultural land as defined above or land that is not currently being used for agricultural production.

Farming occurs in Otter Tail and Wilkin Counties; however, it constitutes a small percentage of overall state agriculture sales at just 3 percent. The following summary is based on information from the Census of Agriculture, which is conducted by USDA.[112] The agricultural census is a complete count of farms, ranches, and the people who operate them, including small plots with at least $1,000 in annual sales. The most recent agricultural census was completed in 2017. The 2022 agricultural census is expected to be released on February 13, 2024.[113] This information will be included in the final EIS if it is available.

In 2017, there were 319 individual farms using 428,148 acres of farmland in Wilkin County—an 18 percent decrease in the overall number of farms and 3 percent decrease in acres from 2012—and 2,544 individual farms using 794,496 acres of farmland in Otter Tail County—a 16 percent decrease in the number of farms and 10 percent decrease in the number of acres from 2012. The value of the products sold, both crop sales and livestock sales, fell about 30 percent in both counties from 2012.[114] **Table 5-20** summarizes each county's agricultural activity.

Table 5-20 USDA Summary for Otter Tail and Wilkin Counties [115]

Item	Otter Tail County (2017)	Wilkin County (2017)
Farms (number)	2,544	319
Land in Farms (acres)	794,496	428,148
Average size of Farm (acres)	312	1,095
Median size of Farm (acres)	135	498
Estimated market value of land and building per farm (dollars)	927,172	4,239,436
Estimated market value of land and building per acre (dollars)	2,969	3,872
Estimated market value of all machinery and equipment (dollars)	383,195,000	185,567,000
Average per farm (dollars)	150,686	474,674
Total cropland (acres)	576,163	414,596
Market value of agricultural products sold (dollars)	349,919,000	185,597,000
Average per farm (dollars)	137,547	474,674

Organic Farming

Organic is a labeling term that indicates that the food or other agricultural product has been produced through approved methods. The organic standards describe the specific requirements that must be verified by a USDA-accredited certifying agent before products can be labeled USDA organic. MDA estimates that about 700 organic certified farms were located in Minnesota as of 2022.

Several databases were searched to identify organic farming operations in the project area. The *Directory of Minnesota Organic Farms* and the *Minnesota Grown Directory*, both maintained by MDA, did not identify any organic farms within the project area.[116, 117] *DriftWatch* "is a voluntary communication tool that enables crop producers, beekeepers, and pesticide applicators to work together to protect specialty crops and apiaries through use of mapping programs." No farms within the project area are registered with this program.[118] The *Organic Integrity* database is maintained by USDA. This database "contains up-to-date and accurate information about operations that may and may not sell as organic," and is maintained by organic certifiers. No farms within the project area are registered with this program.[119]

Farmland Class

There are differences in the quality and suitability of land for agricultural production. Federal regulation 7 CFR Section 657.5(a)(1) defines prime farmland, in part, as:

> Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It has the soil quality, growing season, and moisture supply needed to economically

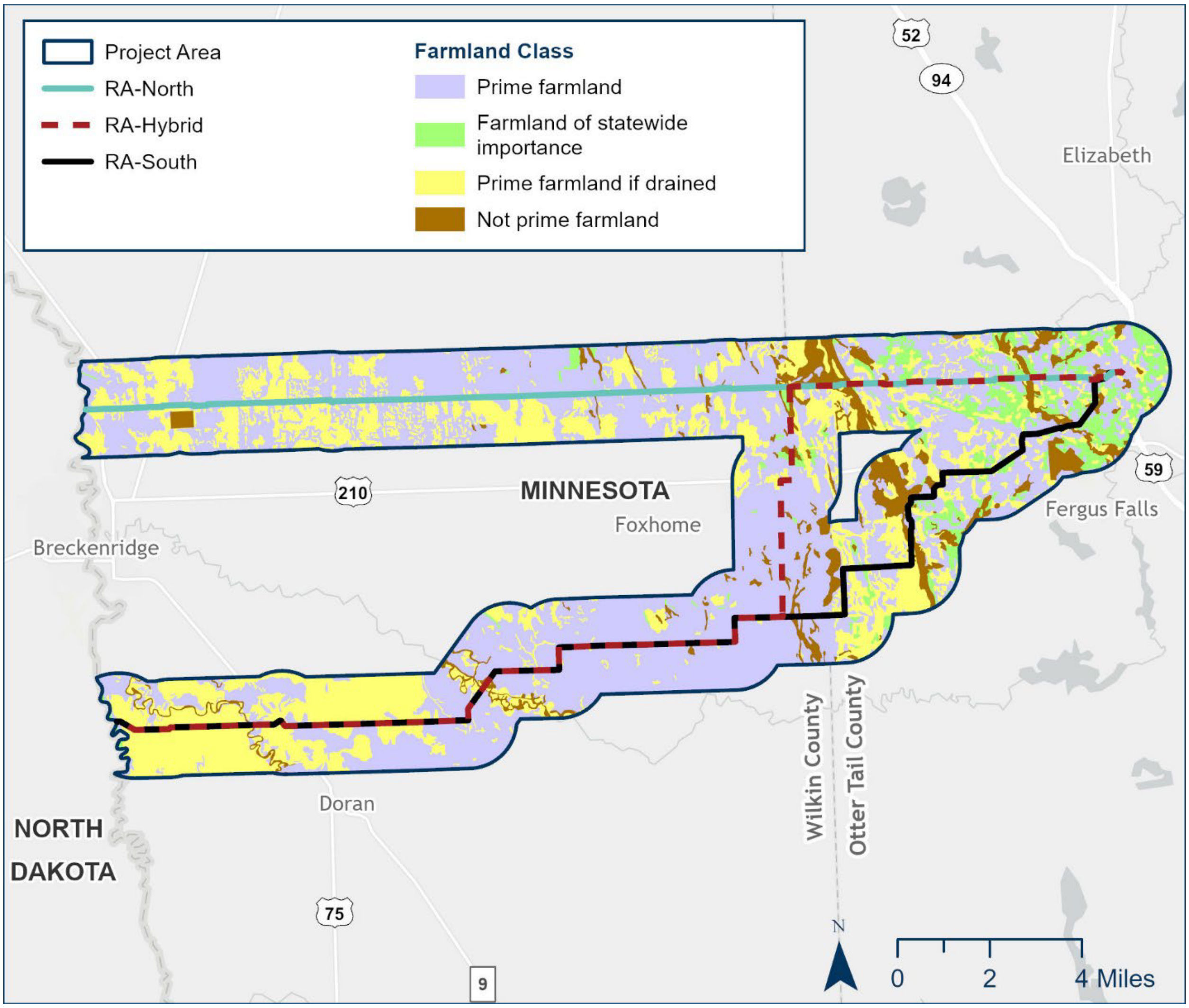
> produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

Although prime farmland characteristics are the same nationwide, certain soils that do not meet these specific characteristics are nevertheless important at a statewide level. Farmland of statewide importance is land, in addition to prime and unique farmlands, that is of statewide importance to produce food, feed, fiber, forage, and oil seed crops.

Criteria for defining and delineating farmland of statewide importance are determined by the appropriate state agency or agencies. Generally, additional farmlands of statewide importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some soils might produce as high a yield as prime farmlands, if conditions are favorable. In some states, additional farmlands of statewide importance may include tracts of land that have been designated for agriculture by law.

The Soil Survey Geographic Database (SSURGO) contains soil information collected by the USDA National Cooperative Soil Survey. **Figure 5-10** shows soils classified by SSURGO as either prime farmland or farmland of statewide importance. About 53 percent of soil types in Otter Tail County are considered prime farmland or farmland of statewide importance, and about 92 percent of soil types in Wilkin County are considered prime farmland or farmland of statewide importance.[120] As such, the different route alternatives cross prime farmland: 1,695 acres within the ROI for RA-South, 1,762 acres within the ROI for RA-Hybrid, and 1,324 acres within the ROI for RA-North have soils that are classified as prime farmland, farmland of statewide importance, or prime farmland if drained.

Figure 5-10 Prime Farmlands in the Local Vicinity of the Route Alternatives



Notes: SSURGO data and NLCD data are unrelated—SSURGO data show soil types; NLCD data show land use/cover types regardless of the underlying soil.

5.5.1.2 Potential Impacts

Construction activities would impact agricultural land within the construction workspace. Impacts on agricultural land include clearing of existing crops during site preparation and construction. Topsoil would be segregated and stockpiled. Soils would be replaced after the trench is backfilled. During the construction period, lands within the construction workspace would not be available for agricultural use, and crops could not be produced. Impacts would be temporary and limited mostly to the length of the construction period of 6 months or less. However, the disturbance from construction could result in reduced crop production post construction. These impacts typically would extend for 2 to 3 years, but could take up to 5 years, depending on impacts on soils from the construction disturbance.

Operation of the pipeline would result in minimal impacts on agricultural lands. Agricultural activities would be allowed to resume within the operational ROW after final restoration activities.

Impacts described for construction have the potential to lead to financial impacts, for example, lost farm revenue. Compensation for crop loss would be negotiated between the applicant and the landowner. These agreements are outside the scope of this EIS.

Organic Farming

Impacts on organic farming are not expected because no organic farms were identified in the route width for any route alternative.

Farmland Class

Table 5-21 shows the acres of prime farmland and farmland of statewide importance crossed by the construction and operational ROW for each route alternative. About 90 percent of the land crossed by all route alternatives is classified as prime farmland. About 5 percent of the construction and operation footprints for both RA-North and RA-South and about 4 percent of RA-Hybrid cross soils classified as farmland of statewide importance. Differences are insignificant, and potential impacts on soils classified as prime farmland and farmland of statewide importance during both construction and operation of the project would be similar for all route alternatives. Operation of the project would result in long-term impacts on prime farmland and farmland of statewide importance at the capture facility, MLVs, and permanent access roads, although the capture facility site is not currently in agricultural use.

Table 5-21 Prime Farmland and Farmland of Statewide Importance Impacts[121]

		Prime Farmland		Farmland of Statewide Importance	
Alternative Route	**Total Footprint Acreage**	**Acres**	**Percent of Total Acreage**	**Acres**	**Percent of Total Acreage**
RA-North					
Construction Footprint	289.8	262.3	90.5	15.8	5.4
Operation Footprint	139.4	125.4	90.0	7.6	5.4
RA-Hybrid					
Construction Footprint	361.9	327.0	90.3	15.7	4.3
Operation Footprint	176.6	158.3	89.6	7.6	4.3
RA-South					
Construction Footprint	348.8	317.7	91.1	17.8	5.1
Operation Footprint	170.1	153.6	90.3	8.5	5.0

During construction, existing vegetation would be cleared and topsoil would be removed. This could expose soils classified as prime farmland and farmland of statewide importance to wind and water erosion. Topsoil classified as prime farmland and farmland of statewide importance could be lost due to improper handling or erosion along the pipeline. Potential impacts from soil erosion would be limited to the length of the construction period until the construction workspace has been restored. Section 5.7.6 provides further discussion of potential impacts on soils from construction and operation of the pipeline.

As shown in **Table 5-21**, operation of the project would have minimal long-term impacts on prime farmland and farmland of statewide importance because areas of the capture facility, MLVs, and permanent access roads would not be available for farming. While the capture facility site is classified as prime farmland, it is adjacent to the ethanol plant and not currently used for agriculture.

5.5.1.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following mitigation for agricultural impacts:

- "The Permittee shall comply with the Agricultural Protection Plan (APP)…. The obligation to comply with the APP as a condition of this permit shall expire with the termination of Commission jurisdiction over this permit as prescribed by Minn. R. 7852.3900, unless otherwise specified in the APP. The Minnesota Department of Agriculture must approve of any amendments to the APP. The Permittee shall file the amended APP with the Commission within 10 days of Minnesota Department of Agriculture approval."
- "The Permittee shall at least 14 days prior to the start of construction provide notice to all landowners affected by construction with the name, telephone number and email address of the Agricultural Monitor and County inspector designated by the County, if appointed."
- "Areas disturbed by construction activities shall be restored to pre-construction conditions."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant proposes the following mitigation measures to minimize impacts on agricultural lands:

- Landowners would be compensated for lost crops due to construction according to the terms of their individual easement agreements.
- Operations and maintenance activities would be coordinated with the landowner.

Additionally, the applicant proposes several measures to minimize or avoid impacts from excessive soil crowning or subsidence in agricultural lands, as discussed in more detail in its Minnesota APP (**Appendix E**). These mitigation measures include:

- Following completion of construction in agricultural lands, the applicant would restore the construction workspace to as close to the original pre-construction contours as practicable. If uneven settling occurs or surface drainage problems develop as a result of pipeline construction, the applicant would provide additional land leveling services after receiving a landowner's written notice, weather and soil conditions permitting. Alternatively, the applicant would negotiate with the landowner for reasonable compensation in lieu of restoration.

- During trench backfilling, subsoil material would be replaced first, followed by topsoil. Subsoil would be backfilled and compacted to prevent subsidence. Compaction by operating construction equipment along the trench is acceptable.
- During frozen conditions in agricultural lands, the applicant would minimize final clean-up activities. Frozen conditions can preclude effective topsoil replacement, removal of construction debris, removal of excess rock, decompaction of soil as required, final grading, and installation of long-term erosion control structures. If seasonal or other weather conditions preclude final clean-up activities, the trench would be backfilled and stabilized, and temporary erosion control measures would be installed until restoration can be completed. Frozen topsoil would not be placed back into the trench until thawing has occurred to prevent soil settlement in the trench. If topsoil/spoil piles remain throughout the winter, the topsoil/spoil piles would be stabilized by methods approved by the regulatory authority. To prevent subsidence, backfill operations would resume when the ground is thawed, and the subsoil would be compacted (as needed) prior to final clean-up activities. The applicant would monitor these areas until final restoration is complete.

Mitigation Proposed During Scoping

Commenters suggested that the pipeline be buried deeper to avoid interference with drain tile and plowing and that an arbitration board be established to resolve disputes between the applicant and landowners.

Mitigation Recommended by EERA Staff

None currently recommended.

5.5.2 Industrial

The ROI for industrial economies is the local vicinity (area within 1,600 feet of the route width). Industrial economies encompass industrial property and businesses. An ethanol plant is located at the east end of the three route alternatives. No other industrial facilities exist within the route width of the three alternatives. Impacts would be short-term and negligible across the three route alternatives. Construction of the pipeline and capture facility might result in temporary, localized traffic delays for workers and delivery of raw materials and products to and from the ethanol plant. Impacts during operation of the pipeline and capture facility are not anticipated.

5.5.2.1 Existing Conditions

An ethanol plant is located at the east end of the three route alternatives. No other industrial facilities exist within the route widths of the three route alternatives.

5.5.2.2 Potential Impacts

A potential impact during construction of the pipeline and capture facility (located southeast of the ethanol plant) may consist of short-term, localized traffic delays. Local roadways would experience a temporary increase in traffic during construction activities. After construction activities have concluded, traffic levels would be anticipated to return to pre-construction conditions quickly. Impacts from traffic on industrial economies would be negligible. Traffic impacts are described in further detail in Section 5.4.9. Impacts during operation of the pipeline and capture facility are not anticipated.

As discussed in Section 5.4.4, Otter Tail County has not established zoning specific to land uses. The Wilkin County Zoning Ordinance establishes zoning ordinances for various land uses within Wilkin County; however, zoning maps are not publicly available online. As development within the ROI continues, future industrial facilities have the potential to be located adjacent to the ethanol plant or pipeline ROW.

The presence of the capture facility would preclude construction of new industrial facilities at that location. No new industrial facilities would be allowed within the operational pipeline ROW.

5.5.2.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to industrial properties. The sample routing permit states that “the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations.”

Applicant-Proposed Mitigation

Additional mitigation for traffic impacts that could be applicable to industrial properties is addressed in Section 5.4.9.

Mitigation Proposed During Scoping

No mitigation specific to industrial properties was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.5.3 Tourism

The ROI for tourism economies is the local vicinity (area within 1,600 feet of the route width). Tourism includes traveling to a destination for recreation or relaxation related activities. Otter Tail and Wilkin Counties offer a variety of recreational opportunities as their primary tourist attraction, such as nature preserves, hiking trails, biking trails, fishing, hunting, snowmobiling, boating, canoeing, kayaking, and swimming. Tourism opportunities are similar for the three route alternatives. Construction would result in temporary and minimal noise, dust, and visual impacts within the local vicinity that could be experienced by tourists in the area. The pipeline facilities would be almost entirely underground during operation and create minimal visual impacts on surrounding areas. The carbon capture facility would be adjacent to the ethanol plant and compatible with its surrounding viewshed. Once construction is finished and the project is in operation, it is not expected to cause any noise or dust impacts on adjacent tourism areas. The project’s impacts on tourism economies would be negligible during operation.

5.5.3.1 Existing Conditions

The three route alternatives all pass through Otter Tail and Wilkin Counties. These counties offer a variety of recreational opportunities. Tourists visiting either county may enjoy recreational activities such as nature preserves, hiking trails, biking trails, fishing, hunting, snowmobiling, boating, canoeing, kayaking, and swimming. Most of the recreational tourism activities occur within or near lakes or parks.[122, 123, 124, 125] Recreational facilities are shown in **Figure 5-8** in Section 5.4.10.

Otter Tail Lakes Country Association provides an online map[126] that displays the location of places and businesses of interest for visitors. While the project is located west of I-94, most of the locations on the Otter Tail Lakes Country map are east of I-94, with the exception of a restaurant (Mabel Murphy's). The restaurant is over 5,500 feet away from RA-South, the closest proposed route.

Wilkin County's website does not provide tourist or visitor information, but the city of Breckenridge provides a list of locations of interest for visitors.[127] The closest attraction is the Bois de Sioux Golf Course, which is over 2 miles from RA-North. Welles Memorial Park is located between the proposed routes and is over 3 miles away from any route. The Breckenridge Family Aquatic Center is nearly 3 miles from RA-North.

The King of Trails Scenic Byway (US Highway 75) is located within the ROI of the project in Wilkin County. This historic highway parallels Minnesota's western border, provides travelers an opportunity to experience the state's historic and natural beauty, and draws people into the local communities.[128] This highway is central to the tourism economy of the communities along its length, including in Wilkin County, and facilitates coordinated events that attract visitors.[129]

5.5.3.2 Potential Impacts

The project would result in short-term, minimal to moderate visual and noise impacts on recreational facilities (see section 5.4.10) during construction. The project would not cause any impacts on noise levels or the surrounding viewshed at recreational facilities during operation. Because impacts to recreation are expected to be minimal, the project's impacts on tourism economies would also be short-term and minimal during construction and negligible during operation.

5.5.3.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to tourism. The sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant did not identify mitigation measures specifically for tourism but would comply with state and county regulations regarding noise.

Mitigation Proposed During Scoping

No mitigation specific to tourism was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.6 Archaeological and Historic Resources

5.6.1 Archaeological Resources

The ROI for archaeological resources is the project area (area within 1 mile of the route width). Archaeological resources or unrecorded historic cemeteries identified within the project area, but outside the route width, are not expected to be impacted by the project. Known archaeological

resources were identified within the route widths for all route alternatives — none have been determined to be Eligible for or Listed in the National Register of Historic Places (NRHP).

Archaeological potential is based on proximity to waterbodies and the number of previously identified archaeological resources within the ROI. While RA-North has not been extensively surveyed for archaeological resources, its lack of archaeological potential compared to RA-Hybrid and RA-South indicates it would likely have the least impact on archaeological resources of the three route alternatives. RA-Hybrid has more potential for unknown archaeological resources to exist than RA-North, but less than RA-South. Of the three route alternatives, RA-South crosses or is near the most waterbodies, increasing its overall archaeological potential, which is evidenced by the number of sites identified by the applicant's survey. If the previously identified archaeological sites within the route widths that have not been evaluated for the NRHP are determined to be Eligible for listing in the NRHP, construction of the project could result in moderate, permanent adverse impacts from direct construction activities. If previously identified archaeological resources are determined Not Eligible for listing in the NRHP, construction of the project could result in negligible impacts from direct construction activities.

5.6.1.1 Existing Conditions

The Minnesota State Historic Preservation Office (SHPO) inventory files and the Minnesota Office of the State Archaeologist online portal were used to identify known Precontact and Post-Contact archaeological resources and unrecorded historic cemeteries within the project area identified for each route alternative. Archaeological resources within the project area and route width for each route alternative are summarized in **Table 5-22.**

Table 5-22 Summary of Archaeological Resources and Unrecorded Historic Cemeteries per Alternative Route

Alternative Route	Archaeological Resources within Project Area	Archaeological Resources within Route Width	Unrecorded Historic Cemeteries within Project Area	Unrecorded Historic Cemeteries within Route Width
RA-North	8	1	2	0
RA-Hybrid	10	4	0	0
RA-South	15	6	0	0

RA-North

Eight archaeological resources were identified within the project area for RA-North. One of these resources is located within the route width (21WL0029).

Seven of the identified sites are Precontact in origin. These sites range from isolated finds (usually a single lithic flake) to artifact scatters and lithic reduction sites (stone tool making sites). The ghost town site of Ames is Post-Contact in origin (21OTat).

Seven of the eight sites have not been evaluated for NRHP listing, and one site has been evaluated and recommended Not Eligible for the NRHP (21OT0228).

Table 5-23 Archaeological Resources within RA-North Project Area

Site No.	Site Name	Township, Range, Section	Description	National Register Status	Within Route Width
21OT0228	No Name	T133N, R43W, S31	Precontact: Isolated Find	Recommended Not Eligible	No
21Otat	Ames	T133N, R44W, S32	Post-Contact: Ghost Town	Not Evaluated	No
21WL0029	Hlubeck	T133N, R47W, S21, 28	Precontact: Lithic Reduction Site	Not Evaluated	Yes
21WL0030	Radig	T133N, R47W, S28	Precontact, Woodland Period: Artifact Scatter	Not Evaluated	No
21WL0044	No Name	T133N, R47W, S34	Precontact: Isolated Find	Not Evaluated	No
21WL0049	No Name	T133N, R47W, S28	Precontact: Artifact Scatter	Not Evaluated	No
21WL0050	No Name	T133N, R47W, 28	Precontact: Isolated Find	Not Evaluated	No
21WL0051	No Name	T133N, R47W, S28	Precontact: Lithic Reduction Site	Not Evaluated	No

Two unrecorded historic cemeteries at the east end of the project area have been identified within the project area for RA-North. The cemeteries are not located within the route width.

Table 5-24 Unrecorded Historic Cemeteries within RA-North Project Area

Cemetery ID	Cemetery Name	Township, Range, Section	Notes[a]
22952	Rosley Meder Cemetery	T133N, R44W, S24	Pope and Fee 1998[130] has this listed as "Cemetery;" name is from the Minnesota Cemetery Project;[131] Inactive; Est. 1890. Confidential location information for this cemetery has been omitted.
22951	Unknown – Cemetery	T133N, R44W, S24	From Pope and Fee 1998[132]

[a] From Terrell and Vermeer 2011[133]

RA-Hybrid

Ten archaeological resources were identified within the project area for RA-Hybrid. Four of these resources are located within the route width (21WL0005, 21WL0075, 21WL0107, 21WL0108).

Eight of the identified sites are Precontact in origin. These sites range from isolated finds (usually a single lithic flake) to artifact scatters and village sites.

One site, the ghost town site of Ames, is Post-Contact in origin (21Otat). One site is indigenous in origin, but of indeterminate age (21WL0107).

Five of these sites have not been evaluated for listing in the NRHP, and five have been evaluated and recommended Not Eligible for the NRHP.

Table 5-25 Archaeological Resources within RA-Hybrid Project Area

Site No.	Site Name	Township, Range, Section	Description	National Register Status	Within Route Width
21OT0228	No Name	T133N, R43W, S31	Precontact: Isolated Find	Recommended Not Eligible	No
21Otat	Ames	T133N, R44W, S32	Post-Contact: Ghost Town	Not Evaluated	No
21WL0003	No Name	T131N, R46W, S4	Precontact: Artifact Scatter	Not Evaluated	No
21WL0005	No Name	T132N, R46W, S24	Precontact: Village	Not Evaluated	Yes
21WL0075	No Name	T132N, R47W, S25	Precontact: Lithic Scatter	Recommended Not Eligible	Yes
21WL0076	No Name	T132N, R46W, S30	Precontact: Isolated Find	Recommended Not Eligible	No
21WL0097	Leinen	T132N, R47W, S27	Precontact: Isolated Find	Not Evaluated	No
21WL0098	Dohman 3	T132N, R47W, S27	Precontact, Archaic and Woodland Periods: Artifact Scatter	Not Evaluated	No
21WL0107	No Name	T132N, R46W, S24	Indeterminate: Isolated Find	Recommended Not Eligible	Yes
21WL0108	No Name	T132N, R46W, S33	Precontact: Lithic Scatter	Recommended Not Eligible	Yes

Two unrecorded historic cemeteries at the east end of the project area have been identified within the project area for RA-Hybrid. The cemeteries are not located within the route width.

Table 5-26 Unrecorded Historic Cemeteries within RA-Hybrid Project Area

Cemetery ID	Cemetery Name	Township, Range, Section	Notes[a]
22952	Rosley Meder Cemetery	T133N, R44W, S24	Pope and Fee 1998[134] has this listed as "Cemetery"; name is from the Minnesota Cemetery project;[135] Inactive; Est. 1890. Confidential location information for this cemetery has been omitted.
22951	Unknown – Cemetery	T133N, R44W, S24	From Pope and Fee 1998[136]

[a] From Terrell and Vermeer 2011[137]

RA-South

Fifteen archaeological resources were identified within the project area for RA-South. Six of these resources are located within the route width (21OT0228, 21OT0235, 21WL0005, 21WL0075, 21WL0107, and 21WL0108).

Thirteen of the identified sites are Precontact in origin. These sites range from isolated finds (usually a single lithic flake) to artifact scatters and village sites.

One site, the ghost town site of Ames, is Post-Contact in origin (21Otat). One site is indigenous in origin, but of indeterminate age (21WL0107).

Eight of these sites have not been evaluated for listing in the NRHP, and the remaining seven sites have been evaluated and found Not Eligible for the NRHP. No unrecorded historic cemeteries were identified in the project area for RA-South.

Table 5-27 Archaeological Resources within RA-South Project Area

Site No.	Site Name	Township, Range, Section	Description	National Register Status	Within Route Width
21OT0136	No Name	T133N, R43W, S31	Precontact: Isolated Find	Not Evaluated	No
21OT0137	No Name	T133N, R43W, S31	Precontact: Lithic Scatter	Not Evaluated	No
21OT0138	No Name	T133N, R43W, S31	Precontact: Isolated Find	Not Evaluated	No
21OT0228	No Name	T133N, R43W, S31	Precontact: Isolated Find	Recommended Not Eligible	Yes
21OT0229	No Name	T132N, R44W, S3	Precontact: Isolated Find	Recommended Not Eligible	No
21OT0235	No Name	T133N, R44W, S36	Precontact: Isolated Find	Recommended Not Eligible	Yes
21Otat	Ames	T133N, R44W, S32	Post-Contact: Ghost Town	Not Evaluated	No
21WL0003	No Name	T131N, R46W, S4	Precontact: Artifact Scatter	Not Evaluated	No
21WL0005	No Name	T132N, R46W, S24	Precontact: Village	Not Evaluated	Yes
21WL0075	No Name	T132N, R47W, S25	Precontact: Lithic Scatter	Recommended Not Eligible	Yes
21WL0076	No Name	T132N, R46W, S30	Precontact: Isolated Find	Recommended Not Eligible	No
21WL0097	Leinen	T132N, R47W, S27	Precontact: Single Artifact	Not Evaluated	No

Site No.	Site Name	Township, Range, Section	Description	National Register Status	Within Route Width
21WL0098	Dohman 3	T132N, R47W, S27	Precontact, Archaic and Woodland Periods: Artifact Scatter	Not Evaluated	No
21WL0107	No Name	T132N, R46W, S24	Indeterminate: Isolated Find	Recommended Not Eligible	Yes
21WL0108	No Name	T132N, R46W, S33	Precontact: Lithic Scatter	Recommended Not Eligible	Yes

A Phase I archaeological reconnaissance survey was completed for RA-South between 2021[138] and 2022.[139] This survey included a combination of systematically walking the route width along stretches of reasonable surface visibility (plowed agricultural fields, for example). The surveyor dug holes about 3 feet deep by hand at 50-foot intervals along stretches where surface visibility was too low, or around areas where artifacts were identified during the Phase I archaeological reconnaissance survey.

Portions of the field survey were completed in coordination with Tribal representatives. The Mille Lacs Band of Ojibwe, the Upper Sioux Community, and the Sisseton Wahpeton Oyate of the Lake Traverse Reservation supported the Phase I archaeological reconnaissance survey effort as Tribal monitors to the surveyors. Most of the route width was surveyed, except for about 255 acres between south of 210th Street and east of the 138th Avenue/220th Street intersection in Orwell Township, Otter Tail County. Survey was instead conducted southeast of this stretch outside of the route width. Surveys between 2021 and 2022 identified seven archaeological sites: 21OT0228, 21OT0229, 21OT0235, 21WL0075, 21WL0076, 21WL0107, and 21WL0108.

5.6.1.2 Potential Impacts

Archaeological resources or unrecorded historic cemeteries identified within the project area, but outside the route width, are not expected to be impacted by the project.

Archaeological resources were identified within the route width for all route alternatives. None of the archaeological sites within the route width for the route alternatives have been determined to be Eligible for or Listed in the NRHP. However, not all sites have been previously evaluated to determine their NRHP eligibility, but they have the potential to be found Eligible. No unrecorded historic cemeteries are located within the route widths for any route alternative.

RA-North

The route width for RA-North contains one archaeological resource (21WL0029, Precontact lithic reduction) that would be impacted by the project. This site has not been evaluated for the NRHP. If the archaeological resource is determined to be Eligible for or Listed in the NRHP, construction of the project could result in moderate, permanent adverse impacts from direct construction activities if the site cannot be avoided. If the archaeological resource is determined Not Eligible, or is avoided, construction of the project could result in negligible impacts from direct construction activities.

Only a small portion of the route width for RA-North (about 1 percent) has been surveyed for archaeological and historical resources. There is a potential for unknown archaeological resources to exist within the unsurveyed portion. RA-North crosses and runs near the fewest waterbodies of the three route alternatives, which decreases its overall archaeological potential compared to the other two route alternatives.

While RA-North has not been extensively archaeologically surveyed, its lack of archaeological potential compared to RA-Hybrid and RA-South indicates it would likely have the least impact on archaeological resources of the three route alternatives.

RA-Hybrid

The route width for RA-Hybrid contains four archaeological resources (21WL0005, 21WL0075, 21WL0107, and 21WL0108) that would be impacted by the project. Three resources have been evaluated and recommended Not Eligible under the NRHP program. Construction of the project would result in negligible impacts on these resources. Construction of the project would result in negligible impacts on the previously identified Not Eligible archaeological resources within the ROI.

One of the four sites has not been evaluated under the NRHP program (21WL0005). If the resource is determined to be Eligible, construction of the project could result in moderate, permanent adverse impacts from direct construction activities, if the site cannot be avoided. If the resource is determined Not Eligible, or if the site is avoided, construction of the project could result in negligible impacts from direct construction activities.

Only a portion of the route width for RA-Hybrid has been surveyed (about 60 percent). There is a potential for unknown archaeological resources to exist within the unsurveyed portion.

RA-Hybrid crosses the same rivers and streams as RA-South but runs near fewer lakes overall. Comparatively, it has more potential for unknown archaeological resources to exist than RA-North, but less than RA-South.

RA-South

The route width for RA-South contains six archaeological resources (21OT0228, 21OT0235, 21WL0005, 21WL0075, 21WL0107, and 21WL0108) and would be impacted by the project.

Five resources have been evaluated and found to be Not Eligible under the NRHP program. Construction of the project would result in negligible impacts on these resources.

One of the six resources has not been evaluated (21WL0005). If the resource is determined to be Eligible, construction of the project could result in moderate permanent adverse impacts from direct construction activities, if the site cannot be avoided. If the resource is determined Not Eligible, or if the site is avoided, construction of the project could result in negligible impacts from direct construction activities.

RA-South has more known archaeological sites within its route width. The applicant has surveyed for archaeological resources about 89 percent of a 300-foot-wide corridor along the pipeline centerline for RA-South. This is about 37 percent of the route width. The majority of RA-North and a large portion of RA-Hybrid have not been surveyed by the applicant. Of the three route alternatives, RA-South crosses or is near the most waterbodies, increasing its overall archaeological potential, which is evidenced by the number of sites identified during the survey.

5.6.1.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following measures to mitigate impacts on archaeological resources:

- "The Permittee shall make every effort to avoid impacts to identified archaeological and historic resources when constructing the transmission [sic] facility. In the event that a resource is encountered, the Permittee shall contact and consult with the State Historic Preservation Office and the State Archaeologist. Where feasible, avoidance of the resource is required. Where not feasible, mitigation must include an effort to minimize project impacts on the resource consistent with State Historic Preservation Office and State Archaeologist requirements."
- "Prior to construction, workers shall be trained about the need to avoid cultural properties, how to identify cultural properties, and procedures to follow if undocumented cultural properties, including gravesites, are found during construction. If human remains are encountered during construction, the Permittee shall immediately halt construction and promptly notify local law enforcement and the State Archaeologist. Construction at such location shall not proceed until authorized by local law enforcement or the State Archaeologist."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant has prepared a Minnesota Unanticipated Discoveries Plan (**Appendix L**) that will be implemented should an unanticipated cultural discovery (archaeological find or human remains) occur during the construction phase of the project. The applicant stated that all construction personnel would receive training on unanticipated discovery procedures and notification protocols. In the event an unanticipated discovery is encountered, the applicant would immediately halt all construction activities within a 100-foot radius, notify the environmental inspector, and implement the notification procedures listed in the Unanticipated Discoveries Plan.

Impacts on all archaeological sites and historic structures eligible for listing in the NRHP would be avoided through adoption of reroutes or construction methodology (for example, HDD). If additional eligible sites, identified after surveys completed in 2022, cannot be avoided through design or construction efforts, the applicant would conduct formal evaluations in consultation with SHPO and develop avoidance or treatment plans to minimize or mitigate effects on those sites.

If the applicant discovers significant cultural resources findings in or adjacent to MnDOT ROW, the applicant will contact the MnDOT Cultural Resource Unit and prepare a Post Review Discovery Plan. The Post Review Discovery Plan would be submitted to the MnDOT Cultural Resource Unit for review. The plan will outline the steps to be taken in the event of an unanticipated discovery of archaeological materials, human remains, or burials, and include language specific to the coordination with MnDOT when a discovery is in MnDOT ROW. MnDOT Cultural Resource Unit staff should be notified within 24 hours in the event of an unanticipated find on or adjacent to MnDOT property during construction.[140]

Mitigation Proposed During Scoping

EERA staff did not receive recommendations for mitigation measures related to archaeological resources during scoping.

Mitigation Recommended by EERA Staff

Should the Commission issue a pipeline routing permit, appropriate surveys for archaeological resources should occur regardless of which route alternative is selected. If archaeological resources are found, treatment plans should be prepared in consultation with Tribes and SHPO, as appropriate.

5.6.2 Historic Architectural Resources

The ROI for historic architectural resources is the project area (area within 1 mile of the route width). Historic architectural resources identified within the project area of the route alternatives, but outside the route width, are not expected to be impacted by the project. Historic architectural resources were identified within the route widths for all alternatives. None of the historic architectural resources within the route widths for the route alternatives have been determined to be Eligible for or Listed in the NRHP. Construction of the project would result in negligible impacts on the previously identified Not Eligible historic architectural resources within the ROI.

5.6.2.1 Existing Conditions

SHPO inventory files, through the online Minnesota Statewide Historic Inventory Portal, were used to identify previously recorded historic architectural resources within the project area for each route alternative. Additionally, the National Park Service online NRHP database was reviewed to identify if NRHP Listed or Eligible Historic Properties or National Historic Landmarks are present within the project area. A summary of historic architectural resources within the project area and route width for each route alternative is presented in **Table 5-28**.

Table 5-28 Summary of Historic Architectural Resources per Alternative Route

Alternative Route	Number within Project Area	Number within Route Width
RA-North	7	2
RA-Hybrid	6	4
RA-South	2	2

RA-North

Seven historic architectural resources were previously identified within the project area for RA-North. Three of these resources are located within the route width (WL-CON-00018, XX-ROD-00020 and XX-ROD-00053). These sites consist of highways, bridges and culverts, and a rural school. All seven previously identified historic architectural resources are Not Eligible for the NRHP.

Table 5-29 Historic Architecture Resources within RA-North Project Area

Site No.	Site Name	Township, Range, Section	Description	National Register Status	Within Route Width
OT-CAR-00001	Culvert 91674	T133N, R44W, S24	Culvert	Not Eligible	No
OT-CAR-00003	Culvert 91800	T133N, R44W, S30	Culvert	Not Eligible	No
WL-NIL-00001	Rural School	T133N, R46W, S29	School	Not Eligible	No
WL-CON-00018	Bridge 8382	T133N, R47W, S21	Bridge	Not Eligible	Yes
WL-NIL-00004	Culvert 97511	T133N, R46W, S20	Culvert	Not Eligible	No
XX-ROD-00020	Trunk Highway/US Highway 75 (formerly Trunk Highway 6)	T133N, R47W, S27	Highway	Not Eligible	Yes
XX-ROD-00053	Trunk Highway 9	T133N, R47W, S26	Highway	Not Eligible	Yes

RA-Hybrid

Six historic architectural resources were previously identified within the project area for RA-Hybrid. Four of these resources are located within the route width (XX-ROD-00020 XX-ROD-00053, XX-ROD-00153, and XX-RRD-NPR038). These sites consist of a highway, culverts, and a railroad. All six previously identified historic architectural resources are Not Eligible for the NRHP.

Table 5-30 Historic Architecture Resources within RA-Hybrid Project Area

Site No.	Site Name	Township, Range, Section	Description	National Register Status	Within Route Width
OT-CAR-00001	Culvert 91674	T133N, R44W, S24	Culvert	Not Eligible	No
OT-CAR-00003	Culvert 91800	T133N, R44W, S30	Culvert	Not Eligible	No
XX-ROD-00020	Trunk Highway/US Highway 75 (formerly Trunk Highway 6)	T132N, R47W, S25	Highway	Not Eligible	Yes
XX-ROD-00053	Trunk Highway 9	T133N, R47W, S26	Highway	Not Eligible	Yes
XX-ROD-00153	Trunk Highway 210	T133N, R44W, S36	Highway	Not Eligible	Yes
XX-RRD-NPR038	Northern Pacific Fergus and Black Hills Railroad Company/Northern Pacific Railway Company	T132N, R45W, S1	Railroad	Not Eligible	Yes

RA-South

Two historic architectural resources were previously identified within the project area for RA-South. Both of these resources are located within the route width (XX-ROD-00020 and XX-ROD-00153). These sites are highways. Both of the previously identified historic architectural resources are Not Eligible for the NRHP.

Table 5-31 Historic Architecture Resources within RA-South Project Area

Site No.	Site Name	Township, Range, Section	Description	National Register Status	Within Route Width
XX-ROD-00020	Trunk Highway/US Highway 75 (formerly Trunk Highway 6)	T132N, R47W, S25	Highway	Not Eligible	Yes
XX-ROD-00153	Trunk Highway 210	T133N, R44W, S36	Highway	Not Eligible	Yes

5.6.2.2 Potential Impacts

Historic architectural resources identified within the project area of the route alternatives, but outside the route width, are not expected to be impacted by the project. Known historic architectural resources were identified within the route widths for all alternatives. None of the known historic architectural resources within the route widths for the route alternatives have been determined to be Eligible for or Listed in the NRHP.

RA-North

The route width for RA-North contains two historic architectural resources that would be impacted. The two sites have been evaluated and determined Not Eligible. Not all of the project area for RA-North has been surveyed for historic architectural resources, so there is the potential for unknown historic architectural resources to exist within the route width. Construction of the project would result in negligible impacts on the previously identified Not Eligible historic architectural resources within the ROI.

RA-Hybrid

The route width for RA-Hybrid contains four historic architectural resources that would be impacted. The four sites have been evaluated and determined Not Eligible. Not all of the project area for RA-Hybrid has been surveyed for historic architectural resources, so there is the potential for unknown historic architectural resources to exist within the route width. Construction of the project would result in negligible impacts on the previously identified not eligible historic architectural resources within the ROI.

RA-South

The route width for RA-South contains two historic architectural resources that would be impacted. The two sites have been evaluated and determined Not Eligible. Not all of the project area for RA-South has been surveyed for historic architectural resources, so there is the potential for unknown historic architectural resources to exist within the route width. Construction of the project would result in negligible impacts on the previously identified Not Eligible historic architectural resources within the ROI.

5.6.2.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following measures to mitigate impacts on historic resources: "The Permittee shall make every effort to avoid impacts to identified archaeological and historic resources when constructing the transmission facility. In the event that a resource is encountered, the Permittee shall contact and consult with the State Historic Preservation Office and the State Archaeologist. Where feasible, avoidance of the resource is required. Where not feasible, mitigation must include an effort to minimize project impacts on the resource consistent with State Historic Preservation Office and State Archaeologist requirements."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

Impacts on all historic structures eligible for listing in the NRHP will be avoided through adoption of reroutes or construction methodology (for example, HDD). If additional eligible sites, identified after surveys completed in 2022, cannot be avoided through design or construction efforts, the applicant would conduct formal evaluations in consultation with SHPO and develop avoidance or treatment plans to minimize or mitigate effects on those sites.

Mitigation Proposed During Scoping

EERA staff did not receive recommendations for mitigation measures related to historic resources during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.7 Natural Environment

5.7.1 Air Quality and Greenhouse Gas Emissions

The ROI for air quality is Otter Tail and Wilkin Counties. Air quality and greenhouse gas (GHG) emission impacts from the project could contribute to increased levels of air pollution in Minnesota. However, by capturing and sequestering CO_2 underground, the project would provide a net benefit to GHG emissions because the CO_2 sequestered from ongoing annual operations would outweigh construction and operation emissions. Construction impacts would include emissions from construction equipment and vehicles, as well as temporary changes in land use along the pipeline ROW. Operational impacts would include emissions from operation of the pipeline and the CO_2 capture facility, including equipment leaks. Construction emissions for the route alternatives would be directly proportional to their lengths. In other words, RA-North would have somewhat lower construction emissions and RA-Hybrid would have somewhat higher emissions compared to RA-South. Operational impacts on air quality would be minimal and would not differ depending on the route alternative.

5.7.1.1 Regulatory Framework

Federal Clean Air Act

The Clean Air Act is the principal federal statute governing air pollution. The Clean Air Act empowered the EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. These pollutants are called “criteria” air pollutants and include the following:

- Ozone
- Particulate matter equal to or less than 10 microns in diameter (PM_{10})
- Fine particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$)
- Carbon monoxide (CO)
- Nitrogen dioxide (NO_2)
- Sulfur dioxide (SO_2)
- Lead

NAAQS include primary standards designed to protect human health and secondary standards to protect public welfare, including visibility and damage to crops and vegetation (see **Table 5-32**).

Table 5-32 National Ambient Air Quality Standards[141]

Pollutant	Averaging Time	National Standards	
		Primary	Secondary
Ozone	1 hour	-	Same as Primary Standard
	8 hour	0.07 ppm[a]	
PM_{10}	24 hour	150 µg/m^3	Same as Primary Standard
	Annual	-	
$PM_{2.5}$	24 hour	35 µg/m^3	Same as Primary Standard
	Annual Arithmetic Mean	12 µg/m^3	15 µg/m^3
CO	1 hour	35 ppm	-
	8 hour	9 ppm	-
NO_2	1 hour	100 ppb	-
	Annual Arithmetic Mean	0.053 ppm[b]	Same as Primary Standard
SO_2	1 hour	75 ppb[c]	-
	3 hour	-	0.5 ppm
	24 hour	0.14 ppm	-
	Annual Arithmetic Mean	0.03 ppm	-
Lead[d]	30-day Average	-	-
	Calendar Quarter	1.5 µg/m^3	Same as Primary Standard
	Rolling 3-month Average	0.15 µg/m^3	

CO = carbon monoxide, NO_2 = nitrogen dioxide, PM_{10} = particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine particulate matter less than or equal to 2.5 microns in diameter, ppb = parts per billion, ppm = parts per million, SO_2 = sulfur dioxide, µg/m^3 = micrograms per cubic meter

[a] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) ozone standards are not revoked and remain in effect for designated areas. Additionally, some areas may have certain continuing implementation obligations under the prior revoked 1-hour (1979) and 8-hour (1997) ozone standards.

[b] The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

[c] The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a State Implementation Plan (SIP) call under the previous SO_2 standards (40 CFR Section 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its SIP to demonstrate attainment of the required NAAQS.

[d] In areas designated nonattainment for the lead standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 $\mu g/m^3$ as a calendar quarter average) also remain in effect.

Minnesota Administrative Rule 7009.0080

Minnesota has adopted state standards for air quality that include standards for criteria pollutants and hydrogen sulfide and retain a standard for total suspended particulates. State air quality standards cannot be less stringent than the NAAQS. The Minnesota Ambient Air Quality Standards, consistent with Minnesota Administrative Rule 7009.0080, are shown in **Table 5-33**.

Table 5-33 Minnesota Ambient Air Quality Standards[142]

Air Pollutant	Averaging Time	Level of Primary Standard	Level of Secondary Standard	Form of the Standard
H_2S	30-minutes	0.05 ppmv (70.0 $\mu g/m^3$)	--	30-minute average not to be exceeded more than two times in 1 year
H_2S	30-minutes	0.03 ppmv (42.0 $\mu g/m^3$)	--	30-minute average not to be exceeded more than two times in 5 consecutive days
Ozone	8-hour	70 ppbv (137 $\mu g/m^3$)	70 ppbv (137 $\mu g/m^3$)	3-year average of the annual fourth high daily maximum 8-hour concentration does not exceed standard
CO	8-hour	9 ppmv (10 mg/m^3)	--	Annual second-high 8-hour concentration does not exceed standard
CO	1-hour	35 ppmv (40 mg/m^3)	--	Annual second-high 1-hour concentration does not exceed standard
SO_2	Annual	30 ppbv (79 $\mu g/m^3$)	--	Annual average concentration does not exceed standard
SO_2	24-hour	140 ppb (367 $\mu g/m^3$)	--	Annual second-high 24-hour concentration does not exceed standard
SO_2	3-hour		500 ppbv (1,310 $\mu g/m^3$)	Annual second-high 3-hour concentration does not exceed the standard
SO_2	1-hour	75 ppb (197 $\mu g/m^3$)	--	3-year average of the annual 99th percentile of daily maximum 1-hour concentrations does not exceed standard
TSP	Annual	75 $\mu g/m^3$	60 $\mu g/m^3$	Annual geometric mean concentration does not exceed standard

Air Pollutant	Averaging Time	Level of Primary Standard	Level of Secondary Standard	Form of the Standard
TSP	24-hour	260 µg/m^3	150 µg/m^3	Annual second-high 24-hour concentration does not exceed standard
NO_2	Annual	53 ppbv (100 µg/m^3)	53 ppbv (100 µg/m^3)	Annual average concentration does not exceed standard
NO_2	1-hour	100 ppbv (188 µg/m^3)	--	3-year average of the annual 98th percentile of daily maximum 1-hour concentrations does not exceed standard
Lead	Rolling 3-month average	0.15 µg/m^3	0.15 µg/m^3	Maximum 3-month rolling average from 3 consecutive years does not exceed the standard
PM_{10}	24-hour	150 µg/m^3	150 µg/m^3	3-year average of the annual estimated exceedance days is less than or equal to 1
$PM_{2.5}$	24-hour	35 µg/m^3	35 µg/m^3	3-year average of the annual 98th percentile of 24-hour concentrations does not exceed the standard
$PM_{2.5}$	Annual	12 µg/m^3	15 µg/m^3	3-year average of the annual seasonally weighted average does not exceed the standard

CO = carbon monoxide, H_2S = hydrogen sulfide, NO_2 = nitrogen dioxide, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine particulate matter less than or equal to 2.5 microns in diameter, ppbv = parts per billion by volume, ppmv = parts per million by volume, SO_2 = sulfur dioxide, µg/m^3 = micrograms per cubic meter, TSP = total suspended particulates

MDH has developed health-based air guidance values that may be used by the public, industry, state and local risk managers and other stakeholders to assist in evaluating potential health risks to people from exposures to a chemical in air.

5.7.1.2 Existing Conditions

Air Quality

Regional Attainment Status

Regions of the country that do not meet the NAAQS are designated as "nonattainment" areas. Certain rural parts of the country do not have extensive air quality monitoring networks. These areas are considered "unclassifiable" and are presumed to be in attainment with the NAAQS. Compliance with the national and state air quality standards in the state of Minnesota is assessed at the county level.

Both Otter Tail and Wilkin Counties are designated as in attainment or unclassifiable for the NAAQS (40 CFR Section 81.324), which means they are also designated as Class II areas by the Clean Air Act. Class II areas allow for a moderate amount of air quality deterioration.[143]

Local Ambient Air Quality

The existing air quality in the project area can be described using data from air pollution control monitors and from predictive models. EPA and the MPCA operate a series of over 50 air pollution control monitors throughout the state. These monitors collect data on criteria pollutants that are used to calculate the daily Air Quality Index (AQI). The AQI scores are divided into five air quality categories: good, moderate, unhealthy for sensitive groups, unhealthy, and very unhealthy.

The air monitoring station nearest to the project area is in Detroit Lakes, Minnesota (**Table 5-34**). Prior to 2021, a second air monitoring station was located in Moorhead, Minnesota (**Table 5-35**). The AQI shows good air quality for most days from 2017 to 2021. In 2021, the most recent data available, the Detroit Lakes station, which is 38.6 miles away from the project area and 39.2 miles from the ethanol plant, recorded 6 days of unhealthy AQI for sensitive groups and 5 days of unhealthy AQI. These events were due to $PM_{2.5}$ pollution (including dust and smoke) and occurred during the months of July and August in an extended period without rain. While there are additional air monitoring stations in neighboring North Dakota and within Minnesota, the monitoring data and MnRISKS data presented in this analysis sufficiently represents the ambient air quality in the ROI.

Table 5-34 Air Quality Index Category by Day (Detroit Lakes, Minnesota)[144]

Year	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy
2021	252	94	6	5	0
2020	343	22	1	0	0
2019	335	23	1	0	0
2018	332	36	0	0	0
2017	341	23	0	0	0

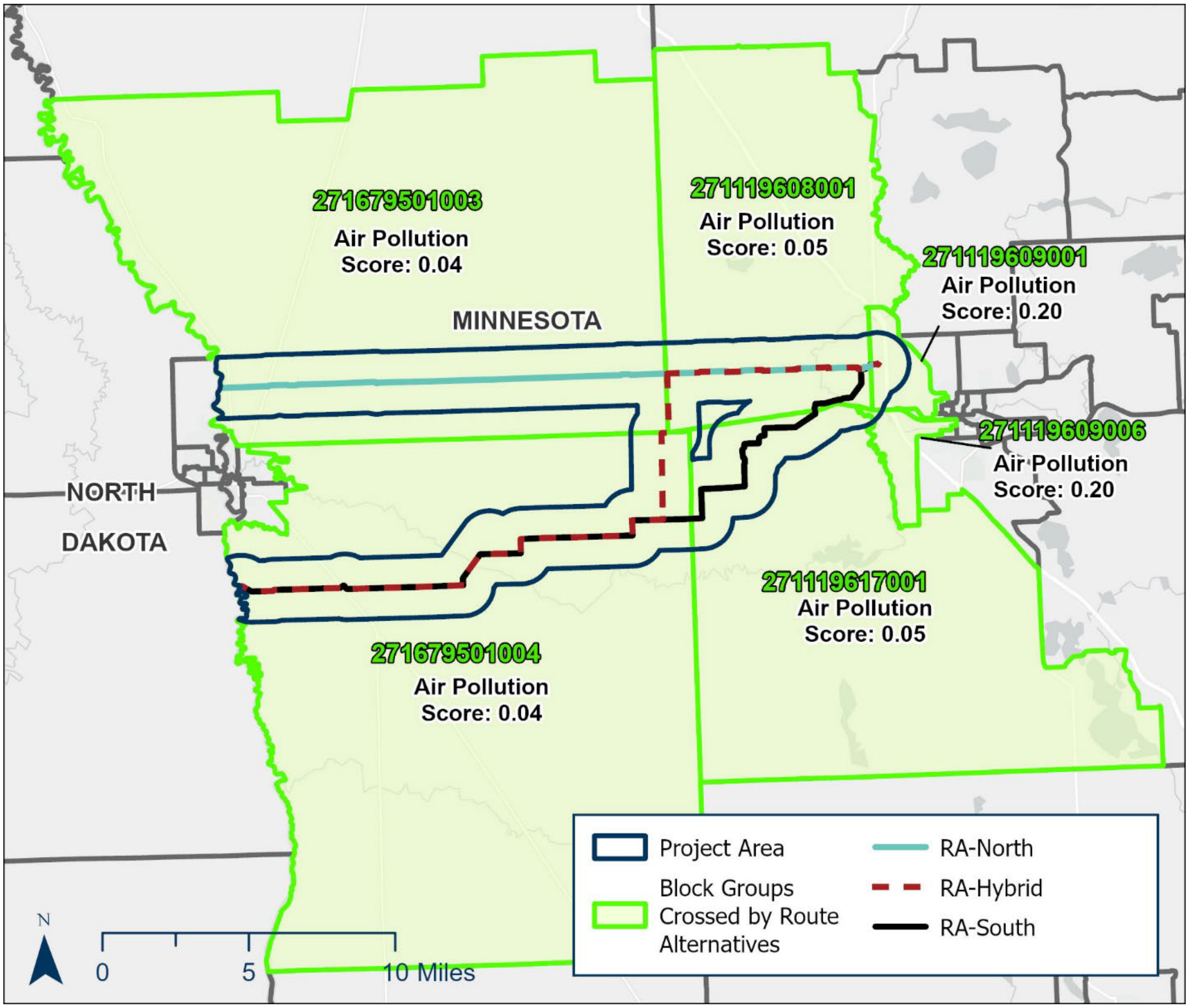
Table 5-35 Air Quality Index Category by Day (Moorhead, Minnesota)[145]

Year	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy
2020	335	27	0	0	0
2019	327	33	1	1	0
2018	300	42	1	0	0
2017	309	53	0	0	0

MPCA developed the MnRISKS tool to compare existing air pollution levels against health benchmarks and estimate the potential for negative health effects. MnRISKS calculates an air pollution score for each census block group in the state. An air pollution score equal to 1 means that air pollution levels are at the health benchmarks. A score less than 1 means that air pollution levels are below the health benchmarks and that health effects are unlikely to result after a lifetime of exposure. A score greater than 1 means that air pollution levels are above the health benchmarks and there might be potential for negative health effects.

As shown in **Figure 5-11**, the project area encompasses six census block groups, which all have air pollution scores less than one. The predominant MnRISKS pollutants anticipated in the area include acetamide, ammonia, benzene, 1,3-butadiene, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and nitrogen dioxide. These pollutants primarily originate from sources such as agriculture and farm equipment, traffic, boats, recreational vehicles, burning of yard or agricultural waste or wood, and permitted industrial activities.

Figure 5-11 MPCA Air Pollution Score for Census Block Groups in the Project Area[146]



GHG Emissions

GHGs, such as CO_2, methane (CH_4), nitrous oxide (N_2O), and fluorinated gases, play a crucial role in global warming. They trap heat in the Earth's atmosphere, a process known as the "greenhouse gas effect," leading to rising temperatures. This warming effect, influenced by the concentration of GHGs, contributes to climate changes, affecting precipitation, flooding, and storms. The global warming potential measures the energy absorbed by 1 ton of GHG over time, with CO_2 having the lowest global warming potential, followed by CH_4, N_2O, and fluorinated gases. To facilitate comparison, global warming potential is calculated relative to the energy absorption of 1 ton of CO_2, and emissions are expressed as carbon dioxide equivalents (CO_2e).

Minnesota has taken action to decrease GHG emissions since 2005. From 2005 to 2020, Minnesota GHG emissions decreased 23 percent across all industry sectors. In 2007, Minnesota established a goal of reducing emissions by 30 percent by 2025. In 2022, the Minnesota Climate Action Framework updated the goal to reduce emissions by 50 percent by 2030 and achieve net-zero emissions by 2050. To meet this goal, Minnesota Climate Action Framework identified steps and actions to reduce GHG emissions. One step is to transition to low-carbon fuels.[147]

In 2020, Minnesota produced a total of 137 million tons of CO_2e across all economic sectors. The top three sectors that produced the most CO_2e are transportation (26 percent), agriculture forestry and land use (21 percent), and electrical generation (19 percent).[148] Other sectors that produce GHGs include residential, industrial, commercial, and waste.

The existing ethanol plant requires an air permit for the emissions emitted during ethanol production. Maximum potential emissions from the ethanol plant under the air permit are shown in **Table 5-36**.

Table 5-36 Ethanol Plant Wet Scrubber Emissions Summary

	Emissions (tpy)							
	Criteria Pollutants[a]						GHGs[b]	HAPs
Description	**NO_x**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**CO_2e**	**Total**
Wet Scrubber	–	–	49.41	–	–	–	204,428	4.36

CO = carbon monoxide, CO_2e = carbon dioxide equivalents, GHG = greenhouse gas, HAP = hazardous air pollutant, NO_X = nitrogen oxides, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, SO_2 = sulfur dioxide, tpy = tons per year, VOC = volatile organic compound

a Source: Green Plains Otter Tail LLC Air Permit (permit number 11100077-101). No information provided for criteria pollutants except for VOC.

b CO_2e emission rates based on a conversion factor of 6.2901 pounds (lbs) of CO_2 per gallon of ethanol produced and assume a maximum production rate of 65 million gallons of ethanol per year. [CO_2e (lbs) = 3,785.41 grams ethanol x 0.789 / (46.07 grams ethanol/44.01 grams CO_2) x 0.0022046 lbs CO_2/gram CO_2].

5.7.1.3 Potential Impacts

Construction

Construction of the project facilities, including the CO_2 capture facility and pipeline, would result in temporary and intermittent air quality and GHG impacts. Emissions would include criteria pollutants, GHGs (including CO_2, CH_4, and N_2O), and hazardous air pollutants (HAP) from internal combustion engines. Sources of emissions would include:

- **Off-road construction equipment engine emissions.** Off-road equipment may include HDD equipment, a guided bore machine, crane, loaders, trackhoes, welders, compressors, dozers, pumps, excavators, graders, generators, light towers, etc. Estimates of the horsepower, hours, quantities, and load factors were used in calculating the criteria pollutant and GHG emissions from these engines. All off-road construction equipment was assumed to meet the Tier 2 emission standard and the analysis used EPA Tier 2 engine emission factors.
- **Mobile (vehicle) emissions from workers and material deliveries.** Emissions from gasoline and diesel engines from worker, delivery, and construction vehicles would meet the standards for mobile sources established by the EPA's mobile source emission regulations codified in 40 CFR Part 85. In addition, the EPA stipulates that the maximum sulfur content of diesel fuel for highway vehicles is 15 parts per million (ppm). During the peak of construction at the CO_2 capture facility, 80 to 100 workers would be traveling to and from the project site daily. During the peak of pipeline construction, 150 workers would be traveling to and from the pipeline construction workspace.
- **Fugitive dust (PM) emissions from vehicle travel on unpaved roads and earthmoving.** Dust emissions would be dependent on the moisture content and texture of the soils disturbed, the type of construction equipment used, recent precipitation, and wind. Fugitive dust emissions are especially a concern near residential areas, farm dwellings, roads, or when strong wind

conditions are present during dry conditions. Most pipeline construction activities in any given area would be completed within a 30-day period. Therefore, fugitive dust emissions during construction would be restricted to the brief active construction period along each segment of the pipeline route,[5-90] with construction impacts diminishing once construction activities end and after disturbed areas are restored. Fugitive dust impacts from construction activities would be short in duration and would be managed by watering the areas of exposed soil, as needed. Fugitive dust emissions were calculated using guidance and equations from *AP-42 Section 13.2.2, Unpaved Roads,* for equipment and vehicle travel and *AP-42 Section 11.9, Western Surface Coal Mining,* for earthmoving activities. Each vehicle was assumed to travel 0.5 mile per day on site.

- **Area emissions from any land use changes.** The project area along the pipeline route is mostly agricultural land. Construction would result in a temporary land use change as crops would not be able to be grown for one growing season. In the long term, the land would return to agricultural use. The capture facility would be located adjacent to the existing ethanol plant where the land is already industrial. Limited tree removal would occur. Therefore, any changes to air emissions resulting from land use changes would be negligible.

This analysis evaluates the emissions for the three route alternatives. Construction emissions have been scaled by route distance for RA-North and RA-Hybrid based on the emissions for the RA-South alternative. RA-Hybrid is 29.0 miles long (or 3.2 percent longer than RA-South) and RA-North is 23.0 miles long (or 18.1 percent shorter than RA-South). It is assumed that construction activities would be similar for all alternatives, so the off-road engine and earthmoving emissions would scale accordingly. Unpaved road emissions were assumed to be constant for all alternatives. Construction emissions for each alternative are summarized in **Table 5-37**.

Table 5-37 Pipeline and Capture Facility Construction Emissions Summary

Description	Emissions (tpy)							
	Criteria Pollutants						GHGs	HAPs
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	CO_2e	Total
RA-North								
Off-Road Engine	63.74	14.49	4.83	0.03	2.64	2.63	2899.93	0.85
Unpaved Roads	–	–	–	–	9.49	0.95	–	–
Earthmoving	–	–	–	–	4.65	0.49	–	–
Total	**63.74**	**14.49**	**4.83**	**0.03**	**16.77**	**4.07**	**2899.93**	**0.85**
RA-Hybrid								
Off-Road Engine	77.88	17.70	5.90	0.04	3.22	3.21	3542.95	1.04
Unpaved Roads	–	–	–	–	9.49	0.95	–	–
Earthmoving	–	–	–	–	5.68	0.60	–	–
Total	**77.88**	**17.70**	**5.90**	**0.04**	**18.39**	**4.76**	**3542.95**	**1.04**

Description	Emissions (tpy)							
	Criteria Pollutants						GHGs	HAPs
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	CO_2e	Total
RA-South								
Off-Road Engine	75.46	17.15	5.72	0.04	3.12	3.11	3433	1.01
Unpaved Roads	–	–	–	–	9.49	0.95	–	–
Earthmoving	–	–	–	–	5.5	0.58	–	–
Total	**75.46**	**17.15**	**5.72**	**0.04**	**18.11**	**4.65**	**3433**	**1.01**

tpy = tons per year; GHG = greenhouse gas; HAP = hazardous air pollutant; NO_x = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; SO_2 = sulfur dioxide; PM_{10} = particulate matter less than 10 microns in diameter; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; and CO_2e = carbon dioxide equivalent

Because both Otter Tail and Wilkin Counties are designated as in attainment or unclassifiable for NAAQS, as demonstrated in **Table 5-36**, construction emissions are not expected to cause or significantly contribute to a violation of an applicable ambient air quality standard. Any odors from construction would be associated with the use of construction equipment and would be negligible and temporary.

Operations

Green Plains Ethanol Plant and CO_2 Capture Facility

The project would include operation of a CO_2 capture facility, located at the ethanol plant, to collect CO_2 gas produced during the plant's ethanol fermentation process and subsequently compress, dehydrate, and cool the gas to form CO_2 in a dense phase for transportation.

The capture facility is designed to capture 100 percent of the CO_2 produced by the ethanol plant. The applicant states that the industry standard methodology to capture the most CO_2 at an ethanol plant is to tie-in a connection at the CO_2 scrubber stack and then process the CO_2 to the desired chemistry to transport or store the CO_2. The project design follows this methodology, using reciprocating compressors to pressurize the CO_2 into a supercritical phase, and a triethylene glycol dewatering system to remove any excess water from the CO_2.

The capacity of the capture facility was determined based on the current ethanol production and potential growth at the ethanol plant. The equipment, piping, and ancillary components have been designed or sized to accommodate 100 percent of the CO_2 production. The capture facility would achieve this capture rate by adhering to standard operating procedures and minimizing equipment downtime through preventative maintenance programs. According to the applicant, this is the only commercially viable capture methodology that has a proven ability to remove 100 percent of the CO_2 emissions. Other capture methodologies would have lower capture rates and higher resulting GHG emissions.

During operation of the capture facility, emissions would include stationary source emissions from the carbon capture facility and fugitive emissions from equipment leaks. Small amounts of lubricants may be used as part of the facility's normal operations and preventative maintenance program on an as-needed basis and are not expected to produce significant emissions. Electricity would be the only source of power, and the capture facility would include instrumentation to allow metering as well as onsite and remote operation. Use of electricity would result in indirect GHG emissions.

The applicant anticipates to staff one full-time equivalent position at the CO_2 capture facility for about one additional commuter vehicle per day. This additional vehicle would be limited primarily to existing driving and parking areas at the ethanol plant. Additional vehicle emissions may be required for future maintenance activities for the capture facilities. These would be infrequent, short-term, and temporary in nature. Operational emissions are not expected to impact the air pollution score in the project area.

The estimated annual operating emissions from the capture facility are shown in **Table 5-38**. During operation, the capture facility would include the following potential new sources of emissions:

- Startup, shutdown, malfunction (SSM) vent
- Dehydration unit vent
- Cooling tower
- Space heating
- Fugitives from equipment leaks

Table 5-38 Capture Facility Emissions Summary and Air Permit Thresholds[149]

	Emissions (tpy)							
	Criteria Pollutants						GHGs	HAPs
Description	**NO_x**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**CO_2e**	**Total**
SSM Vent	–	–	1.81	–	–	–	7,001	0.13
Dehydration Unit Vent	–	–	32.33	–	–	–	10,221	0.92
Space Heating[a]	0.17	0.07	0.01	–	0.01	0.01	218	–
Cooling Tower	–	–	–	–	0.16	–	–	–
Equipment Leaks	–	–	3.83	–	–	–	25	0.28
Total	**0.17**	**0.07**	**37.99**	–	**0.17**	**0.01**	**17,465**	**1.32**
Air Permit Thresholds	100	100	100	50	25	100	100,000	10

[a] Space heating emissions assume year-round usage of natural gas. The final facility may use electric space heating, which would not produce emissions at the capture facility. Therefore, the emissions presented in Table 5-38 are a conservative estimate.

The capture facility may need to bypass the capture system and vent emissions directly to the atmosphere during periods of SSM. SSM emissions would be vented out a separate stack located on the capture facility site, referred to as the SSM stack, which is synonymous with SSM vent. These emissions would not be generated by the capture facility; rather, this exhaust stream would come directly from the ethanol plant to be vented in the new location.

Potential emissions from the SSM vent and dehydration unit vent were calculated in accordance with the emission rates listed in the air permit application. Space heating emission calculations used *AP-42 Section 1.4*, while cooling tower emission calculations used assumptions from EPA AP-42 Chapter 13.4.

Equipment leak emission factors were taken from *EPA-453/R-95-017, Equipment Leak Emission Estimates.*

A Title V air permit is required if CO_2e emissions are above the federal emissions threshold of 100,000 tons per year (tpy) for stationary facilities. There is no state level emissions threshold for CO_2e emissions. As shown in **Table 5-38**, operating emissions at the capture facility would be below Title V air permit thresholds. The applicant submitted an Air Permit Applicability Determination Request for the capture facility to MPCA in September 2022, and MPCA provided a response on December 9, 2022. MPCA determined that the capture facility would be required to limit CO_2 emissions to below 100,000 tpy through an air permit. On February 8, 2023, the applicant submitted an Option D registration permit application for operation of the capture facility.

Operation of the ethanol plant and capture facility would not differ depending on the location of the pipeline. Ethanol production could increase or decrease but would be required to remain within the limits of the MPCA air permit.

Pipeline

Emissions from operation and maintenance of the pipeline would include dust and exhaust emissions from occasional worker vehicles at MLVs/cathodic protection system sites and CO_2 from fugitive leaks at aboveground pipeline facilities, such as MLVs and the pig launcher. Potential emissions from the pipeline facilities are estimated at 0.20 tons per year of CO_2, which is negligible.

Vehicle traffic would be limited primarily to public roads and permanent access roads and would be infrequent, intermittent, and short-term in nature. During operation, the pipeline would not include any stationary sources of criteria pollutants or HAP emissions. Dust related impacts are not expected. Operational impacts on air quality would be minimal and would not differ depending on the route alternative.

GHG Emissions Summary

The project would have a normal planned capacity to capture and transport 524 metric tons per day of CO_2 (about 0.19 MMTPA assuming a 355-day operational year) from the ethanol fermentation process based on the ethanol plant's permitted production capacity. As described in Chapter 1, the project would interconnect to a larger, five-state CO_2 pipeline capture and sequestration system known as the MCE Project. While the project reviewed in this EIS ends at the Minnesota-North Dakota border, the pipeline itself would continue into North Dakota and interconnect with the larger pipeline system to transport the CO_2 to a sequestration area in North Dakota. By capturing and sequestering the CO_2 underground, the project would provide a net benefit to GHG emissions and lower the carbon intensity of the ethanol plant because the emissions sequestered from ongoing annual operations would outweigh the capture facility's construction and operation emissions (see **Table 5-39**).

Table 5-39 GHG Emissions Summary

	GHG Emissions ($MTCO_2e$/year)[a]
Year 1 Estimate of Construction Emissions[b]	3,114
Ongoing Annual Operations Emissions	
CO_2 Captured[c]	(185,454)
Capture Facility[d]	15,624
Electricity Use[e]	26,893
Total Annual Operations[f]	(139,823)
Total Project Lifetime Impact (25-Year Operational Period)	(3,495,575)

[a] To convert from short tons to metric tons, multiply by 0.907185

[b] Conservatively assumes that all construction occurs in 1 year and that no carbon capture occurs in the same year as construction.

[c] See **Table 5-36.**

[d] CO_2 emissions generated from operation of the capture facility or from the fermentation process not captured due to system maintenance, repairs, or upset conditions.

[e] Calculated using California Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model emission factor of 684.35 gCO_2e/kWh for the Midwest Reliability Organization West region, which includes Otter Tail and Wilkin Counties. Annual project electricity use is 39,297,360 kWh. [CO_2e (metric tpy) = 39,297,360 kWh x 684.35 gCO_2e/kWh x 0.0022046 $lbCO_2/gCO_2$/2000 lb/ton x 0.907185 metric ton/ton]

[f] Does not include fugitive CO_2 emissions that may occur from leaks at MLVs.

Consistency with Plans

The Minnesota Next Generation Energy Act, signed in 2007, required the state to reduce GHG emissions by 80 percent between 2005 and 2050, from 174.6 million tpy (158.4 MMTPA) of CO_2e down to 34.9 million tpy (31.7 MMTPA). In 2022, Minnesota's Climate Action Framework updated this goal to achieve net zero by 2050, as codified in the 2023 Minnesota Statutes 216H.01 and 216H.02. Section 216H.01, Definitions, states that statewide GHG emissions include anthropogenic sources within the state and generation of electricity imported from outside the state and consumed in Minnesota. Section 216H.02, Greenhouse Gas Emissions Control, set a goal of reducing statewide GHG emissions by 30 percent by 2025, 50 percent by 2030, and net zero by 2050. The CO_2 capture facility would capture most of the ethanol plant's CO_2 releases and reduce CO_2 emissions in Minnesota, which would be consistent with Minnesota Statutes 216H.01 and 216H.02.

Odors

Carbon dioxide is odorless. Any fugitive CO_2 emissions at the capture facility from equipment leaks during operation or blowdowns that may occur during periods of SSM are not expected to cause an odor nuisance.

5.7.1.4 Mitigation

Air Quality

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not contain mitigation measures specific to air quality. The sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

During construction, dust control measures would include periodically spraying the ground with watering trucks or sprinklers and placing curtains to prevent wind-blown particles from reaching residences or public buildings. The applicant would monitor dust activity.

The project would include the following measures to avoid, minimize, or mitigate adverse effects from stationary source emissions:

- The SSM vent would be used only during periods of facility startup, shutdown, and unforeseen equipment malfunctions.
- The cooling tower would be equipped with mist eliminators to control PM_{10} and $PM_{2.5}$ emissions.
- Space heating would occur only on an as-needed basis during cold weather conditions.
- Stationary source emissions would be minimized by operating and maintaining the equipment according to manufacturer specifications.

Mitigation Proposed During Scoping

No mitigation specific to air quality was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

GHG Emissions

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include additional mitigation measures specific to GHG emissions. The sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant identifies monitoring, reporting, and verification requirements for its CO_2 emission reductions to comply with regulatory requirements or carbon market requirements. Because the project would provide a net benefit to GHG emissions, no mitigation is proposed. The applicant would minimize the release of CO_2 during the separating process by adhering to proper operations and routine maintenance of the equipment at the capture facility.

Mitigation Proposed During Scoping

No mitigation specific to GHGs was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.7.2 Climate Change

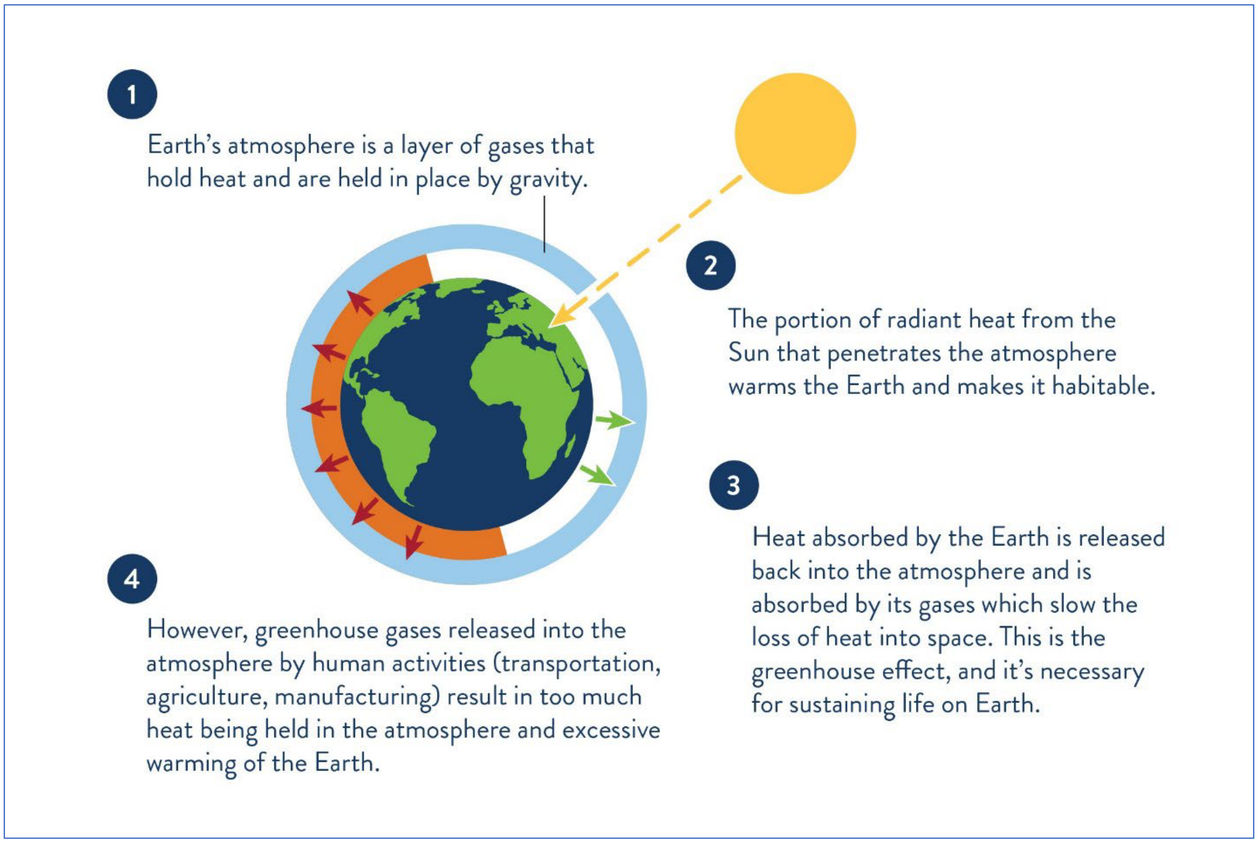
Climate change is expected to result in increasing temperatures and a greater frequency and intensity of extreme weather events. In Minnesota, climate models have identified the potential for increased rainfall, heat, localized flooding, and persisting drought conditions. The project would have a net

beneficial effect on climate change as it would capture and store CO_2 emissions from the ethanol plant. Because the pipeline would be underground, flooding would not impact operation of the project. Any MLVs located in floodplains would be constructed in accordance with floodplain permitting requirements. Drought conditions might require contingency water sources. All route alternatives would face similar impacts regarding climate change.

5.7.2.1 Existing Conditions

Climate change is the change in global or regional climate patterns over time. Climate change is caused by an increase in atmospheric GHG concentrations from the incremental addition of GHG emissions from a vast multitude of individual sources. **Figure 5-12** illustrates the effect of GHGs in the atmosphere. The totality of climate change impacts is not attributable to any single action but is exacerbated by a series of actions and interrelated systems.

Figure 5-12 Greenhouse Gases in the Environment



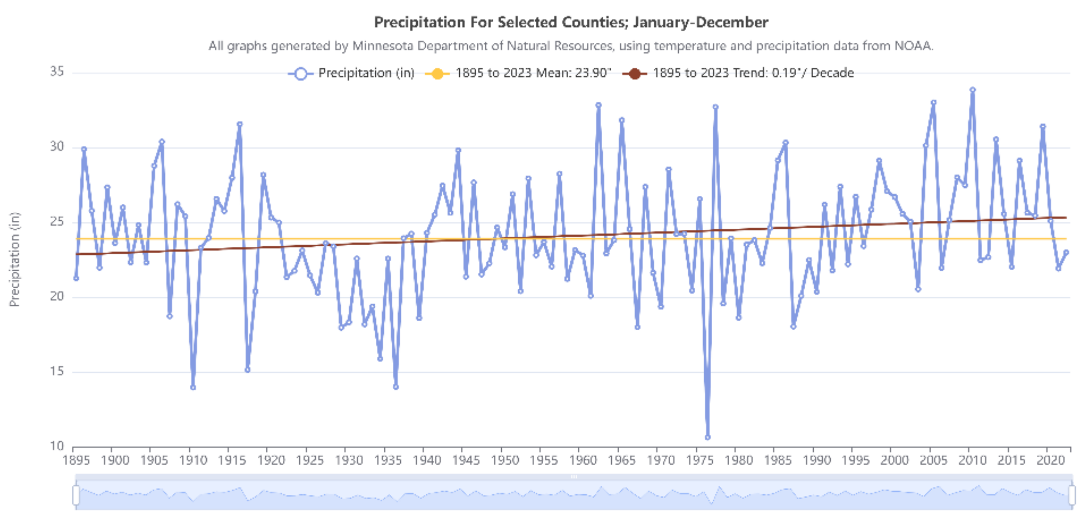
Minnesota's central location in North America exposes the state to a wide range of extreme weather conditions, including blizzards, heatwaves, strong wind, thunderstorms, and heavy rains. The state faces ongoing climate change impacts with projections suggesting significant and rapid shifts in Minnesota's climate in the 21st century. Current and projected future changes in Minnesota's climate include greater intensity rainfall events, more localized flooding, more frequent (repeated) freeze/thaw cycles, lack of snow cover, increased heat, etc., which can damage infrastructure and create safety risks.[150]

Minnesota's average temperature has increased by 3.0°F between 1895 and 2022. Most of this warming is concentrated in recent decades, particularly since 1970. Most of the temperature increase has occurred in the winter season, such that the winter season has warmed two to three times faster than summer.[151] Minnesota might experience intense summer heat waves, yet summer heat waves have not worsened compared to historical patterns. However, climate models used in the 2014 National Climate Assessment have projected a greater tendency toward extreme heat.[152]

The state's annual rainfall has increased by over 3 inches from 1895 to 2020. The occurrence of heavy rains, including 3-inch rains, has become more frequent in Minnesota since 2000. Climate projections suggest a continued increase in such substantial rainfall events in the future.[153] While the specific impact of climate change on drought occurrences in Minnesota remains uncertain, it is evident that drought and dry periods will persist as regular events in the state. There is currently no indication that climate change is altering the character of Minnesota's tornadoes and severe thunderstorms.[154] However, changes to severe weather patterns could occur.

The climate trends for Otter Tail and Wilkin Counties are similar to the overall trends in Minnesota. The Minnesota Climate Trends historical data shows that, for Otter Tail and Wilkin Counties, the temperature has risen by an average of 0.22°F and 0.25°F per decade, respectively, from 1895 to 2022. As shown in **Figure 5-13**, annual precipitation in Otter Tail and Wilkin Counties has shown a slight increase from 1985 to 2022 (0.19-inch increase per decade). Current climate models from Minnesota Climate Explorer anticipate similar annual precipitation through the mid-century and slightly higher precipitation through the late-century.[155]

Figure 5-13 Precipitation History for Otter Tail and Wilkin Counties



Climate change could result in an increased risk of flooding in the project area due to more frequent large storms. Looking specifically at flood risk for the project based on climate change over the next 30 years, the data shows that 14 percent of Otter Tail County and 23 percent of Wilkin County have a greater than 26 percent chance of being severely affected by flooding. In Otter Tail County, these areas are mostly to the north and east of Fergus Falls and are not concentrated near the project area. In Wilkin County, these areas are concentrated near the Otter Tail and Bois de Sioux Rivers. Overall, both counties have a minor risk of flooding, meaning flooding has the potential to impact day-to-day life in the community.[156]

5.7.2.2 Potential Impacts

General

The primary driver for climate change is the rapid increase in GHG emissions. CO_2 is the predominant contributor, making up 79 percent of total United States GHG emissions in 2021.[157] The project would capture and sequester the CO_2 emissions from the ethanol plant underground. Details of GHG emissions and potential sequestration quantities can be found in Section 5.7.1.3.

The project's design incorporates elements that minimize impacts from the increase in extreme weather events, such as increased flooding, storms, and heat wave events that are expected to accompany a warming climate. **Table 5-40** describes possible interactions between proposed activities and climate trends.

Table 5-40 Project's Proposed Activities and Interactions with Climate Trends

Resource Category	Climate Considerations	Project Information	Adaptations
Project Design	Climate change could result in increased risk of flooding or drought conditions.	The pipeline is underground and the MLVs can be operated in flooded conditions and would not change floodplain elevations. Drought could affect the project's ability to appropriate water.	Contingency water sources would be required by permits should water not be available due to drought conditions.
Land Use	Impacts could occur should the project result in a change in land cover.	The project would not result in a change in land cover; land would revert to its prior use following construction.	None proposed.
Water Resources	Impacts could occur from increased chance of flooding or stormwater damage or should discharge of wastewater or appropriation of water cause watershed impacts. Water use could be limited.	The project is mostly underground. MLVs could be operated remotely in case of flooding, allowing the operator to close MLVs using remote capabilities, even during flooding. Stormwater would be managed under MPCA's stormwater permit programs for construction and operation. Minimal use of water and discharge of water is planned. Drought could affect the project's ability to appropriate water. The loss of wetlands would be less than 0.01 acre, resulting in minimal change in water resource land cover.	Contingency water sources would be required by permits should water not be available due to drought conditions.

Resource Category	Climate Considerations	Project Information	Adaptations
Contamination/Hazardous Materials/Wastes	None identified	The project is not expected to generate hazardous waste, and minimal hazardous materials are expected to be used/stored during construction and operation.	None proposed.
Fish, wildlife, plant communities, and sensitive ecological resources (rare features)	Impacts could occur should the project result in a change in land cover and therefore habitat.	Most activities would occur in land that is already actively farmed or developed, minimizing impact on habitat.	None proposed.

Construction

Construction activities are anticipated to be short-term and generally unaffected by long-term climate trends. However, possible flooding or drought conditions could lead to short-term delays in construction activities. In the event of drought, the applicant's ability to obtain water from preferred sources might be hindered if water appropriation permissions by DNR are denied or revoked due to drought conditions, making the need for a contingency water source necessary.

Construction emissions would have a short-term, negligible increase in GHGs that contribute to climate change, as demonstrated in Section 5.7.1.

Operations

The project would capture and sequester the CO_2 emissions from the ethanol plant underground, which would be a beneficial impact on climate change.

Climate change could impact the project. Water availability is critical to growing corn, operating the ethanol plant (for example, process water, cooling water), and operating the capture facility cooling system. Drought conditions could cause a reduction in CO_2 capture capacity or a temporary shutdown of the project.

Climate change could result in an increased risk of flooding in the project area. The applicant has not proposed any specific changes in project design to account for increased flooding. Installation of the pipeline under waterbodies in accordance with depth of cover requirements would protect the pipeline from the effects of flooding. At the larger waterbodies, the pipeline would be installed with HDD at depths greater than 25 feet.

Following construction, the integrity of the pipeline is not expected to be impacted in flood prone areas because the pipeline would be below-ground and would not be impacted by flooding. Any MLVs located in floodplains, such as MLV-321-04 near MP 27.4 on RA-South, would be constructed in accordance with floodplain permitting requirements. Due to the small footprint (less than 0.1 acre), negligible impacts on the floodplain and floodplain elevations would be anticipated.

5.7.2.3 Enhanced Oil Recovery

Between 5 and 20 percent of in-place oil is recovered when an oilfield is initially developed and produced. Additional oil can be recovered using secondary methods of injecting either water or natural gas, or a combination of the two, into the reservoir for maintaining pressure and to act as a driver to displace oil. Enhanced oil recovery (EOR) refers to methods used to recover oil not recovered by secondary processes.[158] CO_2 injection is one of these methods. EOR methods used in the Bakken Formation (the shale oil formation in North Dakota) include CO_2 injection as well as hydraulic fracturing, steam injection, horizontal drilling, and nanotechnology.[159] The Weyburn field in Saskatchewan, Canada is one example where CO_2 has been used for EOR. At this field, the CO_2 transported by pipeline from a synfuels plant near Beulah, North Dakota has been used to increase oil production by 16,000 to 28,000 barrels per day.[160]

Concerns were raised during scoping that the captured CO_2 from this project would be used for EOR. This would contribute to further fossil fuel extraction and GHG emissions and defeat the stated purpose of injecting CO_2 into Class VI wells for permanent sequestration.[161] The applicant has indicated that it does not propose or plan to use CO_2 transported by the project for EOR.

EOR Process

The EOR process using CO_2 consists of injecting CO_2 into the oil reservoir where it helps to move the oil toward a production well. Often, these CO_2 "floods" involve the injection of volumes of CO_2 alternated with volumes of water.[162] Depending on subsurface temperature and pressure conditions, CO_2 will dissolve in the residual oil still in place (miscible conditions) or remain as a separate phase (immiscible conditions). CO_2-enhanced oil recovery under miscible conditions is more effective because CO_2 reduces the viscosity and density of the oil, making it easier to extract.

When CO_2 injection is used for EOR, some of the CO_2 remains in the subsurface and is sequestered.[163] California's Low Carbon Fuel Standards allow for CO_2 to be sequestered permanently through EOR.[164] The amount of CO_2 retained in the subsurface is variable and depends in part on the geology of the oil reservoir, such as the rock type and whether fractures are present.[165] The amount of CO_2 retained in the subsurface is also influenced by the number and geometry of injection and production wells and the recovery method (for example, whether the CO_2 injection is continuous or alternates with water injection).

The CO_2 injected for EOR that does not remain in the subsurface will return to the surface with the recovered oil. This CO_2 is released into the atmosphere unless it is separated and reinjected to form a closed loop. A closed loop system will result in permanent CO_2 storage.

CO_2 Credits

A carbon renewal credit associated with storing CO_2 underground can only be counted once: either it can reduce the emissions from the original source when it was captured or it can reduce the emissions from oil production.[166] Consequently, for a situation in which the CO_2 from the ethanol plant would be used for EOR, the credit would be given to the ethanol plant for avoiding CO_2 emissions. Carbon credits are described more fully in Section 6.2.3.

Section 45Q of the United States tax code provides for a tax credit for CO_2 sequestration.[167] The CO_2 must be captured from an industrial source by carbon capture equipment or be captured directly from the ambient air. The CO_2 must be measured at the source of capture and the measurement must be verified at the point of disposal, injection, or utilization.

The monetary credit is currently \$85/ton CO_2 for carbon capture and geologic storage. It is \$60/ton CO_2 for carbon capture and storage via utilization, which includes EOR. One commenter[168] suggested that, although the tax credit is greater for sequestered CO_2 than for EOR use, this difference likely would not discourage use of the CO_2 for EOR. The commenter notes that oil companies could pay the CO_2 owners

$25 or more per ton to acquire it, which is within the range of historical prices for CO_2 paid by enhanced oil recovery projects.

Consequences of Diverting CO_2 for EOR

If all the CO_2 produced by the ethanol plant is sequestered as proposed, EOR would likely continue in North Dakota using other sources of CO_2, other gases, thermal methods, or chemical methods. Production of oil through EOR would not be dependent on the availability of CO_2 produced by the ethanol plant.

It is possible that diverting some or all the CO_2 produced by the ethanol plant from permanent sequestration to EOR would result in some amount of oil being produced that would not otherwise be produced. As staff understands it, the amount of oil produced and the amount of injected CO_2 needed to produce it, however, is based on many site-specific variables (for example, the porosity of the geologic formation, the vertical and measured depths of the well, the fluid column needed to be lifted, temperature, and pressure, among other factors). Additionally, the rate at which a company chooses to recover the oil can make a significant difference; that is, recovering the oil as fast as possible or letting the well produce over the long term. Given the number of variables, quantifying this amount could not be done with any reasonable certainty, and a generalized formula to predict oil extraction could not be identified.

For illustrative purposes, in 2019, an estimated 300 kilograms CO_2 to 600 kilograms CO_2 was injected in EOR processes to produce a barrel of oil in the United States.[169] Based on these numbers, the proposed project—capturing 0.19 MMTPA (190 million kilograms per year) of CO_2—could, theoretically, help to produce about 316,700 to 633,300 barrels of oil annually.

EOR Conclusion

The applicant proposes to inject CO_2 into Class VI wells for sequestration. If CO_2 was used for EOR, it is likely not all the CO_2 would be sequestered.

Because there are multiple variables that would affect the retention of CO_2 in the subsurface during the EOR process, the amount of CO_2 that would be released at the surface cannot be quantified with a reasonable degree of certainty.

CO_2 from the ethanol plant might contribute to further fossil fuel extraction; however, it would be speculative to conclude whether the availability or absence of CO_2 from the ethanol plant would have a significant effect on future oil production.

5.7.2.4 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures specific to climate change. The sample routing permit states that “the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations.”

Applicant-Proposed Mitigation

Through its lifetime, the project, as proposed, would capture and sequester CO_2. No additional mitigation is proposed.

Mitigation Proposed During Scoping

No mitigation specific to climate change was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.7.3 Geology and Topography

The ROI for geologic features is the area within the construction workspace. The surficial geology is unconsolidated deposits consisting of till and sandy/silty glacial lake sediment from Pleistocene continental glaciation. The topography in the project area is relatively flat with localized areas of steeper slopes occurring adjacent to waterbodies. Bedrock is generally deeper than 50 feet. No mineral resources are within the ROI. The risk to the project facilities from geologic hazards, such as earthquakes and landslides, is low. Surface contours would be restored after construction; however, differential settling could occur, causing crowning or subsidence (low areas). The applicant would monitor for and rectify areas of crowning or subsidence caused by settling. With these measures, impacts on geology and topography would be short-term and minimal. Impacts would not vary among the route alternatives.

5.7.3.1 Existing Conditions

Based on a review of regional maps[170] and local well records,[171] depth to bedrock throughout the project area generally exceeds 50 feet and can exceed 450 feet.[172]

Surficial geology within the ROI for each route alternative is primarily characterized by unconsolidated deposits consisting of till and sandy/silty glacial lake sediment from Pleistocene continental glaciation. The project would not cross karst terrain.[173]

Elevations range from about 1,250 feet above sea level at the capture facility to 960 feet at the Minnesota-North Dakota border for each of the route alternatives. The capture facility would be located at the ethanol plant, which is on relatively flat terrain. Topography along the ROI for RA-North, RA-Hybrid, and RA-South is generally flat (3 to 5 percent slopes). Localized areas of short, steep slopes commonly occur at road crossings and drainage ditches. Additionally, areas of steep slopes occur at the stream and river crossings listed below:

- RA-North:
  - Pelican River (up to 20 percent slope)
  - Unnamed creek (up to 17 percent slope)
- RA-Hybrid:
  - Pelican River (up to 20 percent slope)
  - Unnamed creek (up to 17 percent slope)
  - Otter Tail River (up to 16 percent slope)
  - Unnamed stream (up to 28 percent slope)
  - Bois de Sioux River (up to 16 percent slope)
- RA-South:
  - Pelican River (up to 26 percent slope)
  - Unnamed stream (up to 20 percent slope)

- Unnamed stream (up to 30 percent slope)
- Otter Tail River (up to 16 percent slope)
- Unnamed stream (up to 28 percent slope)
- Bois de Sioux River (up to 16 percent slope)

As described in Section 5.5.5, no mining or quarry operations are present within the ROI for the route alternatives. No oil or gas wells are located within the ROI for the route alternatives.[174]

5.7.3.2 Geologic Hazards

Minnesota has one of the lowest occurrence levels of earthquakes in the United States, and the project crosses areas with a low probability of earthquakes of significant intensity.[175]

The type of landslide most common in Minnesota is shallow slope failure triggered by a heavy rain event. This slope failure is generally less than 3 feet deep but can erode the entire length of a slope. Deeper landslides, mudflows, and debris flows are much less common in Minnesota than in more mountainous areas.

Less destructive landslides, such as slow-moving earthflows and soil creep, can also occur when soil moisture and shallow groundwater saturate sediments during heaving rain events or snowmelt. Human factors including inadequate storm water management, undercutting of slopes, placement of artificial fill, and land-use changes, such as urbanization and agricultural practices, can lead to erosion and landslides.[176] The USGS United States Landslide Inventory[177] has no records of landslides within the vicinity of the project.

5.7.3.3 Potential Impacts

Construction of the pipeline and capture facility would result in minimal and temporary impacts on topography due to grading and excavation operations. The pipeline trench would be about 6 feet deep, and excavations for footings at the capture facility would be approximately 5 to 6 feet deep. Given the depth of the excavations compared to the depth of bedrock in the project area, there is a low likelihood that the project would cause impacts on bedrock geology.

Once construction is complete, disturbed areas would be regraded to restore original surface contours and revegetated. However, there is potential for uneven settling over the trench area over time, resulting in crowning or subsidence that could affect surface drainage patterns. For example, low areas from subsidence can cause water to pond, and crowning can block surface water flow. The applicant would monitor the pipeline ROW and remediate areas of settling and uneven ground in accordance with requirements in state permits and landowner agreements as stated in Section 8.2 of the Minnesota ECP.

The potential risk to the pipeline from geologic hazards, such as earthquakes and landslides, is low because of the relatively flat terrain and low levels of earthquake occurrence in the ROI. As described in more detail in Chapter 8, in 2020 a landslide triggered by heavy rain led to the rupture of a CO_2 pipeline in Satartia, Mississippi. The area where the pipeline rupture occurred was hilly, unlike the area of the proposed project, which has a low risk of landslides.

The applicant has completed geotechnical evaluations for HDD crossings on RA-South at the Otter Tail River and the Bois de Sioux River. The applicant plans to conduct an investigation at the Pelican River once access permission is obtained. The purpose of these investigations is to obtain information on subsurface conditions to be used for assessing the feasibility of the HDD and preparing the HDD engineering design. The soil profile encountered in four borings at the Otter Tail River was generally composed of alluvial soils consisting primarily of lean clay with varying amounts of sand and silt. Discontinuous sand layers 3 to 10 feet thick were encountered at various depths. The applicant conducted a 50-foot-deep geotechnical boring on each side of the Bois de Sioux River. These borings encountered soils consisting primarily of clays, sandy clays, and clayey sands.

During HDD installation it is possible to encounter existing weak areas in the ground where pressurized drilling mud can escape into the surrounding matrix. These can include unconsolidated gravel, coarse sand, soil fissures, and fractured bedrock. Additionally, hydraulic fracturing can occur during drilling when the pressure of the drilling fluid exceeds the strength and confining stress of the surrounding soils. These conditions can result in the release of mud as it follows the path of least resistance. If the mud reaches the surface, it is referred to as an inadvertent release or return. If an inadvertent release occurs within a waterbody, it would cause an increase in turbidity and sedimentation, as described in Section 5.7.8. An inadvertent release could also occur in wetlands or upland areas and could require clean-up actions, depending on the location and extent. Other circumstances can result in abandoning the drill hole, such as refusal of the drill bit by a boulder or collapse of the drill hole in sandy soil.

5.7.3.4 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following mitigation measure relevant to geology and topography: “Areas disturbed by construction activities shall be restored to pre-construction conditions.” Additionally, the sample routing permit states that “the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations.”

Applicant-Proposed Mitigation

After pipeline installation, the applicant would backfill trenches with native material, respread topsoil, and restore the surface topography to pre-construction conditions. Once the construction of the capture facility is complete, the surface topography at the capture facility would be returned to pre-construction conditions, except where facilities have been constructed.

The applicant would develop a contingency plan to address the unintended release of drilling mud to the environment during the execution of each HDD. It would also include contingencies in the event the HDD cannot be completed as planned.

After construction, the applicant would monitor the pipeline ROW to identify areas where remedial measures are required to establish a stable surface for reclamation to be successful. This may include regrading, re-seeding, remulching, and additional monitoring. Section 5.5.1 provides more details regarding mitigation for settling in agricultural areas.

Mitigation Proposed During Scoping

The DNR recommends that unintentional release evaluations should be conducted for waterbody crossings proposed to be installed via HDD to ensure the soils are amenable to HDD. As stated above, the applicant has completed geotechnical evaluations for two of the three HDD crossings at waterbodies and plans to conduct an investigation at the third once access is obtained. An assessment of the potential for an inadvertent release of drilling mud is part of the feasibility analysis and design for HDDs.

Mitigation Recommended by EERA Staff

None currently recommended.

5.7.4 Public and Designated Lands

The ROI for public and designated lands is the route width of each route alternative. The only direct impact on public and designated lands would be at one Waterfowl Production Area (WPA), which would be crossed by all three route alternatives. Impacts on the wetland associated with this WPA are not expected. The route width of RA-South would partially overlap with two other WPAs; however, the WPAs would be outside of the construction workspace. Potential project impacts on public and designated lands for all three route alternatives would be short-term and negligible.

5.7.4.1 Existing Conditions

This section describes the existing public and designated lands in the ROI and assesses the potential impacts from project construction and operation. Public and designated lands include federal, regional, state, and locally managed lands that are owned collectively by the public and are intended for recreation or the preservation of natural areas and wildlife.

In the project area, public and designated lands and their management are as follows:

- Wildlife Management Areas (WMA), managed by DNR
- Aquatic Management Areas, managed by DNR
- Parks, managed locally at the municipal or county level
- WPAs, managed by the United States Fish and Wildlife Service (USFWS)
- Scientific and Natural Areas, managed by DNR

These areas are further discussed in Section 5.7.5.

5.7.4.2 Potential Impacts

All three route alternatives would cross WPA parcels managed by USFWS in Otter Tail County. The detailed route maps in **Appendix B** show the WPA parcels, route widths, and construction workspaces for each route alternative. All three route alternatives would cross an unnamed WPA at MP 0.3. The route width of RA-South would also overlap with the boundary of a WPA at MP 5.2; however, the centerline of RA-South would not cross the WPA. There are four other WPAs within the RA-South route width, as listed in **Table 5-41**. RA-North is adjacent to, but does not cross within, another WPA. No other DNR lands, wilderness areas, or federal lands occur within the route widths for the three route alternatives.

The route width for RA-South does intersect with several WPAs; however, the WPAs do not cross the centerline for RA-South and they would not be impacted by the construction workspace.

Table 5-41 Otter Tail County Waterfowl Protection Areas Crossed by the Route Widths

Route Alternative	WPA Unit Name	Parcel Number	Area of WPA within Route Width (Acres)	Crossed by Centerline?	Nearest MP at Crossing
RA-North	N/A	26000190121000	8.52	Yes	0.3
RA-Hybrid	N/A	26000190121000	8.51	Yes	0.3
RA-South	Ridgeway WPA	44000160070000	0.11	No	N/A
RA-South	Ridgeway WPA	44000090040000	8.86	No	N/A
RA-South	N/A	26000190121000	5.17	Yes	0.3
RA-South	N/A	44000040016002	6.43	No	N/A
RA-South	N/A	44000050025000	9.43	No	N/A

N/A = not available

All three route alternatives would cross one WPA parcel at MP 0.3, near the ethanol plant where the three route alternatives follow the same route. The applicant stated that USFWS staff confirmed the conservation easement is limited to the wetlands on the parcel, and all three route alternatives would avoid all wetland impacts on the parcel.

Four other WPA parcels, including portions of the Ridgeway WPA, are within the route width for RA-South. These areas would be avoided during construction. The parcels would not be impacted by the applicant's proposed construction workspace.

5.7.4.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not include mitigation measures for public and designated lands. The sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant committed to avoiding the wetlands within the WPA parcel at MP 0.3.

Mitigation Proposed During Scoping

No mitigation specific to public and designated lands was proposed by commenters during scoping.

Mitigation Recommended by EERA Staff

None currently recommended.

5.7.5 Rare and Unique Resources

The ROI for rare and unique species is the area within 1 mile of the route widths. Most vegetation cover occurring along all route alternatives does not provide suitable habitat for rare and unique species. Potential impacts for all three route alternatives would be unique to individual listed species, could vary widely, and would be highly localized and limited to specific habitats. No federally listed species are expected to be directly taken. Indirect impacts on federally listed species would be

negligible and could be avoided by following USFWS guidance. No bald or golden eagle nests would be removed or disturbed. There would be no direct take of adult state-listed birds. There is a possibility of take of eggs or young state-listed birds through inadvertent destruction of ground nests during construction. Overall, for each of the three route alternatives, impacts on rare and unique species would be localized, negligible to minimal, and short-term.

5.7.5.1 Existing Conditions

Federal Species

At the federal level, USFWS has a digital project planning tool, Information for Planning and Consultation (IPaC), that "provides information to project proponents to help determine whether a project will have effects on federally listed species or designated critical habitat, as well as other sensitive resources managed by USFWS."[178] IPaC was accessed for information on the documented presence of federally listed species in the project area—federally listed species are potentially present in the ROIs of the route alternatives. These species are protected under the federal Endangered Species Act. IPaC was also used for the range-wide northern long-eared bat determination key, which provides a preliminary determination of effect on northern long-eared bats. Federal candidate species receive no formal protection; however, they could be listed in the future. In addition, because USFWS is continually reviewing species for listing and designating critical habitat, the USFWS National Listing Workplan was accessed to identify those species not yet listed, but under consideration for listing decisions that could potentially occur during project construction and operation.[179]

The Division of Ecological and Water Resources within DNR manages the Natural Heritage Information System (NHIS). NHIS data includes federally endangered, threatened, or candidate plant species and endangered and threatened animal species. The system also includes state endangered, threatened, or special concern species. The NHIS database is a source of information in determining the potential for species presence, but not the sole source for identifying the presence or absence of these species, as some area surveys have not been conducted extensively or recently. NHIS was accessed to identify listed species in the project area. NHIS review confirmed the absence of known northern long-eared bat hibernacula within 0.25 mile and the absence of known roost trees within 150 feet of the three route alternatives.

RA-North

Three federally listed species occur within the ROI of RA-North:

- Northern long-eared bat (*Myotis septentrionalis*), an endangered species
- Tricolored bat *(Perimyotis subflavus*), a proposed endangered species
- Monarch butterfly (*Danaus plexippus*), a candidate species

No federally designated critical habitat has been identified in the RA-North route segment.

In addition to species protected under the Endangered Species Act, bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are known to occur within the RA-North ROI. Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. Aerial nest surveys for bald and golden eagles have not been conducted along RA-North.

RA-Hybrid

Five federally listed species overlap the RA-Hybrid ROI:

- Northern long-eared bat, a federally endangered species
- Tricolored bat, a federally proposed endangered species
- Dakota skipper (*Hesperia dacotae*), a federally threatened species
- Monarch butterfly, a federal candidate species
- Western prairie fringed orchid (*Platanthera praeclara*), a federally threatened species

No federal critical habitats have been identified in the RA-Hybrid ROI. Aerial bald and golden eagle nest surveys have not been conducted along the portions of RA-Hybrid that are not the same as RA-South.

RA-South

Five federally listed species overlap the RA-South ROI:

- Northern long-eared bat, a federally endangered species
- Tricolored bat, a federally proposed endangered species
- Dakota skipper, a federally threatened species
- Monarch butterfly, a federal candidate species
- Western prairie fringed orchid, a federally threatened species

No federal critical habitats have been identified in the RA-South ROI. Aerial nest surveys for bald and golden eagles were performed along the RA South route in March 2022 and identified two active bald eagle nests. Both nests were outside of the disturbance buffer of 660 feet, as specified by USFWS.

Additional Species

In addition, over the next 3 to 4 years, USFWS may be considering potential listing and/or designation of critical habitat for 15 species in Minnesota. Of these, 12 species have no documented occurrences within Otter Tail and Wilkin Counties and/or have no suitable habitat within the ROIs of any of the three route alternatives.

The following three species' listing status will be reviewed and may change during construction or operation of the project:

- Blanding's turtle (*Emydoidea blandingii*) – a Minnesota threatened species, up for federal listing consideration in 2024, with documented occurrences in Otter Tail County and no known occurrences with the ROIs of all three route alternatives
- Plains spotted skunk (*Spilogale putorius interrupta*) – a Minnesota threatened species, up for federal listing consideration in 2023–24, with documented occurrences in Otter Tail County and no known occurrences with the ROIs of all three route alternatives
- Lake sturgeon (*Acipenser fulvescens*) – a Minnesota special concern species, up for federal listing consideration in 2024, with documented occurrences in the Otter Tail River well upstream of all three route alternatives.

State-listed Species

Nine state-listed species occur within the ROI of RA-North:

- Franklin's Gull (*Leucophaeus pipixcan*), a special concern bird
- Marbled Godwit (*Limosa fedoa*), a special concern bird
- Greater Prairie-chicken (*Tympanuchus cupido*), a special concern bird
- Lark Sparrow (*Chondestesgrammacus*), a special concern bird
- Small white lady's-slipper (*Cypripedium candidum*), a special concern plant
- Regal fritillary (*Argynnis idalia*), a special concern butterfly
- Northern gentian (*Gentiana affinis*), a special concern plant
- Nuttall's sunflower (*Helianthus nuttallii ssp. Rydbergii*), a special concern plant
- Black sandshell (*Ligumia recta*), a special concern mussel

Ten state-listed species occur within the ROI of RA-Hybrid:

- Franklin's Gull
- Marbled Godwit
- Greater Prairie-chicken
- Lark Sparrow
- Small white lady's-slipper
- Regal fritillary
- Northern gentian
- Nuttall's sunflower
- Black sandshell
- Fluted-shell (*Lasmigona costata*), a special concern mussel

Five state-listed species occur within the ROI of RA-South:

- Marbled Godwit
- Greater Prairie-chicken
- Lark Sparrow
- Small white lady's-slipper
- Fluted-shell

Minnesota Biological Survey Sites of Biodiversity Significance

At the state level, DNR maintains digitally available information on the location of Sites of Biodiversity Significance (SBS), WMAs, and Native Plant Community types. These sources were used to identify potential habitats for rare species. DNR also classifies rare plant or animal communities across the state. These include Scientific and Natural Areas, High Conservation Value Forest, and Minnesota Biological Survey (MBS) Native Plant Communities and SBS.

MBS SBS are present in the ROI. The ROI for rare and unique species is the area within 1 mile of the route width. According to DNR, MBS SBS are ranked based on the presence of rare species populations, the size and condition of native plan communities within the site, and the landscape context of the site. There are four biodiversity ranks: Outstanding, High, Moderate, and Below.

An "Outstanding" site contains the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most ecologically intact or functional landscapes.

A "High" site contains very good quality of occurrences of the rarest species, high-quality examples of rare native plant communities, and/or important functional landscapes.

A "Moderate" site contains occurrences of rare species, moderately disturbed native plant communities, and/or landscapes that have strong potential for recovery of native plant communities and characteristic ecological processes.

A "Below" site lacks occurrences of rare species and natural features or does not meet MBS standards for outstanding, high, or moderate rank. These sites may include areas of conservation value at the local level, such as habitat for native plants and animals, corridors for animal movement, buffers surrounding higher-quality natural areas, areas with high potential for restoration of native habitat, or open space.

MBS SBS in the ROI for each route alternative are shown on the detailed route maps in **Appendix B** and **Figure 5-14**, and include the following:

- RA-North: the Everts 21, Haarstrick WMA, and Agassiz Beachline WPA. These sites have a biodiversity rank of "Moderate." About 2 acres of the Everts 21 site fall within the RA-North route width. Also within the RA-North ROI is the Foxhome Prairie site, which has a biodiversity rank of "High." The Foxhome Prairie site abuts the north edge of the route width but does not overlap the construction workspace.

- RA-Hybrid: the Breckenridge 21, Everts 21, Haarstrick WMA, and Agassiz Beachline WPA. About 2 acres of the Everts 21 site are within the RA-Hybrid route width. Also within the RA-Hybrid ROI is the Foxhome Prairie site, which has a biodiversity rank of "High." No other MBS sites intersect with the RA-Hybrid route width. The route width does not overlap the Foxhome Prairie site.

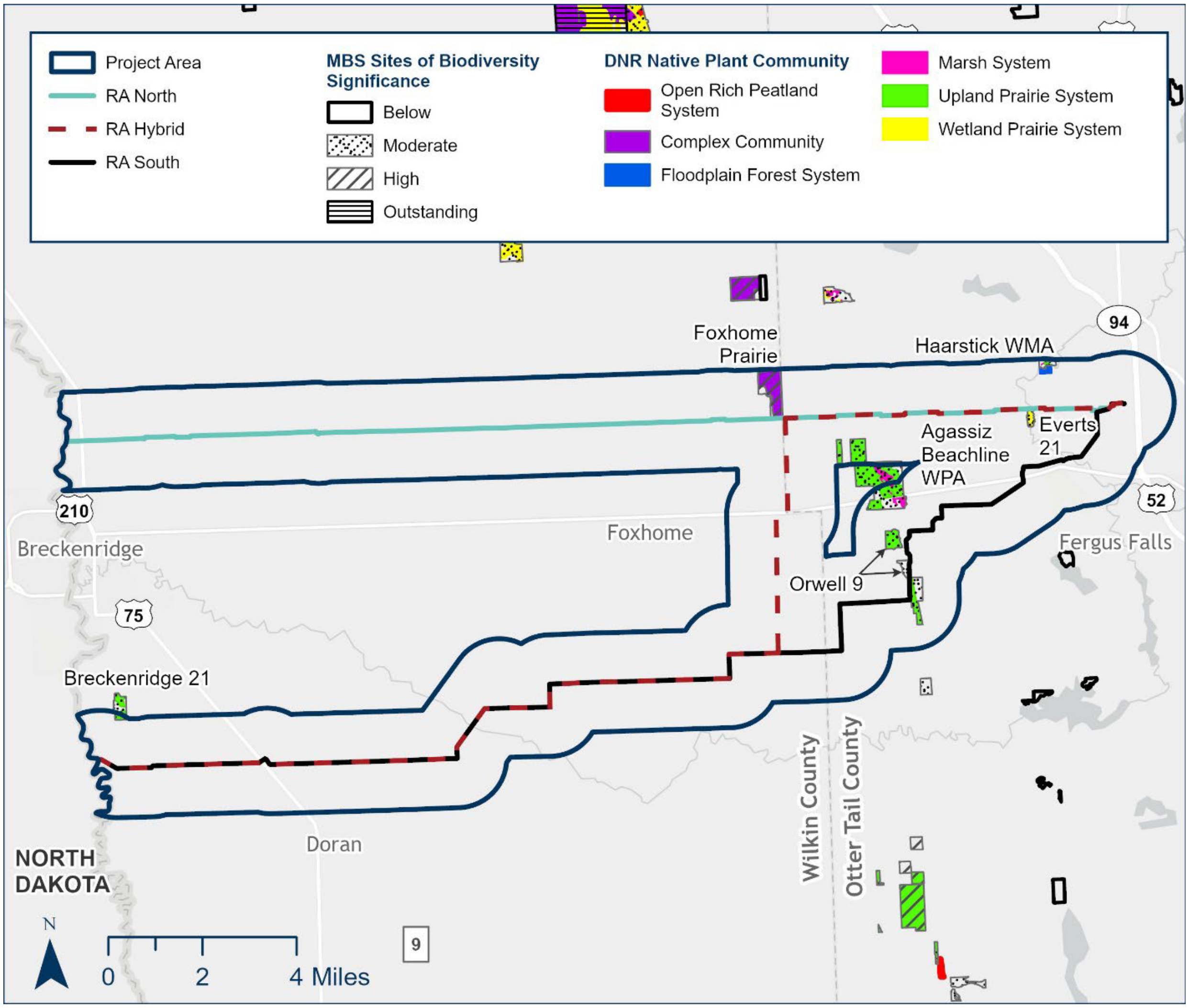
- RA-South: Breckenridge 21, Everts 21, Agassiz Beachline WPA, and Orwell 9. These sites have a biodiversity rank of "Moderate." About 24 acres of the Orwell 9 site are within the RA-South route width.

According to the MnDNR Conservation Planning Report, the RA-North ROI intersects eight MBS Native Plant Communities. These sites are from the following classes: Cattail Marsh (Northern), Mesic Prairie (Northern), Wet Prairie (Northern), Prairie Wetland Complex, and Northern Floodplain Forest. One of these sites, Everts 21, is within the route width of RA-North but does not overlap with the construction workspace.

The RA-Hybrid ROI intersects nine MBS Native Plant Communities. These sites are from the following classes: Cattail Marsh (Northern), Mesic Prairie (Northern), Wet Prairie (Northern), Prairie Wetland Complex, and Northern Floodplain Forest. One of these sites, Everts 21, is within the route width of RA-Hybrid.

The RA-South ROI intersects five MBS Native Plant Communities. These sites are from the following classes: Cattail Marsh (Northern), Mesic Prairie (Northern), and Wet Prairie (Northern). Three of these sites, Agassiz Beachline WPA, Breckenridge 21, and Orwell 9, are within the route width of RA-South.

Figure 5-14 MBS Rare Plant Communities and Sites of Biodiversity Significance



5.7.5.2 Potential Impacts

Pipelines can impact rare and unique resources during construction and operation. Adverse impacts include the taking or displacement of individual plants or animals, invasive species introduction, habitat loss, and reduced community size.

Federally Listed Species

Project activities within the route alternatives would not have a significant direct impact on federally listed species. There would be no direct impact on the endangered northern long-eared bat or the proposed endangered tri-colored bat.

Effective March 31, 2023, the northern long-eared bat was listed as an endangered species.[180] The IPaC range-wide northern long-eared bat determination key provided a preliminary determination that all three route alternatives “may affect, but are not likely to adversely affect” northern long-eared bat. According to the NHIS, there are no hibernacula or roost trees within the ROI of any routing alternative.

The federal listing of the tri-colored bat as an endangered species has not been finalized. Therefore, there are currently no USFWS protections in place for tri-colored bats. When the proposed ruling is finalized, restrictions would likely be similar to those for the northern long-eared bat.

Removal of current non-roost trees would be an alteration of local habitat availability. However, tree cover as a percentage of total vegetation cover removed would be less than 1 percent on all routes (see Section 5.7.7.2). Therefore, tree removal would have a negligible impact on potential habitat for bat species. Additional potential indirect impacts on either listed bat species include disturbance from construction noise, construction vehicle noise, and vibration. These impacts would be short-term and minimal during pre-construction and construction of the project.

There would be no removal of western prairie fringed orchid and no anticipated take of federally threatened Dakota skipper.

Direct take and indirect impacts on the Monarch butterfly could result from removal of milkweed plants, the preferred forage and reproductive habitat for the species, during construction of the project. Direct take would result from removal of plants with Monarch eggs and early development stage larvae on the removed plants. Direct take would be short-term and would have negligible impact on the local Monarch population size. Indirect impacts would result from decreased availability of milkweed. These impacts would be short-term and minimal. Potential impacts would be localized, depending upon the existing distribution of milkweed species along the routes, and occur only in open, grassy areas and at the edges of forested, wetland, agricultural, and developed areas. No milkweed would be present within cultivated agricultural areas.

State-Listed Species

The project would potentially have localized impacts on state-listed species. These impacts would vary by habitat, time of year, and species type.

The potential for take of state-listed bird species is confined to native habitat types, especially short-grass prairie, wet-mesic prairie, wet meadows, and marsh areas. Take of state-listed species in agricultural areas and woodlots is unlikely to occur, as no state-listed species that use these habitats are known to occur within the ROIs of any of the route alternatives.

Direct take of state-listed bird species within the ROIs of any of the route alternatives could occur during both construction and operation of the project. Direct take of mature state-listed bird species is unlikely to occur, as this would involve an individual mature bird being struck by construction equipment or during tree clearing activities. Direct take of active nests with eggs or young present is possible during the clearing and subsequent construction phases of the project. It is also possible that direct take of eggs or young could occur during operational maintenance. While the direct take of eggs and young would be significant and permanent to the individual birds, it would be a negligible short-term impact on local populations of the affected species.

Indirect impacts on state-listed birds include loss of habitat, which would be localized to specific habitat types, specifically short-grass prairie, wet-mesic prairie, wet meadows, and marsh areas. Disturbance in these areas would cause minimal and short-term impacts. Indirect habitat impacts in areas not restored to pre-construction vegetation cover (MLVs and the capture facility) would be long-term and negligible due to the small footprint of the MLVs and the poor quality of habitat at the capture facility. Indirect impacts would be negligible in agricultural areas.

The potential for direct take of state-listed plants is confined to native habitat types, specifically wet prairie, mesic prairie, and wet meadows. Direct take of known locations of state-listed plants within the ROIs of any of the route alternatives would be avoided through pre-construction coordination with DNR to identify potential sites for state-listed species. Coordination with DNR would be followed by targeted field surveys, if needed, for state-listed species in those areas identified by DNR. Direct take of state-listed species would not occur during construction of the project without coordination and permitting through DNR. Additional direct take is unlikely to occur during project operation in areas that are mowed, because areas with state-listed species potentially present would have been identified prior to construction. Direct take of state-listed plant species would be a minimal short-term impact on local populations of the affected plant species. The potential for impacts on state-listed plant species would be similar for the three route alternatives.

There would be no physical removal, and therefore no direct take, of state-listed mussel species. This is because rivers and streams that provide suitable habitat for state-listed mussels would be crossed using HDD techniques, passing under the riverbed habitats of state-listed mussels species. Waterbodies that would be crossed by open trench have insufficient flow to support mussel populations. If an inadvertent release during HDD were to occur, there would be short-term impacts on state-listed mussel species at the point of release and further downstream until the released drilling mud was sufficiently dispersed. Released drilling mud becomes a suspended sediment that can interfere with the gills of mussels, inhibiting the mussels' ability to absorb oxygen and nutrients from the water.[181, 182] If mussels are present, the impact of a drilling mud release would be short-term and minimal to moderate, depending on the amount of drilling mud released.

Potential impacts on state-listed mussel species can also occur as a result of sediment runoff through cleared construction spaces. These could be avoided or reduced through installation and maintenance of redundant sediment control measures immediately after clearing and prior to initial ground disturbance at waterbodies located within 50 feet of the project and where stormwater flows to a waterbody.

5.7.5.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) does not contain mitigation measures specific to rare and unique resources; however, the following mitigation measures would reduce impacts on rare and unique species:

- "Care shall be used to preserve the natural landscape, minimize tree removal, and prevent any unnecessary destruction of the natural surroundings in the vicinity of all pipeline construction and restoration activities."
- "The Permittee shall stabilize stream banks and other sensitive areas disturbed by pipeline construction in accordance with the requirements of applicable state or federal permits. [Implementation of this mitigation measure would reduce potential impacts to state-listed mussels within the ROIs of the route alternatives]."
- "The Permittee shall employ best management practices to avoid the potential spread of invasive species on lands disturbed by project construction activities. [Implementation of this mitigation measure would reduce potential degradation of native plant communities that are

critical to federal and state listed plant species, as well as habitats preferred by state-listed bird species present within the ROIs of the route alternatives.]"

- "The Permittee shall take all reasonable precautions against the spread of noxious weeds during all phases of construction. When utilizing seed to establish temporary and permanent vegetative cover on exposed soil the Permittee shall select site appropriate seed certified to be free of noxious weeds. To the extent possible, the Permittee shall use native seed mixes. The Permittee shall consult with landowners on the selection and use of seed for replanting."
- "The Permittee shall restore the right-of-way, temporary workspaces, access roads, abandoned right-of-way, and other public or private lands affected by construction of the pipeline to the natural conditions that existed immediately before construction of the pipeline and as required by other federal and state agency permits. Restoration must be compatible with the safe operation, maintenance, and inspection of the pipeline. Within 60 days after completion of all restoration activities the Permittee shall advise the Commission in writing of the completion of such activities."

Additionally, the sample routing permit also states "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant would mitigate potential impacts on rare and unique resources through the following measures:

- Pre-construction surveys would identify areas to mark or identify areas with rare and unique resources so that they are easily recognized by workers.
- Workers would abide by all signs posted by the environmental inspector that designate avoidance areas.
- The width of the construction workspace could be reduced when in the proximity of rare and unique resources. Where it is necessary to reduce the workspace, the boundaries of the feature and workspace would be identified and staked in the field.
- Wildlife-friendly erosion and sediment control BMPs that contain biodegradable netting with natural fibers would be used, and use of plastic mesh to minimize impacts on wildlife would be avoided.
- Potential impacts to ground-nesting birds during construction would be lessened or avoided by conducting surveys for these species and their nests, per USFWS standards, at appropriate timing ahead of construction.

Mitigation Proposed During Scoping

During the scoping process, actions for mitigating potential project impacts on rare and unique species were proposed, as detailed below.

CURE proposed the following mitigation actions for reducing potential impacts on federal and state-listed species:

- Prior to construction, field surveys should be conducted for state-listed species. Surveys for state-listed plants should follow the MnDNR protocol described in the April 2022 "Guidance for Documenting and Collecting Rare Plants."[183]
- The USFWS Recovery Plan for the Poweshiek skipperling[184] should be consulted as part of revegetation efforts associated with the project. The species is considered to be extirpated from Minnesota, and field surveys did not locate any individuals. However, the project lies within Conservation Unit 2 in the USFWS Recovery Plan for the species. Measures within the plan for restoring native vegetation would improve the chances for return of the species to the area.
- Proper restoration of native vegetation communities would benefit rare and unique species. The proposed performance standard of 70 percent vegetation density relative to background native vegetation cover is too low and should be higher. In addition, revegetation goals should be met throughout the life of the project.

The DNR made the following mitigation recommendations for reducing potential impacts on federal and state-listed species:

- Isolated dry trench crossing methods should be used on all stream crossings instead of the proposed open trench method. This method reduces silt and sediment suspension and transport to downstream waterbodies. This would reduce potential impacts from local and downstream transport of disturbed sediments on state-listed mussel species.
- Unintentional release evaluations should be conducted for water crossings proposed to be installed via HDD to ensure the soils are amenable to HDD. This would further reduce potential impacts from local and downstream transport of disturbed sediments on state-listed mussel species. (As described in Section 5.7.3.4, the applicant would develop a contingency plan to address the unintended release of drilling mud to the environment during the execution of each HDD.)
- A Vegetation Management Plan (VMP) should be prepared in consultation with the Vegetation Management Plan Working Group (VMPWG), a multi-agency group led by EERA staff in conjunction with several other state agencies, to address potential impacts related to pipeline construction, operation, and maintenance. The VMP should discuss existing vegetation, reestablishment and restoration, seed mixes, noxious weeds and invasive species, herbicide use, sensitive plant communities, and other topics identified during coordination with the VMPWG. Preparation and Implementation of such a plan would improve recovery efforts for state-listed plants and their habitats potentially affected by the project.
- If the selected route alignment is near the Foxhome Prairie High Biodiversity MBS site, the alignment should follow the south side of the road in the area and avoid crossing the MBS site.
- Areas of grass/shrub vegetation to be cleared for construction should be cleared during non-nesting season prior to construction so suitable nesting habitat is not present prior to final clearing and construction.

To reduce potential construction impacts on state-listed species, MnDOT recommended the use of erosion control techniques that avoid entrapping or entangling small wildlife.

Mitigation Recommended by EERA Staff

EERA staff recommend that the applicant should use only "bio-netting" or "natural netting" types and mulch products without synthetic (plastic) fiber additives.

5.7.6 Soils

The ROI for soils is the construction workspace. Soils in the project area consist mainly of well to poorly drained loams and clays. The route alternatives generally share similar soil characteristics. During construction, vegetation clearing, topsoil removal, and trenching would expose soils and increase the potential for erosion, compaction, and mixing of topsoil with subsoil. The applicant would minimize these impacts by complying with required permits and implementing the applicant's Minnesota ECP and Minnesota APP. With these measures, impacts on soils during construction would be minimal and temporary. Impacts on soils during operation would be negligible.

5.7.6.1 Existing Conditions

Soils in the eastern portion of the project area generally consist of well drained to very poorly drained coarse-loamy till to clayey till. Soils in the western portion of the project area generally consist of somewhat poorly drained to very poorly drained loams and clays.[185] Antler clay loam is the predominant soil type along each of the route alternatives, ranging from 21 to 27 percent of the routes. This soil is a somewhat poorly drained clay loam classified as prime farmland with 0 to 2 percent slope. The second most common soil type along RA-North is Doran clay loam, consisting of somewhat poorly drained clay loam or clay and classified as prime farmland with 0 to 2 percent slope. The second most common soil type along RA-Hybrid and RA-South is the Antler-Mustinka complex consisting of clay loam with 0 to 2 percent slope and classified as prime farmland if drained.[186]

Soil characteristics that are more susceptible to impacts from disturbance include prime farmland, hydric soils, compaction-prone soils, highly erodible soils (by water or wind), soils with poor revegetation potential, and stony-rocky soils. Prime farmland is addressed in Section 5.5.1. Sensitive soils characteristics are described as follows:

- Hydric soils are typically indicative of areas with a high mean water table and are one of three indicators (along with wetland hydrology and vegetation) for determining the presence of wetlands.
- Compaction-prone soils include clay loam or finer textures with somewhat poor, poor, and very poor drainage classes. These soils are susceptible to compaction, which can occur from heavy loads or traffic during construction.
- Highly erodible soils are prone to high rates of erosion when exposed to water or wind or after removal of vegetation. A soil's susceptibility to erosion is dependent on texture, moisture, slope, and soil management practices.
- The revegetation potential of soils is based on several characteristics, including topsoil thickness, soil texture, available water capacity, susceptibility to flooding, and slope. Some soils have characteristics that cause a high seed mortality, which requires additional management and may be difficult to revegetate. The clearing and grading of soils with poor revegetation potential can result in a lack of adequate vegetation following construction and restoration.

5.7.6.2 Potential Impacts

Soil characteristics within the construction workspace along RA-North, RA-Hybrid, and RA-South were analyzed from USDA Natural Resources Conservation Service soils data, including both SSURGO and STATSGO2[187] data.

As shown in **Table 5-42**, soil characteristics are similar but vary among the route alternatives. For example, RA-Hybrid has the least acres of hydric soils but the most acres of compaction prone soils. RA-South contains the most acres of soil within the construction workspace that are susceptible to wind and water erosion as well as revegetation concerns, followed by RA-Hybrid and RA-North, respectively.

Table 5-42 Sensitive Soil Characteristics within Each Route Alternative ROI

Route Name	Total Footprint Acreage	Hydric Soils (acres)[a]	Compaction Prone (acres)[b]	Highly Water Erodible (acres)[c]	Highly Wind Erodible (acres)[d]	Revegetation Concerns (acres)[e]
RA-North						
Construction Workspace	289.8	47.6 (16%)	206.1 (71%)	0.6 (<1%)	4.9 (2%)	42.0 (14%)
RA-Hybrid						
Construction Workspace	361.9	41.6 (11%)	285.1 (79%)	0.6 (<1%)	5.4 (1%)	46.7 (13%)
RA-South						
Construction Workspace	348.8	50.9 (15%)	255.2 (73%)	7.4 (2%)	5.7 (2%)	64.5 (18%)

a Includes soils that are classified as hydric by SSURGO.
b Includes soils in somewhat poor to very poor drainage classes with surface textures of clay loam and finer.
c Includes soils with a slope >15% or soils with a K value of >0.35 and slopes >5%.
d Includes soils in wind erodibility group designation of 1 or 2.
e Includes soils with a non-irrigated land capability classification of 3 or greater.

Construction activities that could impact soils include the following:

- vegetation clearing
- trenching
- backfilling
- grading
- transportation of vehicles and equipment along temporary access roads

During pipeline construction, vegetation would be cleared, and topsoil would be separated from subsoil and stockpiled. Subsoils would be removed during trenching. Topsoil and subsoil would be separated and stored separately within the construction workspace. The subsoil would be replaced first, and the topsoil would be spread uniformly over the area from which it was removed. Soils within the construction workspace would be vulnerable to erosion until vegetation has been restored.

Topsoil could be lost to improper handling or erosion along the pipeline. If soil is mixed during backfilling, some biological and chemical properties of the soil could be altered. This could affect reestablishment of plant communities in the short term (typically 2 to 3 years, but potentially up to 5 years) after restoration.

Excavation in rocky soils can bring excess rocks to the surface, particularly in areas of shallow bedrock. Shallow bedrock is not present in the project area. Soil compaction and rutting would occur from movement of construction vehicles within the construction workspace. To minimize soil compaction and rutting, the applicant would suspend certain construction activities on susceptible soils during wet conditions if the topsoil has not been stripped or use low ground weight equipment.

As described in Section 2.4.8, the applicant would dispose of drill cuttings and drilling mud from HDDs that have not been mixed with an additive by spreading the material over the construction workspace in an approved upland location. If spread in the construction workspace, the material would be incorporated into the soil such that no material would migrate off the workspace and soils would remain suitable for restoration and revegetation. If these conditions could not be met, the applicant would contain the materials and dispose of them at a solid waste management facility that accepts drill cuttings and drilling mud. Spreading drill cuttings from deep subsoils and drilling mud can alter the soil chemistry and biological function of underlying topsoil. Impacts on soils from drill cuttings and drilling mud disposal would be negligible to minimal, depending on the quantities.

Soil temperature may vary from heat convection and conduction of the operating pipeline. As described in Section 2.6.1, the CO_2 would enter the pipeline at a temperature between 90°F and 115°F and would then cool down to the ambient ground temperature. According to the applicant's analysis, most of the cooldown (about 90 percent) would occur within about 12 miles and the CO_2 would reach ambient temperatures at about 27 miles from the capture facility (see the response to Supplemental Information Inquiry #10 in **Appendix I**). Heat from the pipeline would warm the soil surrounding the pipeline out to a distance of about 13 inches from the pipe.

Soils characterized as frost susceptible (silt-sized particles) can contribute to frost heave, which occurs when water-saturated soils are uplifted due to expansion upon freezing.[188] Frost heave is the result of the formation of ice lenses by segregation of water from the soil as the ground freezes. Ice lenses are lens-shaped masses of almost pure ice that form in frozen soil or rock. Lens formation takes place at, or a short distance behind, the freezing point at any depth where conditions are favorable and continues until those conditions change.

The amount of vertical movement (heave) is roughly equal to the combined thicknesses of the underlying ice lenses. This results in greater displacement at the surface when compared to areas of greater depth. As described in Section 5.4.8.3, the minimum depth of the pipeline would be below the maximum depth where soil freezes in this region, except under potentially extreme conditions.

Expansive soils, also called shrink-swell soils, are clay soils that exhibit high volume changes when environmental conditions change from dry to wet. Expansion and shrinking of soils due to moisture fluctuations can cause damage to structures. The shrink-swell potential of soils can change with depth within a given soil and is based on features, such as soil type and texture, moisture content, and the amount of clay present in the soil horizon. At the depth to which the pipeline would be installed, about half the soils along each of the route alternatives have low shrink-swell potential, and about half of the soils have moderate shrink-swell potential (see the response to Supplemental Information Inquiry #9 in **Appendix I**). Expansion and retraction of soils typically occurs slowly over large areas, and linear steel pipelines generally are able to adjust to these conditions without sustaining damage. If the expansive soils are not uniform over a large area and abut non-expansive soils, the abrupt change in how the soils react to moisture fluctuations can create a "hinge point" and add stress to the pipeline.

Accidental releases of fuels, lubricants, and coolants from construction equipment could also impact soils. The applicant has developed and would follow spill prevention, containment, and response measures, which include proper handling and storage of fuels and hazardous liquids, refueling procedures, equipment inspection and maintenance, and spill containment and remediation measures.

Construction practices that would minimize impacts on soils, such as erosion and mixing of topsoil and subsoil, are described in detail in the applicant's Minnesota ECP (**Appendix D**) and Minnesota APP (**Appendix E**). Based on the applicant's proposed schedule, the project would not be constructed during winter conditions. If winter construction were to occur, the applicant would implement a winter construction plan, as described further in Section 2.4.9. The plan includes measures for handling frozen soils during construction.

Negligible impacts on soils are anticipated during the operational phase of the project. The ROI would be allowed to revert to prior use in most instances, and no soil disturbance would occur over the pipeline, except for periodic maintenance activities, which would be limited in scope and short in duration.

5.7.6.3 Mitigation

Commission Sample Routing Permit

To address potential impacts on soils, the sample routing permit (**Appendix H**) states:

- "The Permittee shall implement those erosion prevention and sediment control practices recommended by the Minnesota Pollution Control Agency (MPCA) Construction Stormwater Program. If construction of the facility disturbs more than one acre of land, or is sited in an area designated by the MPCA as having potential for impacts to water resources, the Permittee shall obtain a National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) Construction Stormwater Permit from the MPCA that provides for the development of a Stormwater Pollution Prevention Plan (SWPPP) that describes methods to control erosion and runoff."
- "The Permittee shall implement reasonable measures to minimize erosion and sedimentation during construction and shall employ perimeter sediment controls, protect exposed soil by promptly planting, seeding, using erosion control blankets and turf reinforcement mats, stabilizing slopes, protecting storm drain inlets, protecting soil stockpiles, and controlling vehicle tracking. Contours shall be graded as required so that all surfaces provide for proper drainage, blend with the natural terrain, and are left in a condition that will facilitate re-vegetation and prevent erosion. All areas disturbed during construction of the facilities shall be returned to pre-construction conditions."
- "The Permittee shall take precautions to minimize mixing of topsoil and subsoil during excavation of the trench for the pipe unless otherwise negotiated with the affected landowner."
- "Compaction of agricultural lands by the Permittee must be kept to a minimum and mitigated in accordance with its agricultural protection plan [if applicable]."
- "Areas disturbed by construction activities shall be restored to pre-construction conditions."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant would need to obtain a NPDES General Construction Stormwater Coverage Permit prior to construction. Per the NPDES permit, the applicant would be required to use approved protection measures to manage soil erosion and minimize soil compaction. In addition to measures required by the NPDES permit and other permits and regulations, the applicant would implement the following:

- Stabilize all areas of exposed soils when construction activities are complete or have temporarily ceased and would not resume within 14 days, and reseed non-agricultural areas with native seed mixes approved by the Board of Water and Soil Resources (BWSR).
- Remove excess rocks from the construction workspace so that where rocks over 3 inches in diameter are present, their size and frequency are similar to adjacent soil not disturbed by construction.

Mitigation Proposed During Scoping

One commenter suggested that the applicant should have detailed plans for saving and segregating topsoil and subsoil during construction. These details are provided in the applicant's Minnesota ECP and Minnesota APP contained in **Appendices D** and **E**, respectively.

Mitigation Recommended by EERA Staff

None currently recommended.

5.7.7 Vegetation

The ROI for vegetation is the construction workspace. Vegetation in the ROI is dominated by cultivated crops. Vegetation associated with developed areas is also prevalent along all three route alternatives. Impacts on agricultural vegetation during construction and operation are lowest for RA-North, due to its length. Agricultural impacts along RA-South and RA-Hybrid are approximately equal. Otherwise, the relative percent of cover and distribution of non-agricultural vegetation types is similar among all three route alternatives. Impacts on vegetation would result almost entirely from removal and crushing during construction. Indirect impacts include possible introduction of invasive species. Overall, construction impacts on vegetation are expected to be short-term and minimal for all route alternatives. Removal of woody vegetation in forested areas would be long-term due to longer regeneration time for woody cover. Forested areas comprise less than 1 acre total for each of the route alternatives. Operational impacts on vegetation would be long-term and minimal.

5.7.7.1 Existing Conditions

Vegetation types were analyzed using existing land cover databases,[189] available aerial imagery, and information from DNR. Other guidance included:

- The Marschner Map, a detailed account of native vegetation compiled by Francis Marschner in 1895, based on the Public Land Surveys conducted in the late 1800s and early 1900s. The Marschner information provides important details on vegetation prior to European settlement of the area.
- The Minnesota Noxious Weed Law, administered by MDA. The law defines noxious weeds as annual, biennial, or perennial plants designated to be injurious to the environment, public health, public roads, crops, livestock, or other property. The purpose of the law is to protect

residents of Minnesota from the injurious effects of these weeds. MDA lists four categories of noxious weeds with differing levels of eradication, control, reporting, transport, sales, and propagation requirements.[190] According to the State Prohibited Noxious Weed List, there are 16 weeds on the Eradicate list, 16 on the Control list, and 19 on the Restricted list. None of the weeds on these lists are to be transported, propagated, or sold in the state.[191]

Prior to European contact, tallgrass prairie and wet prairie were the dominant vegetation in the ROI for each of the three route alternatives. Tallgrass prairies included several grasses such as bluestems, Indian grass, dropseed, and switchgrass. Wet prairies were dominated by cordgrass, cattails, rushes, and sedges. Narrow forested floodplains were common along larger streams and rivers. Fire, drought, flooding, and bison grazing historically shaped the vegetative communities; however, many of those factors have since been suppressed or eliminated from European settlement activity.[192]

The current landscape is rural open space, including existing transportation corridors and agricultural use dominated by row crops and pastureland. Commercial and residential development is relatively higher on the far western and eastern ends of the project where it nears Breckenridge and Fergus Falls, respectively.

Overall, there is minor variation in land cover types among the three route alternatives. For all three route alternatives, as shown in **Figure 5-2**, the ROIs are predominantly agricultural, with smaller areas of development, forest, open land (bare rocky ground and grass), open water, and wetlands distributed along each of the route alternatives. See Section 5.4.4.2, and specifically **Table 5-4,** for definitions and a detailed list of land cover type and subtype acreages. The percent distribution of general land cover types within the construction workspace by route alternative is shown in **Table 5-43**.

Table 5-43 Cover Types for Each Route Alternative

Land Cover Type	RA-North	RA-Hybrid	RA-South
Agricultural (cultivated and pasture/hay)	67%	82%	88%
Developed	32%	17%	11%
Upland forest (deciduous and coniferous)	<1%	<1%	<1%
Open areas	<1%	<1%	0%
Open water	<1%	0%	0%
Wetlands (emergent herbaceous and forested)	<1%	1%	1%

Vegetation communities in the local vicinity adjacent to the route alternatives have a similar composition and distribution of agricultural, developed, open land, forest land, open water, and wetland. Developed land cover areas range from impervious surfaces (roads, buildings, parking lots) to residential areas with minimal, artificially maintained vegetated surfaces. The current distribution and relative prevalence of vegetative cover types differs greatly from the pre-European contact vegetation cover types, which were dominated by prairie (open areas), with scattered small stands of upland forest and emergent wetlands.

Sensitive plant communities are addressed in Section 5.7.5.

5.7.7.2 Potential Impacts

Potential impacts on native vegetation include disturbance and/or removal of plants (clearing), crushing under construction equipment, and alteration of soils in a way that deters regrowth of the pre-construction vegetation. Introduction of non-native species could also occur.

Due to the relatively uniform, high-percent cover of agricultural land, most of the direct impact on vegetation would be clearing grain and seed crops during site preparation and construction. This would be a short-term (seasonal), moderate direct impact during construction. During operation of the project, direct impacts on agricultural vegetation would be long-term and negligible. Section 5.5.1 discusses impacts on agriculture.

Table 5-44 shows the acreage of impacts on vegetation within the construction workspace and during operation of the pipeline.

Table 5-44 Acres of Impact on Vegetation by Route Alternative

	Acres of Impact within Construction Workspace					
	RA-North		RA-Hybrid		RA-South	
Vegetation Type	Construction	Operation	Construction	Operation	Construction	Operation
Agricultural (cultivated and pasture/hay)	194.6	82.7	297.5	137.9	305.8	144.4
Developed	93.6	56.1	62.6	37.3	38.7	22.7
Upland forest (deciduous and coniferous)	0.3	<0.1	0.1	0	0.1	0.1
Open areas (bare ground, rock, grassy areas)	0.1	0	0.1	0	0	0
Open Water	0.2	0.2	0	0	0	0
Wetlands (emergent herbaceous and forested)	1.3	0.8	2.1	1.6	4.7	3.3
Total	**290.1**	**139.8**	**362.4**	**176.8**	**349.3**	**170.5**

The potential impact on sensitive plant communities from construction of the project would be limited to the small area where the workspace overlaps a corner of the northern section of the Orwell 9 MBS Site.

Impacts on agricultural vegetation would be similar for the RA-South and RA-Hybrid alternates. RA-North would have fewer impacts on agricultural vegetation than the other two route alternatives. Impacts on vegetation in developed areas would be relatively higher in RA-North than in RA-South or RA-Hybrid.

Direct impacts from removal of existing vegetation would also occur in forested areas, non-agricultural open land, and wetlands. Impacts on these vegetation types would be minimal, both in total and relative acreage for all three route alternatives. Construction and operational impacts on wetland vegetation would be highest for RA-South; however, these impacts are still very low in terms of acreage and total vegetation impacts.

All vegetated areas not cleared within the construction workspace would potentially be exposed to localized, short-term crushing or matting of plants under construction equipment. Impacts of soil disturbance (addressed in Section 5.7.6.2) could affect reestablishment of plant communities in the short term (typically 2 to 3 years, but potentially up to 5 years) after restoration. The applicant's Minnesota APP (**Appendix E**) and its Minnesota ECP (**Appendix D**) detail specific measures to avoid and minimize impacts on vegetation.

Localized, short-term impacts on wetland vegetation would be caused by installation of wetland matting if construction occurs outside of frozen ground conditions. This would be a short-term, negligible impact, as root structures would remain. Wetland impacts are described further in Section 5.7.9.2.

Clearing vegetation followed by soil disturbance is also an opportunity for the introduction of invasive species. These species may spread and alter the composition of native and other non-agricultural vegetation communities. To reduce the potential for introduction of non-native species on exposed soils, all areas of exposed soils would be stabilized when construction activities are complete or have temporarily ceased and would not resume within 14 days. Non-agricultural areas would be reseeded with BWSR-approved, weed-free native seed. Non-native species can also be introduced through topsoil contaminated with weed seeds and by vehicles importing weed seeds from a contaminated site to an uncontaminated site. Introductions of non-native invasive species would primarily be localized and linear. Invasive species could cause potentially long-term moderate impacts. However, if invasive species were to establish and continue to spread, the impact could expand beyond the linear footprint of the pipeline. Consultation with local weed management boards and landowners would determine locations of state-identified noxious or invasive species. Where required by weed control boards, infested topsoil can be stored separately from other topsoil and subsoil.

In areas adjacent to HDDs, the disposal by spreading of drill cuttings from deep subsoils can alter the soil chemistry and biological function of underlying topsoils. Similarly, the spread of drilling mud can also alter topsoil chemistry and function (see Section 5.7.6.1 for further discussion of this topic). This would be a localized, short- to intermediate-term impact on vegetation around the areas of HDD sites, with a negligible to minimal level of impact, depending on the amount and extent of HDD cuttings spread at the drill site.

In the event of an inadvertent return of HDD drilling mud into a vegetated area, the intensity and duration of the impact would vary depending on the amount of drilling mud released and the area in which it is released. It would also vary depending on how quickly and completely the release is contained and cleaned up. A large spread of drill cuttings and/or mud that is not cleaned up in a timely manner could result in a long-term, moderate impact on vegetation re-establishment.

Forested and native plant communities take much more time to develop and mature than agricultural and non-native plant communities. As a result, clearing and other disturbances within native forested and herbaceous plant communities bring a higher risk of conversion to a different vegetation community type altogether. It may be more difficult for the species that comprise these communities to re-establish. Failure of pre-construction vegetation communities to re-establish might alter existing local ecological functions. This would be a localized impact with varying duration and intensity, depending on the extent of the altered area and the degree of alteration.

Spills of gasoline, oils, and other fluids would also have a direct, localized, permanent impact on individual plants and could have a short-term negligible impact on adjacent individual plants and plant communities. The potential duration and context of this type of vegetation impact would be reduced through implementation of spill prevention, containment, and response measures related to handling and storage of fuels and hazardous liquids.

Potential impacts resulting from operation of the pipeline would be similar across the route alternatives. After construction, the applicant would generally maintain the 50-foot-wide operational ROW over the pipeline by mowing and removing woody vegetation taller than 15 feet in non-cultivated areas. Exceptions include the area between HDD entry and exit points where the vegetation would not be maintained and at riparian buffers adjacent to waterbodies where only a 10-foot-wide corridor would be maintained. This routine maintenance for the continued safety and operation of the pipeline would result in long-term, minimal impacts on vegetation.

5.7.7.3 Mitigation

Commission Sample Routing Permit

To mitigate potential impacts on vegetation, the sample routing permit (**Appendix H**) states:

- "The Permittee shall implement those erosion prevention and sediment control practices recommended by the Minnesota Pollution Control Agency (MPCA) Construction Stormwater Program. If construction of the facility disturbs more than one acre of land, or is sited in an area designated by the MPCA as having potential for impacts to water resources, the Permittee shall obtain a National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) Construction Stormwater Permit from the MPCA that provides for the development of a Stormwater Pollution Prevention Plan (SWPPP) that describes methods to control erosion and runoff."
- "The Permittee shall implement reasonable measures to minimize erosion and sedimentation during construction and shall employ perimeter sediment controls, protect exposed soil by promptly planting, seeding, using erosion control blankets and turf reinforcement mats, stabilizing slopes, protecting storm drain inlets, protecting soil stockpiles, and controlling vehicle tracking. Contours shall be graded as required so that all surfaces provide for proper drainage, blend with the natural terrain, and are left in a condition that will facilitate re-vegetation and prevent erosion. All areas disturbed during construction of the facilities shall be returned to pre-construction conditions."
- "The Permittee shall take precautions to minimize mixing of topsoil and subsoil during excavation of the trench for the pipe unless otherwise negotiated with the landowner."
- "Care shall be used to preserve the natural landscape, minimize tree removal and prevent any unnecessary destruction of the natural surroundings of the vicinity of all pipeline and restoration activities."
- "The Permittee shall clear the permanent right-of-way and temporary right-of-way preserving to the maximum extent practicable windbreaks, shelterbelts, living snow fences, and vegetation in areas such as trail and stream crossings where vegetative screening may minimize aesthetic impacts, to the extent that such actions do not impact the safe operation, maintenance, and inspection of the pipeline and are in compliance with all applicable laws and regulations."
- "Tree stumps will be removed at the landowner's request or when necessitated due to trench location. The Permittee will dispose of all debris created by clearing at a licensed disposal facility."

- "The Permittee shall restrict pesticide use to those pesticides and methods of application approved by the Minnesota Department of Agriculture, DNR, and the U.S. Environmental Protection Agency. Selective foliage or basal application shall be used when practicable. All pesticides shall be applied in a safe and cautious manner so as not to damage adjacent properties including crops, orchards, tree farms, apiaries, or gardens. The Permittee shall contact the landowner or designee to obtain approval for the use of pesticide at least 14 days prior to any application on their property. The landowner may request that there be no application of pesticides on any part of the site within the landowner's property. The Permittee shall provide notice of pesticide application to affected landowners and known beekeepers operating apiaries within three miles of the project site at least 14 days prior to such application."
- "The Permittee shall employ best management practices to avoid the potential spread of invasive species on lands disturbed by project construction activities."
- "The Permittee shall take all reasonable precautions against the spread of noxious weeds during all phases of construction. When utilizing seed to establish temporary and permanent vegetative cover on exposed soil the Permittee shall select site appropriate seed certified to be free of noxious weeds. To the extent possible, the Permittee shall use native seed mixes. The Permittee shall consult with landowners on the selection and use of seed for replanting."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant would mitigate potential impacts on vegetation through the following measure:

- Prior to and during construction the applicant would work with local weed management boards and landowners to determine locations of state-identified noxious or invasive species. Where required by weed control boards, infested topsoil can be stored separately from other topsoil and subsoil. The applicant may use herbicides to address invasive species during construction of operation of the project in accordance with applicable regulations.

Mitigation Proposed During Scoping

During scoping, CURE stated that the proposed vegetation restoration performance standard for percent vegetation density relative to background native vegetation cover is too low and should be higher, and revegetation goals should be met throughout the life of the project.

The DNR recommended a VMP be prepared in consultation with the VMPWG. The VMP should discuss existing vegetation, reestablishment and restoration, seed mixes, noxious weeds and invasive species, herbicide use, sensitive plant communities, and other topics identified during coordination with the VMPWG.

Mitigation Recommended by EERA Staff

None currently recommended.

5.7.8 Water Resources

The ROI for surface waters and groundwater is the project area (area within 1 mile of the route width). The ROI for floodplains is the route width. None of the three route alternatives would cross lakes, or waters with federal or state designations related to high resource value. The route alternatives would cross a similar number of drainage ditches. RA-North would cross fewer rivers and streams than RA-Hybrid and RA-South. While there are wells within the groundwater ROI for all three route alternatives, the majority are outside of the construction workspaces of RA-North and RA-South, and no wells are within the construction workspace of RA-Hybrid. Potential impacts on surface waters would occur during construction and would be short-term and minimal for all route alternatives. Construction activities would have temporary, minimal, and localized impacts on groundwater. Floodplain impacts would be short-term and negligible during construction for all route alternatives. Water supply appropriations would be regulated by DNR-issued permits that would have conditions to minimize impacts on groundwater resources. DNR would review permit applications and would not issue a permit if the amount of water to be withdrawn would adversely affect the aquifer or other users. Therefore, no long-term impacts on water resources are expected during project operation.

5.7.8.1 Existing Conditions

Surface Waters

Surface water data was analyzed from the DNR Hydrography Dataset,[193] which represents surficial hydrology in Minnesota, and the Public Waters Inventory. Surface waters in the vicinity of the project consist primarily of drainage ditches, rivers, and streams.

Surface waters within the ROI are shown on the detailed route maps in **Appendix B** and are summarized in **Table 5-45**.

Table 5-45 Number of Surface Waters within the ROI

Waterbody Type	RA-North	RA-Hybrid	RA-South
Drainage Ditch	80	90	76
Lake	1	2	2
Stream (Intermittent)	33	68	61
Stream (Perennial)	14	23	22
Total surface waters within the ROI by route alternative	***128***	***183***	***161***
Public Waters Inventory Listed	5	6	4
MPCA Impaired Water	3	5	5
Crossed by Route	17	26	25

The project does not cross the following federal or state special designated waters along any of the route alternatives:

- Outstanding Resource Value Waters (MPCA)
- Nationwide Rivers Inventory waters (National Park Service)
- Trout streams or lakes (DNR)
- Wildlife lakes (DNR)

- Migratory waterfowl feeding/resting lakes (DNR)
- Wild rice lakes or rivers (DNR)
- Wild and scenic rivers (federal and state)

Minnesota water quality standards are written to protect lakes, rivers, streams, and wetlands by defining how much of a pollutant (for example, mercury, bacteria, turbidity, nutrients) can be in the water before it is no longer drinkable, swimmable, fishable, or useable in other, designated ways. A lake, river, or stream can be designated as an "impaired water" if it fails to meet one or more water quality standard.[194] Methods used to evaluate impairment include benthic macroinvertebrate bioassessments. These use small aquatic animals and the aquatic larval stages of insects as indicators of the biological condition of waterbodies.[195] Measurements of turbidity are also used to evaluate impairment. Turbidity is defined as a concentration of suspended particles, which include soil particles, algae, and microscopic organisms that decrease the clarity of a waterbody. Factors that increase turbidity include stream bank erosion, sediment laden water runoff, and disturbance of bottom sediments.[196]

Seven waterbodies within the project area for the three route alternatives are listed under the MPCA 2022 Impaired Waters list:

- Pelican River
- Judicial Ditch 2
- Ottertail River
- Unnamed Creek (H-026-082)
- Bois de Sioux River
- A drainage ditch
- Red River

None of the proposed temporary or permanent access roads would cross any waterbodies. The MLV/cathodic protection system sites, launcher, and the capture facility would not impact any waterbodies.

Surface waters crossed by the pipeline are summarized in **Table 5-46**, **Table 5-47**, and **Table 5-48**. Detailed descriptions of crossing methods are addressed in Sections 2.4.5 and 2.4.8.

RA-North

As shown in **Table 5-46**, the centerline of RA-North would cross 17 surface waters consisting of intermittent streams, drainage ditches, the Pelican River, and the Red River. Some streams would be crossed more than once by the centerline of RA-North. The Pelican River is impaired due to potential E. coli/fecal matter contamination, which affects the aquatic life and recreational use of the waterbody. The Red River is impaired due to the presence of arsenic, E. coli, mercury in fish tissue, and turbidity. RA-North passes about 2,300 feet north of the City of Breckenridge Drinking Water Supply Management Area and about 38 miles south of the Moorhead-Buffalo Aquifer North Drinking Water Supply Management Area.

Table 5-46 Surface Waters Crossed by RA-North

Kittle Number	Kittle Name	Stream Type	Approximate Top of Bank Width (feet)[a]	Nearest Milepost	303(d) Impairment[b]	Proposed Crossing Method
H-026-081-012	Pelican River	River (Perennial)	55	2.2	E. coli	HDD
MAJ-09022367	NA	Stream (Intermittent)	NA	4.4	NA	Open Cut
MAJ-09022590	NA	Stream (Intermittent)	NA	5.1	NA	Open Cut)
MAJ-09022581	NA	Stream (Intermittent)	NA	5.5	NA	Open Cut
H-026-081-010-002	Unnamed Creek	Stream (Intermittent)	NA	5.7	NA	Open Cut
MAJ-09022978	NA	Drainage Ditch	22	7.6	NA	Open Cut
MAJ-09022621	NA	Stream (Intermittent)	NA	9.1	NA	Open Cut
MAJ-09022945	NA	Drainage Ditch	20	10.7	NA	Open Cut)
MAJ-09023614	NA	Stream (Intermittent)	36	12.2	NA	Open Cut)
MAJ-09022447	NA	Drainage Ditch	NA	13.5	NA	Open Cut
MAJ-09022447	NA	Drainage Ditch	NA	14.5	NA	Open Cut
H-026-081-001	Unnamed Creek	Drainage Ditch	34	17.6	NA	Open Cut
MAJ-09024011	NA	Drainage Ditch	NA	17.6	NA	Open Cut
MAJ-09023857	NA	Drainage Ditch	NA	18.1	NA	Open Cut
MAJ-09024229	NA	Drainage Ditch	26	20.3	NA	Open Cut
MAJ-09024105	NA	Drainage Ditch	13	20.6	NA	Open Cut
MAJ-09024220	NA	Drainage Ditch	26	20.7	NA	Open Cut
MAJ-09024220	NA	Drainage Ditch	33	21.4	NA	Open Cut
MAJ-09024220	NA	Drainage Ditch	14	22.7	NA	Open Cut

Kittle Number	Kittle Name	Stream Type	Approximate Top of Bank Width (feet)[a]	Nearest Milepost	303(d) Impairment[b]	Proposed Crossing Method
H-026	Red River	Perennial	150	23.0	As; E. coli; Hg-F; T	HDD

[a] NA = Width of surface water crossing was not visible on aerial photography.
[b] Impairment: E. coli – Escherichia coli, As – arsenic, Hg-F – mercury in fish, T – Turbidity; NA = not listed as impaired

RA-Hybrid

As shown in **Table 5-47**, the centerline of RA-Hybrid would cross 26 surface waters consisting of perennial and intermittent streams, drainage ditches, the Pelican River, the Otter Tail River, and the Bois de Sioux River. Some streams would be crossed more than once by the centerline of RA-Hybrid. The Pelican River and an unnamed perennial creek (Kittle Number H-026-082) are impaired due to potential E. coli/fecal matter contamination, which impacts the aquatic life and recreational use of the waterbody.

The Otter Tail River is impaired due to benthic macroinvertebrate bioassessments and turbidity. The Otter Tail River is also classified as a drinking-water-protected surface water (Use Class 1C) due to the potential impairment by nitrate. Nitrate is commonly found in fertilizers used on agricultural fields, grass lawns, and golf courses.

The Fergus Falls surface water intake on the Otter Tail River within the Fergus Falls Water Assessment Area is upstream from RA-Hybrid and would not be affected by the project.

The Bois de Sioux River is impaired due to dissolved oxygen, benthic macroinvertebrate bioassessments, mercury levels that limit fish consumption, E. coli/fecal matter contamination, nutrients that grow algae, and turbidity.

Table 5-47 Surface Waters Crossed by RA-Hybrid

Kittle Number	Kittle Name	Stream Type	Approximate Top of Bank Width (Feet)[a]	Nearest Milepost	303(d) Impairment[b]	Proposed Crossing Method
H-026-081-012	Pelican River	River (Perennial)	55	2.2	E.coli	HDD
MAJ-09022367	NA	Stream (Intermittent)	NA	4.5	NA	Open Cut
MAJ-09022590	NA	Stream (Intermittent)	NA	5.1	NA	Open Cut
MAJ-09022581	NA	Stream (Intermittent)	NA	5.5	NA	Open Cut
H-026-081-010-002	Unnamed Creek	Stream (Intermittent)	NA	5.7	NA	Open Cut
MAJ-09022978	NA	Drainage Ditch	23	8.2	NA	Open Cut

Kittle Number	Kittle Name	Stream Type	Approximate Top of Bank Width (Feet)[a]	Nearest Milepost	303(d) Impairment[b]	Proposed Crossing Method
MAJ-09022499	NA	Drainage Ditch	NA	11.6	NA	Open Cut
MAJ-09022836	NA	Stream (Intermittent)	NA	11.9	NA	Open Cut
MAJ-09023432	NA	Stream (Intermittent)	NA	12.3	NA	Open Cut
MAJ-09022982	NA	Drainage Ditch	21	13.8	NA	Open Cut
MAJ-09022827	NA	Drainage Ditch	NA	15.3	NA	Open Cut
MAJ-09022943	NA	Stream (Intermittent)	42	16.3	NA	Open Cut
MAJ-09022585	NA	Drainage Ditch	NA	16.9	NA	Open Cut
MAJ-09022807	NA	Drainage Ditch	15	18.2	NA	Open Cut
MAJ-09022834	NA	Stream (Intermittent)	NA	19.2	NA	Open Cut
H-026-081	Otter Tail River	River (Perennial)	128	20.5	InvertBio; T	HDD
MAJ-0902388	NA	Drainage Ditch	NA	23.7	NA	Open Cut
MAJ-0902439	NA	Drainage Ditch	10	23.9	NA	Open Cut
MAJ-090294	NA	Drainage Ditch	NA	24.4	NA	Open Cut
MAJ-0902316	NA	Drainage Ditch	NA	24.4	NA	Open Cut
MAJ-0902461	NA	Drainage Ditch	NA	24.9	NA	Open Cut
MAJ-0902336	NA	Drainage Ditch	NA	25.3	NA	Open Cut
H-026-082	Unnamed Creek	Stream (Perennial)	NA	26.1	E. coli	Bore
H-026	Bois de Sioux River	River (Perennial)	140	28.0	DO; E. coli; FishesBio; Hg-F; Nutrients; T	HDD

[a] NA = Width of surface water crossing was not visible on aerial photography.
[b] Impairment: DO – Dissolved Oxygen, E. coli – Escherichia coli, FishesBio – fish bioassessments, Hg-F: mercury in fish tissue, InvertBio – benthic macroinvertebrate bioassessments, T – Turbidity; NA = Not listed as impaired

RA-South

As shown in **Table 5-48**, the centerline for RA-South would cross 25 surface waters consisting of perennial and intermittent streams, drainage ditches, the Pelican River, the Otter Tail River, and the Bois de Sioux River. Some streams would be crossed more than once by the centerline of RA-South. As stated in RA-Hybrid, both Pelican River and an unnamed perennial creek (Kittle Number H-026-082) are impaired due to E. coli/fecal matter contamination.

Otter Tail River is impaired due to benthic macroinvertebrate bioassessments and turbidity and is classified as a drinking-water-protected surface water (Use Class 1C) due the potential impairment by nitrate.

The Fergus Falls surface water intake on the Otter Tail River within the Fergus Falls Water Assessment Area is upstream from RA-South and would not be affected by the project.

Bois de Sioux River is impaired due to dissolved oxygen, benthic macroinvertebrate bioassessments, mercury levels that limit fish consumption, E. coli/fecal matter contamination, nutrients that grow algae, and turbidity.

Table 5-48 Surface Waters Crossed by RA-South

Kittle Number	Kittle Name	Stream Type	Approximate Top of Bank Width (Feet)[a]	Nearest Milepost	303(d) Impairment[b]	Proposed Crossing Method
MAJ-09023305	NA	Stream (Intermittent)	NA	1.6	NA	Open Cut
H-026-081-012	Pelican River	River (Perennial)	120	1.9	E. coli	HDD
MAJ-09023534	NA	Stream (Intermittent)	NA	3.6	NA	Open Cut
MAJ-09023534	NA	Stream (Intermittent)	10	4.2	NA	Open Cut
MAJ-09023534	NA	Drainage Ditch	NA	4.7	NA	Open Cut
MAJ-09022525	NA	Stream (Intermittent)	3	5.0	NA	Open Cut
MAJ-09022525	NA	Stream (Intermittent)	NA	5.3	NA	Open Cut
MAJ-09023593	NA	Stream (Intermittent)	56	5.6	NA	Open Cut
MAJ-09023571	NA	Stream (Intermittent)	12	6.6	NA	Open Cut
MAJ-09023619	NA	Stream (Intermittent)	NA	9.8	NA	Open Cut
MAJ-09023556	Judicial Ditch 2	Drainage Ditch	55	10.8	NA	Open Cut

Kittle Number	Kittle Name	Stream Type	Approximate Top of Bank Width (Feet)[a]	Nearest Milepost	303(d) Impairment[b]	Proposed Crossing Method
MAJ-09022982	NA	Drainage Ditch	21	12.8	NA	Open Cut
MAJ-09022827	NA	Drainage Ditch	NA	14.3	NA	Open Cut
MAJ-09022943	NA	Stream (Intermittent)	NA	15.3	NA	Open Cut
MAJ-09022943	NA	Stream (Intermittent)	NA	15.4	NA	Open Cut
MAJ-09022585	NA	Drainage Ditch	NA	15.8	NA	Open Cut
MAJ-09022807	NA	Drainage Ditch	15	17.2	NA	Open Cut
MAJ-09022834	NA	Stream (Intermittent)	NA	18.1	NA	Open Cut
H-026-081	Otter Tail River	River (Perennial)	170	19.5	InvertBio; T	HDD
MAJ-0902388	NA	Drainage Ditch	NA	22.7	NA	Open Cut
MAJ-0902439	NA	Drainage Ditch	10	22.8	NA	Open Cut
MAJ-090294	NA	Drainage Ditch	NA	23.3	NA	Open Cut
MAJ-0902316	NA	Drainage Ditch	NA	23.3	NA	Open Cut
MAJ-0902461	NA	Drainage Ditch	NA	23.8	NA	Open Cut
MAJ-0902336	NA	Drainage Ditch	NA	24.3	NA	Open Cut
H-026-082	Unnamed Creek	Stream (Perennial)	40	25.0	E. coli	Bore
H-026	Bois de Sioux River	River (Perennial)	140	28.0	DO; E. coli; FishesBio; Hg-F; Nutrients; T	HDD

[a] NA = Width of surface water crossing was not visible on aerial photography.
[b] Impairment: DO – Dissolved Oxygen, E. coli – Escherichia coli, FishesBio – fish bioassessments, Hg-F: mercury in fish tissue, InvertBio – benthic macroinvertebrate bioassessments, T – Turbidity; NA = Not listed as impaired

The widest waterbodies that would be crossed are the Bois de Sioux River (crossed by RA-Hybrid and RA-South), Red River (crossed by RA-North), Ottertail River (crossed by RA-Hybrid and RA-South), and Pelican River (RA-North, RA-Hybrid, and RA-South), all of which are impaired waters. Each of these rivers would be crossed by HDD.

Groundwater

Unconsolidated permeable glacial deposits and recent alluvial deposits are the most important groundwater sources in the project area. These deposits consist primarily of glacial sand and/or gravel outwash, ice-contact deposits, or sand and gravel alluvium that was deposited along existing streams. Glacial aquifers are classified as surficial aquifers when the water table is in these deposits. The surficial glacial aquifers vary in thickness from a few feet to over 300 feet and can produce water up to 3,000 gallons per minute or more, depending on the thickness and extent of the saturated deposits. Buried glacial aquifers are separated from the ground surface or from overlying surficial glacial aquifers by a laterally continuous layer of lower permeability silt and/or clay that functions as an aquitard, meaning it creates a barrier to vertical flow. The buried glacial aquifers are typically confined, and some wells that are completed in them flow freely without pumping, indicating “artesian” conditions.

Most lakes, rivers, and many wetlands near the project are hydraulically connected with the water table and are typically observed as a surface expression of the water table. The project area in Otter Tail County has a depth to water table typically less than 20 feet below ground surface, and the depth to water table in Wilkin County is typically less than 10 feet below ground surface.[197]

Groundwater sources within the ROI are pumped from wells for commercial, industrial, public, and private uses.

According to the DNR, RA-South crosses a surficial beach ridge aquifer between MPs 4.6 and 7.7 in Otter Tail County. RA-North and RA-Hybrid might also cross this aquifer in Otter Tail County. Shallow geology and groundwater can be highly variable and complex in beach ridge areas. DNR’s review of aerial photos shows a groundwater upwelling signature down slope from the beach ridge. DNR stated that the area is prone to significant groundwater discharge and an initial groundwater investigation by the applicant confirmed that artesian groundwater conditions are present along RA-South in the beach ridge system. Groundwater investigations have not been conducted along RA-North and RA-Hybrid. However, MDH reports that, based on well records in its County Well Index, artesian conditions are present in shallow confined aquifers within 1 mile of each route alternative (see **Appendix J**).

Based on a review of the Minnesota Spring Inventory,[198] the nearest groundwater spring (Kennedy Park Spring) is located about 3.7 miles southeast of MP 1.5 along the three route alternatives.

Based on the MDH’s County Well Index[199] database:

- 56 wells are located within 1 mile of RA-North
- 42 wells are located within 1 mile of RA-Hybrid
- 73 wells are located within 1 mile of RA-South

The County Well Index does not include all existing wells in Minnesota. A pre-construction survey would be required to identify all wells within the construction workspaces. The tables below summarize wells listed in County Well Index that are located within the respective construction workspace for each alternative.

Four out of the 56 wells within 1 mile of RA-North are within the RA-North construction workspace, as shown in **Table 5-49**.

Table 5-49 Wells within the RA-North Construction Workspace

MWI Well ID	Well Type	Distance from Centerline (feet)	Nearest MP	Direction from Centerline	Static Water Level (feet)[b]
589079	MW	17.5	18.6	Southeast	11.8
589080	MW	16.9	18.6	Southeast	15.5
589078	MW	15.2	18.6	Southeast	11.8
589083	MW	115.4	20.7	Northeast	16.3

[a] MW – Monitoring Wells are used to measure or monitor the level, quality, quantity, or movement of subsurface water.
[b] The distance from the land surface (or the measuring point) to the water in the well under non-pumping (static) conditions.

None of the 42 wells within 1 mile of the RA-Hybrid route centerline would be within the construction workspace. A total of 73 wells are within 1 mile of the RA-South route centerline, one of which is located within the construction workspace near MP 6.8, as shown in **Table 5-50**.

Table 5-50 Wells within the RA-South Construction Workspace

MWI Well ID	Well Type[a]	Nearest MP	Distance from Centerline (feet)	Direction from Centerline	Static Water Level (feet)[b]
847292	OB	6.8	28.4	Northwest	10

[a] OB – Observation Wells are a permanent well structure which is used to obtain data on a periodic or ongoing basis for aquifer characteristics or water quality.
[b] The distance from the land surface (or the measuring point) to the water in the well under non-pumping (static) conditions.

Minnesota Rules 4725.2150 provides minimum required separation distances between a well and a pipeline carrying flammable or volatile gas. This distance is 10 feet or 5 feet with the shorter distance applying if the person constructing the well, or the person installing the pipeline, marks the well with a permanent sign warning of the location of the pipeline. Any well that is determined to be located less than the minimum required distance from the pipeline provided in Minnesota Rules 4725.2150, must be sealed by a Minnesota licensed well contractor, who must provide a report of any well sealed to MDH.

Floodplains

Floodplain crossings for each route were determined based on a review of Federal Emergency Management Agency (FEMA) floodplain Zone A/AE data along the ROI. While there are no FEMA-mapped floodplains that would be crossed in Otter Tail County, there are a few FEMA-mapped floodplain crossings in Wilkin County. RA-North crosses one floodplain near MP 23. RA-Hybrid has floodplain crossings at MPs 20.3, 20.8, 21.3, 28.4, and 29. RA-South crosses floodplains near MPs 19.2, 19.8, 20, 20.3, 27.3, 27.4, 28.

5.7.8.2 Potential Impacts

Surface Waters

Impacts on surface water may occur during construction activities. These include clearing and grading of stream banks, topsoil disturbance, in-stream trenching, trench dewatering, backfilling, and expansion of access roads. These activities can increase sedimentation and erosion, modify hydrological flow, release chemical and nutrient pollutants from sediments, and introduce chemical contaminants such as fuel and lubricants. These impacts would be minimal and short-term, occurring only during construction. RA-North would cross 17 intermittent waterbodies, RA-Hybrid would cross 26 intermittent waterbodies, and RA-South would cross 25 intermittent waterbodies. As shown in **Table 5-46**, **Table 5-47**, and **Table 5-48**, impacts on perennial waterbodies would be avoided by the use of HDD.

The capture facility and associated MLV/cathodic protection system are about 1.5 miles from the nearest waterbody. The four remaining MLVs are at least 0.5 mile from the nearest waterbody. None of the temporary or permanent access roads cross any waterbodies and are far enough away from any waterbodies that they are not anticipated to have any impact.

After the initial clearing and grading is completed, the pipeline would be installed at waterbodies crossed by the project using either open cut (nonflowing/flowing) or trenchless construction methods including HDD and conventional bores.

The nonflowing open cut method would be used at waterbody features that have no flow or when flow is unlikely between initial disturbance and final stabilization. Section 4.5.1 of the Minnesota ECP describes this crossing method in more detail. If sufficient flow appears during the time of construction of the crossing, or if water flow is expected during construction, the flowing open cut construction method would be used. Section 4.5.2 of the Minnesota ECP describes this crossing method in more detail. The non-flowing open cut method places straw bales or silt screening across the width of low- or non-flowing watercourses during trenching. The flowing open cut method is used when flow is too consistent to place silt screening or bales, and uses a small coffer dam or water dam to slow flow while trenching is completed.

As part of the License to Cross Public Waters permitting process, the DNR would determine construction and restoration plans for each public water crossing, including those that would be crossed via a trenchless (HDD) method.

Prior to installation of a waterbody crossing, the applicant would review the crossing to confirm conditions and review upcoming weather patterns. Work would be completed per the time windows outlined in Section 4.4 of the Minnesota ECP. In-stream construction activities (specifically trenching, pipeline installation, backfill, and restoration of the streambed contours) at waterbodies 0 to 10 feet in width would generally be completed in under 24 hours.

The crossing of intermediate waterbodies 10 to 100 feet in width would generally be completed in under 48 hours. If sufficient flow appears during the time of construction of the crossing, or where water flow is expected during construction across the waterbody, the flowing open cut construction method would be used. Work would be planned during a time of low stream flow (in other words, it would not occur during periods of high flow). This method entails pre-work to stage the crossing equipment outside the waterbody, welding the pipe segment for the crossing in adjacent uplands, trenching across the waterbody, carrying the made-up pipe into the trench, and then backfilling the trench and restoring the stream banks. In stream construction would be completed as expediently as practicable. Work would be completed per the time windows outlined in Section 4.4 of the Minnesota ECP.

Perennial rivers would be crossed by the HDD method as described in Chapter 2. Throughout the process of drilling and enlarging the small diameter pilot hole along a pre-determined path under a waterbody, a bentonite clay slurry, known as “drilling mud,” would be circulated through the drilling tools to lubricate the drill bit, remove drill cuttings, and stabilize the open hole. The water used to create the drilling mud may be appropriated from surface or groundwater sources under water appropriation permits issued by DNR.

Under certain conditions, an additive might need to be mixed with the drilling mud for viscosity or lubricating reasons. These additives would be certified by the National Sanitation Foundation. If additives are not used in the drilling mud, there is an increased chance of inadvertent releases and a higher potential for failed crossings. If a wetland or waterbody is near the drilling location, the drilling mud might flow into that resource. In most circumstances, releases can be contained. However, when drilling mud releases to a waterbody, it disperses quickly into the water and can increase discharge of sediments downstream.

Prior to conducting HDDs, the applicant would develop a contingency plan to address the unintended release of drilling mud to the environment. This plan would include: (1) a contingency for the waterbody crossing in the event the drill is unsuccessful or proves infeasible, (2) measures to reduce the risk for an inadvertent return to occur, and (3) procedures to monitor for inadvertent returns during drilling. The applicant states that containment, response, and clean-up equipment would be available prior to beginning the HDD to assure a timely response in the event of an inadvertent release.

The applicant would not clear trees within riparian zones, which would help to minimize the potential of construction-related sediment from reaching each feature. In accordance with the MPCA Construction Stormwater General Permit, the applicant would also use erosion and sediment control BMPs during construction and restoration activities to minimize sediment and other contaminants from entering the waterbody.

Once in operation, the project would have limited impacts on waterbodies. Impacts associated with maintenance and repair would be rare and infrequent. Operational impacts on surface waters may occur during the first few years of operation as vegetation and restoration methods establish.

The project would not be close enough to affect the City of Breckenridge, the Drinking Water Supply Management Area, or the Moorhead-Buffalo Aquifer North Drinking Water Supply Management Area. The Fergus Falls surface water intake on the Otter Tail River within the Fergus Falls Water Assessment Area is upstream from RA-Hybrid and RA-South and would not be affected by the project.

Groundwater

Ground disturbance or excavation associated with installation of a 4-inch-diameter pipeline is not expected to significantly affect groundwater resources. Ground disturbance associated with construction would be primarily limited to depths between 5 and 6 feet, although sheet piling, if used, would extend to depths of 10 to 15 feet. Sheet piling consists of steel sheets that can be interlocked and driven into the ground in sequence to provide lateral support along the trench wall. Sheet piling can provide stability in unstable or highly saturated soils, create a dry workspace at waterbody or road crossings, or strengthen an excavation that might need to remain open for some time.

Groundwater recharge could be impacted by vegetation clearing and soil compaction. Where the water table is shallower than the depth of excavation, dewatering of the trench or bore pit might be required. Dewatering is regulated by DNR and would be conducted according to permit requirements. The impacts of these construction activities on groundwater would be temporary, minimal, and localized.

Use of sheet piling in locations with a shallow confined aquifer carries the potential that the sheet piling could intersect the aquitard that confines the aquifer, thereby breaching the aquifer. If artesian conditions are present, when the sheet piling is removed the void created can act as a flow path and uncontrolled flow of water can occur. The breaching of a shallow confined aquifer could have significant long-term impacts on groundwater resources. Geotechnical investigations prior to construction in beach ridge areas would identify areas where sheet pile use should be avoided.

Depending on the quantity, spills and leaks of fuels or hazardous materials during construction could impact groundwater, especially in areas with a shallow water table. The applicant has developed and would follow spill prevention, containment, and response measures, which include proper handling and storage of fuels and hazardous liquids, refueling procedures, equipment inspection and maintenance, and spill containment and remediation measures. With these measures, impacts on groundwater in the event of a leak or spill, if any, would likely be minimal.

As described in Section 5.7.8.1, wells are documented within the construction workspace for two of the route alternatives. Additional wells could be present that are not documented. Wells within the construction workspace have the potential to be damaged. Additionally, Minnesota Rules Chapter 4725 defines an isolation distance of 50 feet or variance process for a hazardous buried pipeline from water supply wells.[200] The applicant states it would consult with affected landowners regarding known cased wells that may be crossed by the project and take appropriate action to avoid or minimize impacts. If necessary, the applicant states it would work with landowners to develop site-specific plans for wells within 50 feet of the pipeline, which could include capping the well and constructing a new well or, if preferred by the landowner, the applicant could request a variance from MDH.

Based on current knowledge of groundwater conditions in the ROI, impacts on groundwater would be similar for each of the route alternatives.

Water Use

During pipeline construction, installation of HDDs, hydrostatic testing, and dust control could involve appropriations from surface water or groundwater sources, if permitted by DNR. The use of water for HDDs and hydrostatic testing would be single-event appropriations, whereas dust control appropriations would be variable, as needed, based on conditions. The applicant estimates about 125,000 gallons of water would be needed for construction of the pipeline. Most of the water, 110,000 gallons, would be used for hydrostatic testing.

Water used for hydrostatic testing and dust control during construction of the capture facility would be obtained from either a local surface water source or groundwater well directly or indirectly from the ethanol plant or the city of Fergus Falls. The amount of water needed for capture facility construction has not yet been determined.

Once the applicant has finalized water appropriation sources and volumes needed for construction, the applicant would apply for coverage under individual or general DNR water appropriation permits for any surface or groundwater appropriated for these activities. These permits would contain BMPs for water withdrawals, which the applicant would be required to follow. Water appropriation permits from DNR would also inform the locations used, any seasonal restrictions to account for low-flow conditions, and volume and measurement requirements.

Water would not be needed for operation of the pipeline. Water for operation of the capture facility would be obtained from existing on-site wells at the ethanol plant. The applicant estimates that the capture facility would require 8.2 gallons per minute in winter months and 40.9 gallons per minute in summer months, for an average water usage of about 13 million gallons per year. Water supply appropriations would be regulated by DNR-issued permits that would have conditions to minimize impacts on groundwater resources. DNR would review permit applications and would not issue a permit if the amount of water to be withdrawn would adversely affect the aquifer or other users.

If withdrawing water from surface water appropriations, the applicant would use a 3/16-inch mesh intake screen to reduce impingement and entrainment of aquatic life and manage flow rates. The applicant would conduct reporting as required by permit conditions.

Floodplains

The pipeline and temporary access road construction impacts within floodplains would be temporary. Following construction, the pipeline would be underground and would not be impacted by flooding or affect floodplain dynamics.

MLV 321-04 and a portion of its associated permanent access road along RA-Hybrid (MP 28.8) and RA-South (MP 27.7) would be within a FEMA-mapped 500-year floodplain located near MP 27. MLV 321-03 and a portion of its associated permanent access road along RA-Hybrid (MP 21.4) and RA-South (MP 20.3) would be within a FEMA-mapped 500-year floodplain located near MP 21. None of the MLVs are within FEMA-mapped 100-year floodplains. No other aboveground facilities would be in floodplains.

The applicant would coordinate with Wilkin County to secure a floodplain permit for the portions of the project that would be constructed within designated floodplains, as needed. A Floodplain Ordinance serves to minimize flood losses and protect public health and the safety of the county.[201]

5.7.8.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following measures to mitigate impacts on water resources:

- “Wetlands and riparian areas shall be accessed using the shortest route possible in order to minimize travel through wetland areas and prevent unnecessary impacts. No temporary workspace areas shall be placed within or adjacent to wetlands or water resources, as practicable.”
- “Soil excavated from the wetlands and riparian areas shall be contained and not placed back into the wetland or riparian area.”
- “Dewatering during periods of excessive precipitation or in areas where the natural groundwater table intersects the pipeline trench will not be directed into wetlands or water bodies. Dewatering discharges will be directed toward well vegetated upland areas. Should discharge activities need to be directed off the right-of-way landowner consent will be obtained and locations will be chosen to minimize impacts. All discharge activities will comply with applicable agency permits or approvals.”
- “Areas disturbed by construction activities shall be restored to pre-construction conditions.”
- “Water resource areas disturbed by construction activities shall be restored to pre-construction conditions in accordance with the requirements of applicable state and federal permits or laws and landowner agreements. All requirements of the U.S. Army Corps of Engineers (USACE), Minnesota Department of Natural Resources (DNR), and local units of government shall be met.”

- "Water resource areas disturbed by construction activities shall be restored to pre-construction conditions in accordance with the requirements of applicable state and federal permits or laws and landowner agreements."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant would mitigate impacts on the large perennial rivers (the Pelican River, the Otter Tail River, and the Bois de Sioux River [or Red River for RA-North]) and adjacent riparian areas by installing the pipeline using HDD methods.

Mitigation Proposed During Scoping

DNR made the following recommendations for mitigations to reduce potential impacts on water resources:

- Exploratory borings should be conducted to characterize the shallow subsurface anywhere sheet piling would be used and submitted to DNR groundwater staff for evaluation. Exploratory borings should be conducted to at least the maximum depth of any construction impacts.
- At a minimum, Pennsylvania standards for trench breaker placement should be used, and knowledge gained from additional subsurface site characterization may provide further guidance on where to place trench breakers most effectively. Trench breakers should be used at the entrance and exit of every waterbody regardless of slope (except for HDD crossings).
- The pipeline should be installed deep enough to prevent pipe exposure over time. The DNR's Area Hydrologists may have specific data on depth of cover for river and stream crossings and should be consulted.
- Unintentional release evaluations should be conducted for water crossings proposed to be installed via HDD to ensure the soils are amenable to HDD. (As indicated in Section 5.7.3.3, the applicant has completed geotechnical evaluations for two of the three HDD crossings at waterbodies and plans to conduct an investigation at the third once access is obtained. An assessment of the potential for an inadvertent release of drilling mud is part of the feasibility analysis and design for HDDs.)
- The applicant should continue to consult with DNR on groundwater investigations for the potential routes and on construction methods in relation to groundwater.

MDH states that any previously unknown well discovered during pipeline construction should be reported to MDH and protected from damage. If the well is no longer in use, it should be additionally protected from becoming lost, so a licensed well contractor can evaluate it for sealing. Any well that is uncovered, where the wellhead had been buried, cannot be reburied unless sealed by a licensed well contractor.

Mitigation Recommended by EERA Staff

EERA staff recommends that the applicant should provide to the Commission results of geotechnical evaluations of groundwater conditions for any beach ridge areas in which sheet piling would be used for pipeline construction. The evaluations should be provided 30 days prior to the Plan and Profile submittal, and the applicant should document coordination with DNR staff. The submittal could include DNR staff concurrence regarding use of sheet piling.

5.7.9 Wetlands

The ROI for wetlands is the route width. Wetlands listed in the National Wetlands Inventory were compared for the three route alternatives. Primarily emergent wetlands were identified, with lesser amounts of forested and riverine wetlands. Direct wetland impacts would occur during pipeline construction. Wetland impacts are comparable among the three route alternatives. Impacts on forested wetlands would be slightly higher for RA-Hybrid relative to RA-North and RA-South. Impacts would be minimal and short-term in emergent wetlands, and minimal to moderate and longer-term in forested wetlands. Indirect impacts on wetlands would be comparable among all three route alternatives and would be negligible to minimal and long-term during operation of the project. Wetland impacts would be minimized through implementation of standard best management practices and conditions required under the state and federal permits for work in wetlands.

5.7.9.1 Existing Conditions

Wetlands listed in the National Wetlands Inventory (NWI) were compared for the three route alternatives. Although the applicant delineated wetlands along RA-South, similar studies have not been performed for portions of RA-Hybrid or for RA-North. Use of NWI data allows the three route alternatives to be compared on the same basis. The NWI wetlands geospatial dataset provides information on the nation’s wetland habitat types, locations, and trends to support research, land management planning and analyses, policy development, and modeling activities.[202]

Wetlands provide a variety of environmental benefits, including flood storage, wildlife habitat, water quality, flow, nutrient sequestration, and recreation. The following section describes the wetlands crossed by the route alternatives and measures to minimize impacts. Many of these wetlands are limited based on topography and highly interspersed in the landscape. Emergent wetlands crossed by the project are generally located in agricultural roadside areas, which are generally maintained ditches and free of woody vegetation.

Emergent wetlands, also known as palustrine emergent (PEM) wetlands, consist of sedge- and rush-dominated wetlands adjacent to waterbodies, fresh (wet) meadows in roadside and agricultural drainage ditches, seasonally flooded basins in agricultural areas, and shallow marsh communities dominated by cattails (*Typha* spp.) and reed canary grass (*Phalaris arundinacea*). Widely scattered small, ephemeral pools support a variety of emergent hydrophytes, which are plants that only grow in or on water. Common plant species in emergent wetlands include cattail, reed canary grass, prairie cordgrass (*Spartina pectinata*), giant goldenrod (*Solidago gigantea*), and nodding smartweed (*Persicaria lapathifolia*).

Forested wetlands, also known as palustrine forested (PFO) wetlands, are dominated by forested plant communities and by tree, shrub, and understory herbaceous species that are adapted to and tolerant of periodic inundated or saturated soils. Canopy tree species in forested wetlands in the area are typically cottonwood, black ash, and/or aspen. Understory species may include young ash and a variety of wet-tolerant shrubs. Sedges, bluejoint grass, and a variety of wet-tolerant herbaceous species comprise the forest floor community.

NWI wetlands within the route width (the ROI) of each alternative are summarized in **Table 5-51** below.

Table 5-51 Wetlands within the Route Alternatives

Route	County	Cowardin Type[a]	Wetland Type	Acres within the ROI
RA-North	Otter Tail	PEM	Freshwater Emergent Wetland	9.4
RA-North	Otter Tail	PFO	Freshwater Forested Wetland	3.1
RA-North	Otter Tail	PUB	Freshwater Pond	0.0
RA-North	Otter Tail	PSS	Freshwater Shrub Wetland	1.1
RA-North	Otter Tail	R	Riverine	1.4
RA-North	Wilkin	PEM	Freshwater Emergent Wetland	4.7
RA-North	Wilkin	PFO	Freshwater Forested Wetland	0.4
RA-North	Wilkin	PUB	Freshwater Pond	0.2
RA-North	Wilkin	R	Riverine	0.6
			TOTAL	**20.9**
RA-Hybrid	Otter Tail	PEM	Freshwater Emergent Wetland	9.4
RA-Hybrid	Otter Tail	PFO	Freshwater Forested Wetland	3.1
RA-Hybrid	Otter Tail	PUB	Freshwater Pond	0.0
RA-Hybrid	Otter Tail	PSS	Freshwater Shrub Wetland	1.0
RA-Hybrid	Otter Tail	R	Riverine	1.4
RA-Hybrid	Wilkin	PEM	Freshwater Emergent Wetland	5.7
RA-Hybrid	Wilkin	PFO	Freshwater Forested Wetland	1.8
RA-Hybrid	Wilkin	R	Riverine	2.4
			TOTAL	**24.7**
RA-South	Otter Tail	PEM	Freshwater Emergent Wetland	29.0
RA-South	Otter Tail	PFO	Freshwater Forested Wetland	2.3
RA-South	Otter Tail	PAB	Freshwater Pond	0.7
RA-South	Otter Tail	PSS	Freshwater Shrub Wetland	1.1
RA-South	Otter Tail	R	Riverine	1.2
RA-South	Wilkin	PEM	Freshwater Emergent Wetland	5.7
RA-South	Wilkin	PFO	Freshwater Forested Wetland	1.8
RA-South	Wilkin	R	Riverine	2.7
			TOTAL	**44.6**

[a] PEM = Palustrine Emergent; PSS = Palustrine Scrub-Shrub; PFO = Palustrine Forested, R= Riverine.

5.7.9.2 Potential Impacts

Table 5-52 summarizes wetland types crossed by the route alternatives. Wetlands along the project routes, including type and ID number, are shown on the maps in **Appendix B**.

Table 5-52 Wetlands Crossed by the Route Alternatives

Route	County	Cowardin Type[a]	Wetland Type	Milepost	Acres in Construction Workspace	Crossing Length by Centerline (feet)
RA-North	Otter Tail	PFO	Freshwater Forested Wetland	2.2	<0.1 [b]	207
RA-North	Otter Tail	PFO	Freshwater Forested Wetland	2.2	<0.1 [b]	370
RA-North	Otter Tail	R	Riverine	2.2	<0.1 [b]	72
RA-North	Wilkin	PEM	Freshwater Emergent Wetland	14.6	0.7	245
RA-North	Wilkin	PFO	Freshwater Forested Wetland	23.0	<0.1 [b]	55
RA-North	Wilkin	R	Riverine	23.0	<0.1 [b]	207
				TOTAL	**0.7**	**998**
RA-Hybrid	Otter Tail	PFO	Freshwater Forested Wetland	2.2	0.4 [b]	207
RA-Hybrid	Otter Tail	PFO	Freshwater Forested Wetland	2.2	0.8 [b]	370
RA-Hybrid	Otter Tail	R	Riverine	2.2	0.1 [b]	72
RA-Hybrid	Wilkin	PEM	Freshwater Emergent Wetland	20.3	0.1 [b]	43
RA-Hybrid	Wilkin	R	Riverine	20.5	0.2 [b]	127
RA-Hybrid	Wilkin	PEM	Freshwater Emergent Wetland	20.6	0.1 [b]	51
RA-Hybrid	Wilkin	PEM	Freshwater Emergent Wetland	26.1	0.4[b]	325
RA-Hybrid	Wilkin	PEM	Freshwater Emergent Wetland	26.1	0.1 [b]	53
RA-Hybrid	Wilkin	R	Riverine	29.1	0.1 [b]	98
				TOTAL	**2.3**	**1,347**
RA-South	Otter Tail	PEM	Freshwater Emergent Wetland	0.6	0.1	45
RA-South	Otter Tail	PEM	Freshwater Emergent Wetland	1.6	0.1	42
RA-South	Otter Tail	PEM	Freshwater Emergent Wetland	1.9	0.4 [b]	372
RA-South	Otter Tail	PSS	Freshwater Shrub Wetland	1.9	0.1 [b]	42
RA-South	Otter Tail	R	Riverine	1.9	0.1 [b]	76
RA-South	Otter Tail	PEM	Freshwater Emergent Wetland	5.3	0.1	81

Route	County	Cowardin Type[a]	Wetland Type	Milepost	Acres in Construction Workspace	Crossing Length by Centerline (feet)
RA-South	Otter Tail	PEM	Freshwater Emergent Wetland	5.7	0.6	447
RA-South	Otter Tail	PFO	Freshwater Forested Wetland	6.9	0.2	168
RA-South	Otter Tail	R	Riverine	10.8	<0.1	18
RA-South	Wilkin	PEM	Freshwater Emergent Wetland	19.2	0.1 [b]	43
RA-South	Wilkin	R	Riverine	19.5	0.2 [b]	127
RA-South	Wilkin	PEM	Freshwater Emergent Wetland	19.6	0.1 [b]	51
RA-South	Wilkin	PEM	Freshwater Emergent Wetland	25	0.1 [b]	53
RA-South	Wilkin	PEM	Freshwater Emergent Wetland	25.1	0.4 [b]	325
RA-South	Wilkin	R	Riverine	28.0	0.1 [b]	98
				TOTAL	**2.7**	**1,989**

a PEM = Palustrine Emergent; PFO = Palustrine Forested; PSS = Palustrine Scrub-Shrub; R= Riverine.[203]

b Although this wetland would be crossed by the route alternative, impacts would be avoided by use of bore or HDD technique.

Note: The sum of addends may not total correctly due to rounding.

As shown in **Table 5-52**, the acreage of wetlands in the construction workspace would be highest along RA-South, followed by RA-Hybrid and RA-North. However, the total acreages for each route alternative and the differences between them are small. The MLVs/cathodic protection system, launcher, and capture facility would not impact wetlands. Final wetland impacts would be determined pending completion of wetland field surveys and evaluation of workspace in wetland areas.

Typical construction in most wetlands would be similar to construction in uplands and would consist of clearing, trenching, dewatering, installation, backfilling, clean-up, and revegetation. Construction across wetlands would result in temporary impacts and, in a few situations, minor changes in plant species composition for emergent wetlands. Construction activities that result in plant species composition of forested wetlands would be a long-term, moderate impact because it would take longer for the tree species and associated understory shrub species that dominate forested wetlands to regenerate, and forested wetlands within the operational ROW would be maintained as emergent wetlands. Temporary impacts may include loss of wetland vegetation because of clearing and other construction activities; soil disturbance associated with clearing, trenching, and equipment traffic; and increases in turbidity and alterations of hydrology as the result of trenching, dewatering, and soil stockpiling activities.

The pipeline trench would be excavated in wetlands using a backhoe excavator. In unsaturated wetlands, up to 12 inches of topsoil would be stripped from the trench line and stockpiled separately from trench spoil. Grading of wetlands would be dictated by soil saturation (see Sections 5.2 and 5.3 of the Minnesota ECP in **Appendix D**). Wetlands that have saturated soils, but do not have standing water, would use a standard wetland crossing method, which consists of pre-assembled and positioned pipe that is lined up adjacent to a trench and lowered into the pre-cut trench. The dry crossing method would be used to cross wetlands that have no standing water and no water present below the surface so that topsoil can be segregated easily. Pipe-stringing would occur within the wetland or adjacent to the wetland, depending on site conditions and designated workspace.

Wetlands designated as public waters are subject to DNR's Public Waters Work Permit process. The project would not impact public water basins along any of the proposed route options.

Near MP 0.3, all three route alternatives cross one parcel that has USFWS wetland interests administered by the Fergus Falls Wetland Management District. USFWS staff confirmed the wetlands on the parcel are the only features subject to the conservation easement. The project avoids wetland impacts on the parcel.

In Minnesota, wetland crossings are regulated by USACE, MPCA, DNR, and BWSR Local Government Units (LGU) through the Clean Water Act and Minnesota's Wetland Conservation Act. Prior to construction, the applicant must acquire all wetland permits for the project from local, state, and federal agencies.

The applicant submitted an application to request Clean Water Act, Section 404/10 coverage under the Utility Regional General Permit from USACE (certified by MPCA under Section 401 of the Clean Water Act) for the RA-South route in October 2022 and submitted updated materials in March 2023. The applicant would request Section 404/10 coverage for any route approved after submittal of this EIS.

The project falls under the Wetland Conservation Act Federal Approvals Exemption for Utilities, which is overseen by BWSR. This exemption applies to utilities, as defined by USACE, as "any pipe or pipeline for the transportation of any gaseous, liquid, liquefiable, or slurry substance, for any purpose, and any cable, line, or wire for the transmission of electrical energy, telephone, electronic data, and radio or television communication." In accordance with Minnesota Statute 103G.2241, subdivision 3, and Minnesota Rule 8420.0420, subpart 4, a replacement plan is not required for wetland impacts resulting from the construction, maintenance, or repair of utility lines, including pipelines and associated facilities when such a project is authorized by USACE under Section 404 of the Clean Water Act. The applicant submitted a Notice of Intent to use this exemption to the Otter Tail County and Wilkin County LGUs concurrent with the USACE application and states it would keep BWSR and the LGUs apprised of the USACE permitting process.

5.7.9.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following measures to mitigate impacts on wetlands:

- "Wetlands and riparian areas shall be accessed using the shortest route possible in order to minimize travel through wetland areas and prevent unnecessary impacts."
- "No temporary workspace areas shall be placed within or adjacent to wetlands or water resources, as practicable."
- "To minimize impacts, construction in wetland areas shall occur during frozen ground conditions where practicable and shall be according to permit requirements by the applicable permitting authority. When construction during winter is not possible, wooden or composite mats shall be used to protect wetland vegetation."

- "Soil excavated from the wetlands and riparian areas shall be contained and not placed back into the wetland or riparian area."
- "Dewatering during periods of excessive precipitation or in areas where the natural groundwater table intersects the pipeline trench will not be directed into wetlands or water bodies. Dewatering discharges will be directed toward well vegetated upland areas. Should discharge activities need to be directed off the right-of-way landowner consent will be obtained and locations will be chosen to minimize impacts. All discharge activities will comply with applicable agency permits or approvals."
- "Areas disturbed by construction activities shall be restored to pre-construction conditions. Restoration of the wetlands will be performed by Permittee in accordance with the requirements of applicable state and federal permits or laws and landowner agreements."
- "Wetland and water resource areas disturbed by construction activities shall be restored to pre-construction conditions in accordance with the requirements of applicable state and federal permits or laws and landowner agreements. All requirements of the U.S. Army Corps of Engineers (USACE), Minnesota Department of Natural Resources (DNR), and local units of government shall be met."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant would mitigate impacts on wetlands by following measures in its Minnesota ECP. In addition, the applicant would mitigate potential impacts on wetlands through the following measures:

- At wetlands, the pipeline construction workspace width would be reduced from 100 feet to 75 feet. Where a wetland cannot support construction equipment (for example, in wetlands with saturated soils), construction activities would be accomplished from construction mats or using low ground pressure equipment. If used, construction mats would be removed upon project completion. To help mitigate the flow and deposition of sediments into wetlands, redundant sediment control measures would be installed and maintained immediately after clearing and prior to initial ground disturbance at wetlands located within 50 feet of the project and where stormwater flows to a wetland.
- The applicant would limit post-construction vegetation maintenance to promote the growth of the riparian filter strip (buffer), and maintain a 10-foot-wide corridor centered over the pipeline for ongoing maintenance, visual inspections, and to allow for corrosion and leak surveys. Between HDD entry and exit points at waterbody crossings, the applicant would not clear riparian wetland vegetation during construction or operations. Vegetation management would be limited to hand trimming necessary to set the HDD guidewires or a pump for water withdrawal.

Mitigation Proposed During Scoping

MPCA recommended that details be provided in the ECP for preventing excessive crowning or subsidence above the restored centerline, and for addressing excessive crowning or subsidence if it is discovered during post-construction monitoring. This could be especially important if excessive crowning or subsidence has the potential to impact pre-construction vegetation or hydrology, especially in wetlands and near waterbodies.

Mitigation Recommended by EERA Staff

None currently recommended.

5.7.10 Wildlife and their Habitats

The ROI for wildlife and their habitats is the route width. For all three route alternatives, the majority of wildlife species present are common generalist species well-adapted to disturbed habitats and human activities. Wildlife species range from larger mammals to smaller reptiles, amphibians, and invertebrates. Fish, aquatic amphibians, and aquatic invertebrates could be present in intermittent and perennial streams crossed by the route alternatives. Larger, more mobile wildlife species would likely avoid portions of the ROI during construction. Smaller, less mobile wildlife species and/or species in burrows could be inadvertently injured or killed by construction equipment. Habitat loss or degradation would be minimal, as most of the route width for all three route alternatives is agricultural land. Potential impacts on wildlife would be comparable across all three route alternatives. Most impacts on wildlife would be highly localized, short-term, and negligible. Impacts on freshwater species would be minimized by the use of HDD techniques and sediment controls. Operation of the project would have minimal impact on wildlife and their habitats.

5.7.10.1 Existing Conditions

Wildlife that could occur in the ROI are common generalist species associated with disturbed habitats and are accustomed to human activities occurring in the area (for example, agriculture, roads, and rural homesteads). Wildlife species in the area include white-tailed deer, coyote, beaver, muskrat, river otter, rabbits, squirrels, red and gray fox, raccoon, bald eagles, woodcock, ruffed grouse, wild turkeys, migratory waterfowl (for example, geese, ducks, trumpeter swans, herons), and various birds (for example, meadowlarks, sparrows, thrushes, songbirds, various woodpeckers, shore birds). Less mobile wildlife that could occur within the route width include reptiles and amphibians, such as turtles, snakes, frogs, toads, and small mammals like mice and voles. Invertebrate wildlife species, which include insects and pollinator insect species, also occur within the ROI. Rare and unique wildlife species are discussed in Section 5.4.5.

Fish species may be present in perennial or intermittent rivers and streams crossed by the route. Commonly found fish species in the Otter Tail River include black and brown bullheads, black crappie, bluegills, large- and smallmouth bass, walleye, rock bass, and carp. Lake sturgeon are also known to occur in the Otter Tail River; however, most are found in the upper reaches of the river near the outlet from Otter Tail Lake. Commonly found fish species in the Pelican River include smallmouth bass, perch, carp, and bullheads. The variation in waterbody characteristics at the route crossings affects the potential habitat for fish. Habitat suitability depends on species-specific needs combined with factors such as the waterbody's size, flow regime, water quality, aquatic and riparian vegetation, and the setting and geographic location of the watershed.

The DNR Watershed Health Assessment Framework (WHAF) ranks the health of a watershed along five biological, geological, and water quality components and generates a score from low health to high health. The Watershed Health Assessment Framework rates the ROIs of all three route alternatives as "low."[204]

Minnesota defines Species in Greatest Conservation Need (SGCN) as "native animals, nongame and game, whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. Also included are species for which Minnesota has a stewardship responsibility."[205] The Wildlife Action Network is "mapped terrestrial and aquatic habitats, buffers, and connectors that represent a diversity of quality habitat…representing viable or persistent populations and 'richness hotspots' of SGCN."[206] The Otter Tail River is a mapped feature in the Wildlife Action Network. This feature received a rank of low to medium-high around the eastern portion of RA-South and RA-Hybrid. RA-North does not cross the Otter Tail River. **Table 5-53** identifies stressors that contribute to population declines in species of greatest conservation need. "Habitat-related stressors were considered a predominant stressor for 70 percent of SGCN (241 of 346 species), indicating that loss, degradation (including from contaminants), and fragmentation of habitats are the most serious challenges facing SGCN populations."[207]

Table 5-53 Habitat Stressors for Species of Greatest Conservation Need[208]

Stressors	% Predominant Factor[a]
Habitat Stressors	70
Habitat degradation	38
Habitat is rare, vulnerable, or declining	35
Habitat loss	31
Habitat fragmentation	23
Depends on natural processes that are no longer within natural range of variation	10
Contaminants	9
Requires large home range or multiple habitats as part of their life cycle	4
Depends on large habitat patch	4
Other Stressors: Specific Threats	13
Invasive animal species	9
Disease	3
Overexploitation, collecting, bounty killing	2
Deliberate killing	1

[a] The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead might indicate that there is not sufficient information available to determine the level of influence the problem has on SGCN.

Habitats in the local vicinity consist of open land, wood land, and wetland habitats. Open land habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Woodland habitat consists of areas of deciduous plants, coniferous plants, or both and associated grasses, legumes, and wild herbaceous plants. Wetland habitat wildlife consists of open, marshy, or swampy shallow water areas.[209]

Linear corridor projects have the potential for fragmenting wildlife habitats. Habitat fragmentation can be a moderate to significant long-term impact when it occurs in more natural, less prevalent vegetation communities. The ROIs for all three route alternatives are dominated by agricultural land, with small, isolated areas of deciduous forest, wetlands, and other non-agricultural habitats.

5.7.10.2 Potential Impacts

Construction of the pipeline along any of the three route alternatives would not significantly diminish wildlife habitat quality or availability. This is because habitat quality is already relatively low overall, and those areas of higher habitat quality comprise less than 5 percent of the construction workspace and less than 4 percent of the operational ROW for any of the route alternatives.

Impacts from construction activities would likely result in the loss of individuals of certain wildlife species. The species most likely to be directly impacted by construction are those that are small, with limited mobility and/or visibility, such as small mammals, amphibians, and invertebrates. Burrows, dens, and other types of low or subsurface habitats might be removed, crushed, or damaged by construction. Although impacts on individual wildlife would be permanent and significant, the impact on the viability of any given wildlife species would be short-term and negligible to minimal.

Larger and/or more mobile wildlife using existing habitats within the ROI are expected to be displaced temporarily during construction due to increased human activity (for example, noise, odors, human presence). Most mobile wildlife would return to the area after construction. Impacts on displaced wildlife would be localized, short-term, and negligible.

Construction and operation of the project facilities would occur in developed areas or in agricultural areas, where wildlife habitat is generally limited. The capture facility and MLV sites would be graveled and fenced, significantly limiting use by wildlife.

Impacts on ground nesting birds could occur as part of clearing and trenching activities. Following construction, impacts on avian species are not anticipated as the pipeline would be underground during operation. Information regarding known raptor nests within the route widths is not known at this time. In the event that a raptor nest would need to be moved, the relocation would follow species-dependent DNR requirements, which could include placing the nest back on the new structure or constructing a separate nesting platform. The relocation of a raptor nest would be a short-term, negligible impact, if properly timed. Impacts on the overall viability of local avian species populations would be short-term and negligible.

Streams would be crossed using HDD or open trench methods. HDD crossings would impact habitat for freshwater species only in the event of an inadvertent release of drilling mud. A release of drilling mud would have localized, short-term, minimal impacts on fish populations near the point of the release. Impacts to mussels from an inadvertent release of drilling mud are described in Section 5.7.5.2. Open trench crossings should have localized, short-term, negligible impacts on fish and mussel populations if proper BMPs are in place. Similarly, sediment entering streams from exposed soils during construction could have an impact on fish and mussel species.

Reptiles, such as snakes, move underground below the frost line and become inactive or hibernate over winter months and then emerge in early spring.[210] Turtles and amphibians generally hibernate under pond bottoms, but would also hibernate on land underneath the frost line, and also emerge in early spring. Impacts on overwintering reptiles and amphibians could occur during early spring construction; that is, individuals might be inadvertently killed, should disturbance occur at their place of overwintering prior to emergence. Impacts on individuals of reptile and amphibian species would be permanent and significant. Habitat disturbance resulting from the project is not expected to result in a decline in local reptile and amphibian populations. The majority of the habitat types available to reptiles and amphibians is agricultural, with relatively little wetland, forested, aquatic, or open upland habitat available. While some reptile and amphibian species use agricultural habitat, the project's impact on more preferred habitat types would be minimal. Therefore, the project's impact on reptile or amphibian species would be short-term and minimal.

Due to the relatively small size of insects in each developmental stage, it is difficult to estimate the size and extent of potential impacts on insect populations. "Insects may winter above or below ground as eggs, larvae, pupae, or adults, depending on the species" in areas like grass thatch, leaf litter, bunch grasses, tunnels in wood, etc.[211] Early spring construction could have an impact on insects, on the ground or in the litter layer, that have not yet hatched or become active. Given the broad distribution of most insect species in the ROI, the impacts on insect populations overall would be short-term and negligible.

Potential long-term impacts on terrestrial and aquatic species are anticipated to be minimal along all route alternatives. Operational impacts are expected from continued maintenance of the ROW. Impacts on wildlife habitat would be associated primarily with clearing activities associated with project construction and conversion of existing habitat to maintained ROW. Regardless of the route alternative selected, wildlife habitat would be converted to maintained route corridors. These direct impacts would be long-term and minimal because most of the ROI is cultivated cropland.

5.7.10.3 Mitigation

Commission Sample Routing Permit

The sample routing permit (**Appendix H**) includes the following mitigation measures that apply to protection of vegetation, and thus to support wildlife habitats:

- "Care shall be used to preserve the natural landscape, minimize tree removal, and prevent any unnecessary destruction of the natural surroundings in the vicinity of all pipeline construction and restoration activities."
- "Areas disturbed by construction activities shall be restored to pre-construction conditions."
- "The Permittee shall clear the permanent right-of-way and temporary right-of-way preserving to the maximum extent practicable windbreaks, shelterbelts, living snow fences, and vegetation in areas such as trail and stream crossings where vegetative screening may minimize aesthetic impacts, to the extent that such actions do not impact the safe operation, maintenance, and inspection of the pipeline and are in compliance with all applicable laws and regulations."
- "The Permittee shall restrict pesticide use to those pesticides and methods of application approved by the Minnesota Department of Agriculture, DNR, and the U.S. Environmental Protection Agency. Selective foliage or basal application shall be used when practicable. All pesticides shall be applied in a safe and cautious manner. The Permittee shall provide notice of pesticide application to affected landowners and known beekeepers operating apiaries within three miles of the project site at least 14 days prior to such application."

Additionally, the sample routing permit states that "the Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of those permits unless those permits conflict with or are preempted by federal or state permits and regulations."

Applicant-Proposed Mitigation

The applicant would mitigate impacts on wildlife by implementing measures in its Minnesota ECP, including the following:

- To allow the passage of wildlife and livestock, and to facilitate the natural drainage pattern, spoil piles would have gaps that align with the breaks of the strung pipe. Plugs of subsoil in the ditch would be left or bridges may also be constructed to allow the passage of wildlife and livestock.
- Trenching procedures would be followed closely to ensure the length of time the trench is left open is minimized to the extent practicable.

In addition, the applicant would use HDD for crossing certain waterbodies and implement the following BMPs recommended by DNR for native plant communities and MBS Sites:

- Do not park equipment, stockpile supplies, or place spoil within the MBS sites.
- Inspect and clean all equipment prior to bringing it to the site to prevent the introduction and spread of invasive species.
- Use effective erosion prevention and sediment control measures.
- Revegetate disturbed soil with native species suitable to the local habitat as soon after construction as possible.
- Use only weed-free mulches and seed mixes.

The applicant would use wildlife-friendly erosion and sediment control BMPs that contain biodegradable netting with natural fibers and would avoid the use of plastic mesh to minimize impacts on wildlife.

The impacts on fisheries from pipeline construction would be reduced with the implementation of waterbody crossing BMPs. The applicant would avoid or minimize impacts on fisheries by implementing specific BMPs during construction, including but not limited to:

- Selecting a crossing technique that is most appropriate for each waterbody, after consultation with DNR.
- Completing in-stream work activities within the timeframes outlined in Section 4.4 of the Minnesota ECP, including DNR in-water work restrictions to protect critical fish life phases.
- Installing and maintaining redundant sediment control measures immediately after clearing and prior to initial ground disturbance at waterbodies located within 50 feet of the project and where stormwater flows to a waterbody. On portions of the project where work would be occurring during applicable “work in water restrictions” for public waters, all exposed soil areas within 200 feet of the water’s edge, and that drain to that water, would be stabilized within 24 hours during the restriction period. Stabilization of all exposed soils within 200 feet of the public water’s edge, and that drain to that water, would be initiated immediately and completed within 7 calendar days whenever construction activity is complete or has temporarily ceased on any portion of the site outside of the restriction period. Stream banks would be protected from erosion using temporary and long-term soil stabilization techniques. Examples of erosion control techniques include placement of erosion control blankets, mulch, straw bales, bio-logs, silt fence, and prompt seeding following construction activities.
- Establishing perennial vegetative buffers of up to 50 feet adjacent to lakes, rivers, and streams and buffers of 16.5 feet adjacent to ditches. The applicant would minimize the long-term impacts from riparian clearing by limiting post-construction vegetation maintenance to promote

the growth of the riparian filter strip (buffer), and only maintaining a 10-foot-wide corridor centered over the pipeline for ongoing maintenance and visual inspections of the pipeline and to allow corrosion and leak surveys to occur. Vegetation between HDD entry and exit points would not have routine clearing or mowing. Clearing would be limited to hand trimming necessary to set the HDD guidewires or a pump for water withdrawal.

Mitigation Proposed During Scoping

DNR recommended the following mitigation for reducing potential impacts on wildlife and their habitats:

- Limit the length of time the trench is open.
- One additional mitigation for nesting birds in areas of grass/shrub vegetation to be cleared for construction would be to mow/cut these areas during non-nesting season prior to actual construction so suitable nesting habitat is not present prior to final clearing and construction.
- Follow MnDOT’s 2020 *Standard Specifications for Construction* for rolled erosion control materials that specify only natural fibers with no plastic mesh be used.

Mitigation Recommended by EERA Staff

EERA staff recommends that the applicant should use only “bio-netting” or “natural netting” types and mulch products without synthetic (plastic) fiber additives.

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Chapter 6 Potential Impacts and Mitigation for Alternative Technologies

Chapter 6 studies two alternative technologies: a suite of agricultural practices and a suite of energy use and efficiency changes. These alternative technologies would not reduce emissions from fermentation at the ethanol plant because they do not use carbon capture and sequestration. The technologies could, however, reduce the carbon intensity score (CI score) of the ethanol produced at the ethanol plant through lowered GHG emissions in the ethanol life cycle and by increased sequestration of CO_2 in soil. These technologies could enhance the marketability of the ethanol produced at the ethanol plant in LCFS markets if implemented. The technologies discussed in this chapter are complementary, not only to each other, but to carbon capture and storage as well. The lowest CI score comes from doing both.

This chapter is organized as follows:

- Section 6.1 describes what a CI score is and how it is determined.
- Section 6.2 discusses agricultural practices that could avoid emissions to lower the CI score of corn cultivation, such as no-till or reduced tillage, reduced fertilizer application, retaining corn stover/residues, and cover cropping.
- Section 6.3 discusses energy use and efficiency strategies that could be undertaken by the ethanol plant, including upgrading process equipment, implementing combined heat and power systems, and using renewable energy.
- Section 6.4 discusses energy use and efficiency strategies that could be undertaken by feedstock producers, such as biodiesel powered machinery and electrifying the grain drying process.
- Section 6.5 analyzes the impacts of the technology alternatives on human and environmental resources and how those impacts compare to the applicant's proposed project. It also identifies applicable mitigation measures that could reasonably be implemented to avoid or minimize the impacts.
- Section 6.6 discusses conclusions of this analysis.

This chapter analyzes the two alternative technologies ordered by the Commission and was prepared with data collected and analyzed "commensurate with the importance of the impact and the relevance of the information to a reasoned choice among alternatives."[1] The Commission cannot select any of these alternative technologies as an alternative; however, the information provided will inform the Commission's decision to issue a pipeline routing permit.[2]

Costs are not included as part of this analysis. Information related to operation of the ethanol plant and its current energy use was provided by the applicant in response to EERA staff's Supplemental Information Inquiries, which are included in **Appendix I**.

6.1 Carbon Intensity Score

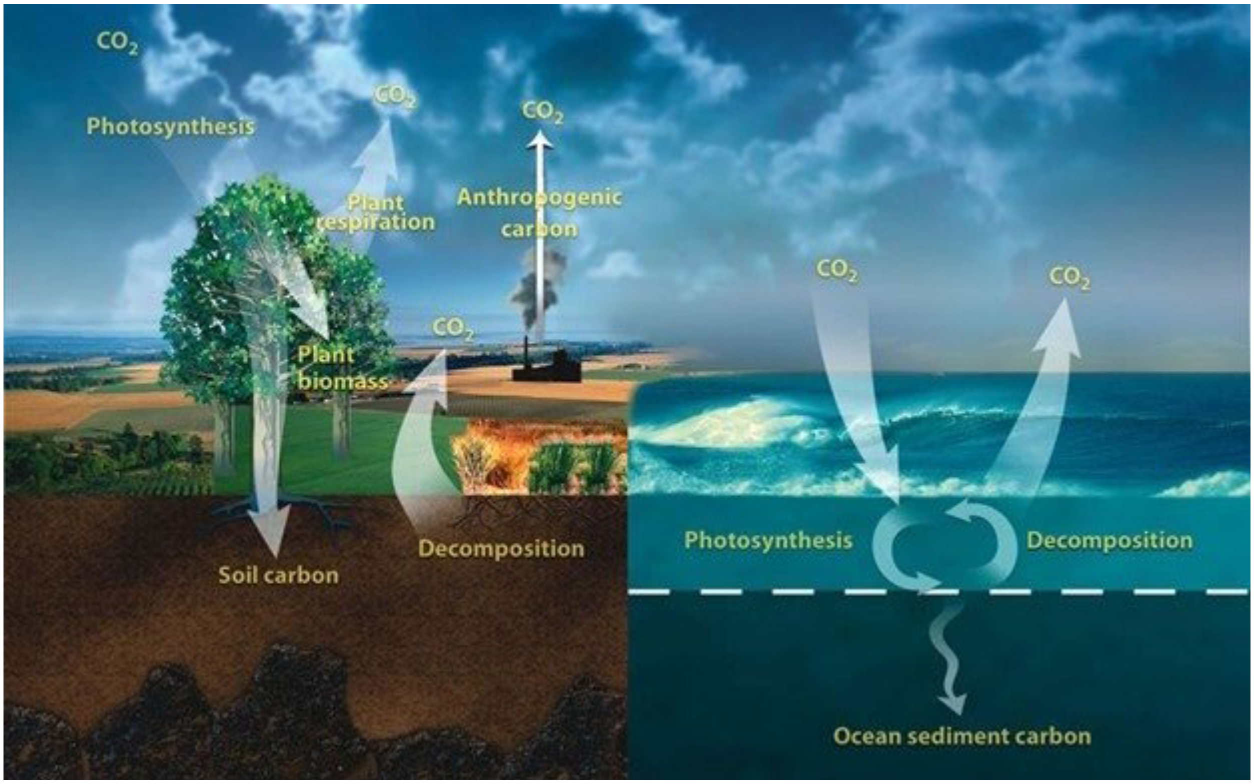
The CI score is a metric used by LCFS markets to determine the credits or deficits a fuel can generate based on its environmental impact through its life cycle.

This section describes the carbon cycle and CI score, how the CI score is derived, and why it is important in the context of the proposed project. This section also provides background information to summarize the current state of the science, estimation, and regulation of GHG emissions from fuel production and the relative ranking of different fuel types in LCFS markets.

6.1.1 The Earth's Carbon Cycle

The Earth's carbon cycle is a natural process that involves the dynamic transport of carbon atoms among the atmosphere, oceans, soils, and living organisms, as illustrated in **Figure 6-1**. This cycle plays a role in maintaining a balance of CO_2 in the atmosphere.

Figure 6-1 Earth's Carbon Cycle[3]



Key components of the carbon cycle include biological respiration, photosynthesis, and decomposition. The largest sinks of CO_2 are soils and oceans. Soils absorb CO_2 from the atmosphere, which is primarily mediated by plants through photosynthesis. During photosynthesis, CO_2 is converted into sugars and other carbon-based compounds that are released through the roots into the soil. These carbon-based compounds are either stored in the soil as organic matter or used as a nutrient source for microorganisms. Not all CO_2 released from microbial respiration and decomposition escapes into the atmosphere; some of it is converted into more stable forms of organic carbon and deposited long term. That process is called soil carbon sequestration.

Combustion of fossil fuels acts as a large source of GHGs such as CO_2 and other GHGs that also have global warming potential—mainly CH_4, N_2O, sulfur hexafluoride (SF6), carbon tetrafluoride (CF_4/PFC-14), and a host of hydrofluorocarbons and chlorofluorocarbons.[4]

Human activities have accelerated an increase in atmospheric CO_2e. As a result of these emissions, increased temperatures and shifting climates have triggered feedback loops releasing even more CO_2e that was previously stored in glaciers, permafrost, forests, and all terrestrial ecosystems including agricultural lands.[5] The United States Department of Energy (DOE) defines CO_2e as representing the total climate impact of all GHGs, not just CO_2. CO_2 is the primary GHG emitted through human activities such as the combustion of fossil fuels, deforestation, and land use change.

6.1.2 Definition of CI Score and How it is Derived

The CI score is a key indicator for energy-related CO_2e emissions projections and tracking. The CI score is defined as the amount of CO_2e emissions per unit of energy produced. It is one of the four components of the Kaya identity—a mathematical framework that estimates the amount of CO_2e emissions from human activities.[6] Depending on the pathway of the fuel production life cycle, the CI score can be extremely low or even negative, implying that the entire fuel production process takes more CO_2e out of the atmosphere than it emits. Conversely, when little or no CO_2e is removed from the atmosphere and fuel production processes rely heavily on the combustion of fossil fuels, the CI score can be extremely high.

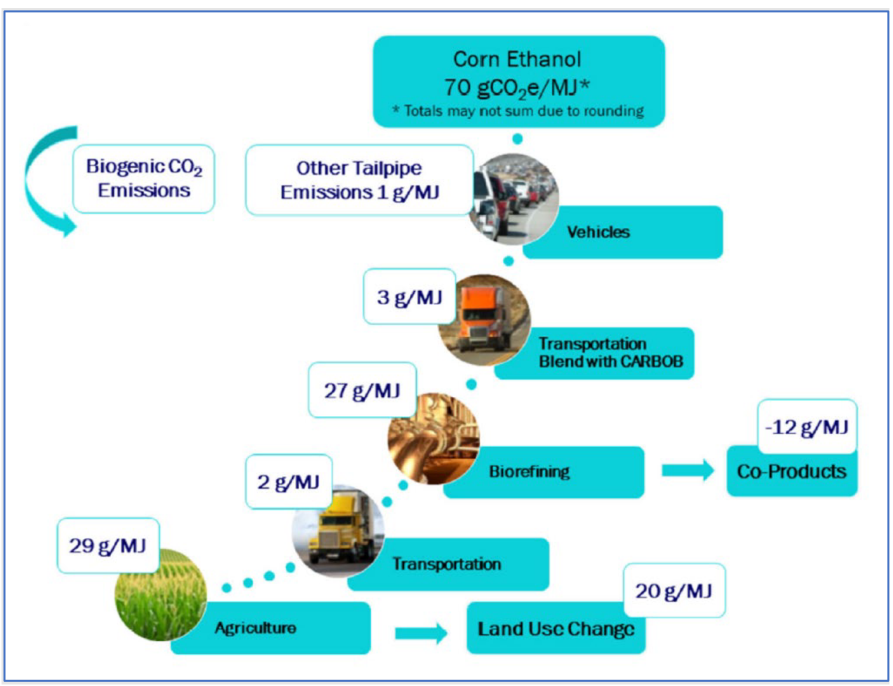
To accurately derive the CI score for a fuel, a rigorous life cycle assessment approach is employed. A life cycle analysis (LCA) for fuel involves using various models to assess the environmental impacts attributable to the fuel at each life cycle stage, from raw material sourcing to end use. The CI score for the fuel is then derived by aggregating the carbon intensity at each stage to represent the net amount of CO_2e emission per unit of energy contained within the finished fuel.

The CI score serves as a quantitative indicator of the net carbon intensity of a fuel and is expressed in grams of CO_2e emitted per unit of energy produced by the fuel in grams of CO_2e per megajoule of energy (gCO_2e/MJ).

$$\text{CI score} = \frac{\text{Total mass of CO}_2\text{ emissions from LCA of fuel}}{\text{Total power generated from biofuel}} = \frac{\text{gCO}_2\text{e}}{\text{MJ}}$$

Based on the models and methods used by the State of California, the general life cycle associated with the average CI score for corn ethanol is shown in **Figure 6-2** and is used as an illustrative example of CI scores associated with each stage.

Figure 6-2 Fuel Life Cycle for Corn Ethanol[7]



Land use change refers to the indirect emissions associated with the conversion of land to meet demand for a product when land previously producing that product switches to corn production for ethanol feedstock. This often occurs in response to market driven pressures and affects all crop-based feedstocks.[8]

Each producer of corn ethanol will have a different CI score yet fall within a range associated with a fuel pathway. A fuel pathway is a detailed description of the life cycle stages of fuel production and use for a specific transportation fuel. The three main components of a fuel pathway include:

- **Feedstock**. A type of renewable biomass that is converted into a renewable fuel.
- **Production process.** The type of technology used to convert biomass into renewable fuel.
- **Fuel type.** Renewable fuels include liquid and gaseous fuels derived from biomass sources.

The range of CI scores associated with a given fuel pathway stems from CI score variability at each stage of the life cycle, whether it's the distance feedstock must travel from farm to biorefining, or the electricity source mix used by the ethanol plant's electric utility provider.

6.1.3 Why CI Score is Important

The CI score is a necessary metric used in the evaluation of the environmental impact of fuel production. Its importance lies in providing a quantifiable measure of GHG emissions associated with the entire life cycle of a fuel, from harvest/extraction to consumption. The CI score guides stakeholders, policymakers, and industries in their efforts to reduce carbon emissions and advance alternative energy sources.

LCFS are regulatory frameworks designed to reduce the carbon intensity of fuels and promote the use of more sustainable fuel alternatives. These standards play a role in addressing climate change by incentivizing the production and consumption of low-carbon and renewable fuels. The CI score is a central component of the LCFS market. It serves as the primary metric to quantify and compare the environmental impact of different fuels.

LCFS regulation requires fuel reporting entities to submit a discrete set of inputs used to calculate the CI score along with summary data and documentation from the applicants' monitoring systems. For example, the California Air Resources Board (CARB) requires determination of a fuel pathway as either Tier 1 (first generation fuels like starch and sugar-based ethanol) or Tier 2 (next generation fuels like ethanol from crop residues, algae biodiesel, hydrogen). Tier 1 and Tier 2 pathway applications require independent verification of data reports by a CARB-accredited verifier. Certification approval processes are managed through an interactive, secure web-based system to track the fuel pathway certification process, fuel transactions and recordkeeping, and credit generation and transfers. Current submission requirements include a CARB-issued CI score summary in Microsoft Excel with operating conditions, supporting documents as required by operating conditions for the selected pathway, and previously certified calculation of the CI score from 24 months of operational data from the preceding 2 calendar years.[9]

Table 6-1 compares the CI scores of some common commodity crop feedstock ethanol to the CI score of gasoline.

Table 6-1 Carbon Intensity Scores of Common Fuels

	CI Score Range (gCO_2e/MJ)	Source	Location
Gasoline	93–101	Scully et al. 2021[10]	United States
Corn Ethanol	52.1–78.3	Scully et al. 2021[11]	United States
Wheat Ethanol	40–110	Yan and Boies 2013[12]	United Kingdom
Sorghum Ethanol	55.83–70.7[a]	Lewandrowski and Pape 2019[13]	United States

[a] Weighted average ranges from *The California Low Carbon Fuel Standard: Incentivizing Greenhouse Gas Mitigation in the Ethanol Industry*, USDA, Office of the Chief Economist, November 2020.

The estimates in **Table 6-1** do not account for land use change. Research funded by the National Wildlife Federation and DOE found that ethanol is likely at least 24 percent more carbon-intensive than gasoline due to emissions from land use change associated with corn cultivation practices. This demonstrates the large range of estimates concerning the CI score of ethanol.

Each LCFS market functions by setting an annual CI score target based on the average life cycle CI score of all transportation fuels for that year. Over time, that target decreases to reach emissions reduction goals by a given target year. All fuel sellers within that market must report how many million gallons are sold. Conventional fuels such as gasoline and diesel, which have the highest CI scores, would be compared to the target CI score to determine how many additional GHGs were emitted past the target. Companies report deficits against the annual CI score target.

To meet the LCFS markets' annual CI score target, companies must make up the difference of their reported deficit by purchasing credits. Companies can earn credits by selling low CI score fuels within the LCFS market that come in under the annual target. Credits are then sold to high CI score fuel producers to reach the annual target for each compliance period. Non-compliance may result in penalties.

Each LCFS market sets its own CI score targets based on transportation emissions reduction goals. The first LCFS was established by the State of California in 2009 and developed and implemented by CARB in 2010. CARB approved amendments to regulations to reach more aggressive targets in recent years. All current fuel pathways certified by CARB are available on the CARB website for reference.[14]

These standards have paved the way for defining LCFS regulations in other jurisdictions across the United States such as Oregon's Clean Fuels Program[15] and Washington's Clean Fuel Standard.[16] Other states including Illinois,[17] New Mexico,[18] New York,[19] Michigan,[20] Minnesota,[21] and Massachusetts[22] have passed or are considering bills to develop similar LCFS programs. A bill recently introduced in the United States House of Representatives would establish the first federal LCFS for aviation fuels.[23]

In 2013, British Columbia became the first Canadian Province to introduce its own LCFS program with a similar structure to California's LCFS.[24] At the national level, Canada began implementing the Clean Fuel Regulations in 2023.[25]

Demand for credits under these regulations create market signals for investment in low CI score fuels. The LCFS markets in the United States have increased investment in producing fuels with lower CI scores because of the increased incentive to produce fuels with CI scores that create credits. These credits can then be sold. As such, biofuel producers seek to lower their CI score to compete in these markets, which creates opportunities for farmers as feedstock providers.

6.1.4 Project CI Score

The ethanol plant produces corn ethanol. In accordance with its 2019 *Air Individual Permit Part 70 Reissuance 11100077-101*, MPCA permits the ethanol plant to produce up to 65 million gallons of undenatured ethanol per year. The ethanol produced at the ethanol plant currently has a CI score of 76.[26] The project proposes to capture and store CO_2 from ethanol fermentation at the ethanol plant, thus reducing the CI score of the ethanol produced.

The project is designed to capture approximately 0.19 MMTPA of the CO_2 generated by the ethanol plant, which is the equivalent of 524 metric tons per day. The project would reduce the ethanol plant's CI score to 36.3. The following equation shows how the project would change the CI score of the ethanol plant by serving as a credit that can be deducted from the overall score:

$$\text{CI score} = \frac{0.19\ \text{MMT CO}_2}{1\ \text{year}} \times \frac{10^{12}\text{g}}{1\ \text{MMT}} \times \frac{1\ \text{year}}{65\ \text{M gal}} \times \frac{1\ \text{gal}}{80.53\ \text{MJ}} = 36.3\ \frac{\text{gCO}_2}{\text{MJ}}$$

The life cycle phases being studied in this chapter focus on opportunities at the agriculture stage, as well as at the production stage, to lower the total CI score of the ethanol produced at the ethanol plant. The score could be reduced at various life cycle stages, including the following:

- Agricultural production
- Transportation of feedstock to plant
- Feedstock processing
- Fermentation and distillation
- Creation of co-products and by-products
- Energy source for plant operations
- Distribution and transportation
- End-use combustion

6.2 Agricultural Practices

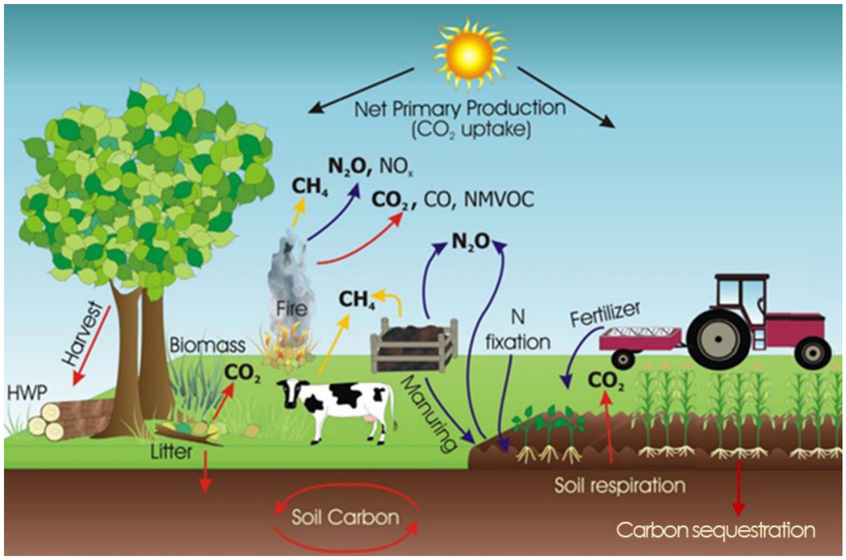
6.2.1 How CI Score Applies to Agricultural Practices

This section describes the role of agriculture as an avenue for mitigating the carbon intensity associated with corn ethanol production at the ethanol plant. This analysis describes alternative agricultural technologies that can reduce the CI score of the ethanol produced to enhance its marketability in LCFS markets. The impacts of alternative agricultural technologies on resources are addressed in Section 6.5.

The emissions stemming from agricultural practices account for nearly 25 percent of the total CI score.[27] The CI score of corn ethanol across the United States has varied over time and within each stage of the LCA. The DOE attributes reduced CI scores to several factors, including improvements in corn yields, implementation of conservation practices, and increased efficiency in ethanol production technologies.[28]

Soils can act as carbon sinks, sequestering CO_2 from the atmosphere, while natural processes such as plant and animal respiration and decomposition act as a source of GHG emissions. Management activities such as energy use and fertilizer and pest management applications are also sources of GHG emissions. These dynamic fluxes of GHGs from farming operations are shown in **Figure 6-3**. Changes in land management practices can sequester CO_2 from the atmosphere.[29]

Figure 6-3 Agricultural GHG Sources and Sinks[30]



HWP = harvested wood products; NMVOC = non-methane volatile organic compounds

The carbon intensity of corn grain cultivation for biofuel can be quantified using industry standard models with input data reflecting the biological, environmental, and market-driven changes in corn production. A transparent and easy-to-use tool for calculating the CI score of biofuel feedstocks, the Feedstock Carbon Intensity Calculator, uses farming inputs and on-farm energy consumption to estimate GHG emissions associated with upstream fuel manufacturing and on-farm use. The Feedstock Carbon Intensity Calculator is integrated into a dynamic version of the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model, which evaluates the LCA of over 100 different fuel pathways.[31]

The GREET default farming input data are provided in the model as references and are derived from publicly available data and reports from USDA, including the National Agricultural Statistics Service, Economic Research Service, and Office of the Chief Economist. USDA and the Economic Research Service periodically compile on-farm energy consumption data at the United States state level from the Agricultural Resource Management Survey for corn, soybean, and rice. These integrated tools were developed by the Argonne National Laboratory (funded by DOE's Office of Energy Efficiency and Renewable Energy) for quantifying the LCA of fuel feedstocks. These tools have determined an average CI score for corn farming to be approximately 29 gCO_2e/MJ.[32]

6.2.2 Agricultural Practices for Ethanol Plant Farmers

The ethanol plant sources its biofuel feedstock from local farmers, grain elevators, and farmer co-ops within trucking distance (that is, within approximately 40 miles from the ethanol plant's location in Fergus Falls), primarily within Otter Tail and Wilkin Counties (see **Appendix I**).

The ethanol plant calculated its CI score using industry-approved standards and tools based on the research methodology adopted by the Argonne National Laboratory research supported by DOE, EPA, and states' regulations. The ethanol plant used the following models to compare to the CI score of corn:

- Argonne National Laboratory GREET model
- CARB GREET model

- Washington State GREET model
- Canada's recently introduced Clean Fuel Regulations

The ethanol plant calculated its CI score for its ethanol on a per bushel basis of its primary feedstock source of USDA #2 Yellow corn grain. The CARB Tier 1 calculator[33] estimates that each bushel of corn grain has a CI score of approximately 6,442.02 gCO_2e/bushel. This is equivalent to a CI score of 21.44 gCO_2e/MJ for agricultural practices associated with corn feedstock production for the ethanol plant (see responses to Supplemental Information Inquiries #4 and #8 in **Appendix I**).

6.2.3 Alternative Agricultural Strategies

Alternative agricultural practices could be implemented in place of conventional agricultural practices to reduce the CI score of the corn cultivation portion of the corn ethanol LCA.

For the purposes of this EIS, conventional farming practices means practices such as tillage, irrigation, synthetic inputs (fertilizer, herbicide, pesticide), and cultivation of a concentrated monocrop. Many of these practices are carbon intensive and contribute to reductions in soil carbon sequestration.

Alternative agricultural practices can lower the CI score of cultivated corn by reducing GHG emissions from various land management practices. Minnesota has set a goal to reduce GHG emissions by 50 percent by 2030 and by 100 percent by 2050 from a 2005 baseline.[34] Agriculture accounts for approximately 25 percent of Minnesota's GHG emissions, so strategies to reduce emissions from this sector are necessary to reach statewide goals.[35] In addition to reducing CO_2e emissions and lowering CI scores of corn cultivation for ethanol, some alternative strategies could help maintain soil health and reduce erosion, which would help farms adapt to warmer and wetter conditions as the climate changes.[36]

Farmers already implement various alternative agricultural practices like planting shelterbelt trees and reducing intensive tillage practices.[37] Minnesota's Buffer Law requires perennial vegetative buffers of up to 50 feet along lakes, rivers, and streams and buffers of 16.5 feet along ditches.[38] These buffers help filter out phosphorus, nitrogen, and sediment. Many of the ethanol plant's farmer feedstock producers also already use alternative agricultural practices such as cover cropping, conservation tillage, no till, and precision fertilizer application; however, no quantitative data has been collected to estimate how extensively these practices are currently used.

Adopting additional alternative agricultural practices to further lower the CI score of corn cultivation is a strategy that can be quantitatively evaluated by estimating alternative future emissions scenarios. When considering alternative agricultural practices to study in this EIS, the following considerations guided our decisions for choosing alternative agricultural practices that are feasible and accessible to the ethanol plant's farmer producers:

- Alternative agricultural practices should be well-suited to the local climate conditions in Otter Tail and Wilkin Counties. That includes considerations for temperature, precipitation, and soil type.
- Alternative agricultural practices that align with the specific agroecological conditions of the region are more likely to be successful and sustainable.
- Alternative agricultural practices chosen for this evaluation must be feasible in terms of cost, equipment requirements, and ease of integration into existing farming systems. Accessibility is crucial for practical implementation by local farmers.

Selected alternative agricultural practices must not result in a decrease in the yield per acre of biofuel feedstock. Ideally, practices should aim to maintain or even increase yield, ensuring economic viability and sustainability of the biofuel production process. The practices chosen for evaluation are backed by industry-proven technologies or established regenerative agricultural knowledge/practices. This criterion ensures that the selected methods have been tested, validated, and demonstrated to be effective in real-world conditions, minimizing the risk associated with adopting new and untested technologies.

The most beneficial alternative agricultural practices, in terms of CI score, for farmers supplying corn grain to the ethanol plant are as follows:

- **No-till/Reduced Tillage.** Reducing soil disturbance helps promote soil carbon sequestration. Tillage can disrupt the soil structure, reduce water infiltration, accelerate decomposition of organic matter, and release GHGs into the atmosphere. Conventional practices that use intensive tillage often require fuel usage to power tractors and other heavy equipment. By reducing or eliminating tillage practices, farmers can save energy, which in turn can reduce the overall carbon intensity of the farming operation.
- **Cover Cropping.** Cover crops can be interseeded with corn during the growing season. They can also be planted in the fall after harvest. These crops can be terminated by winter temperatures or by mechanical or chemical practices in spring. Cover cropping practices have shown up to 3 percent increases in corn yields after 5 consecutive years[39] and can reduce GHG emissions by 0.27 ton/acre.[40] Planting legume species can increase soil nitrogen and reduce the need for added fertilizer in the spring.[41] Cover cropping can contribute to reducing the need for synthetic fertilizer through nitrogen fixation and phosphorus bioavailability.
- **Fertilizer Reduction.** Synthetic nitrogen-based fertilizers are carbon intensive. This is associated with the manufacturing processes and transportation. The machinery and equipment used to apply fertilizers also contribute to the overall carbon intensity associated with corn cultivation. Improving fertilizer use efficiency (for example, application timing, injection into soil) reduces overall fertilizer application. Additionally, precision application that enhances nitrogen uptake by plants reduces nitrogen-based compounds that would otherwise be lost to the environment as emissions or runoff.
- **Retaining Corn Stover/Residues.** Leftover plant materials—like leaves, stems, and stalks—after harvest are agricultural residues and contain organic matter. The organic matter gradually decomposes and contributes to the organic content of the soil, which promotes carbon sequestration. Portions of the residues are sometimes used to graze livestock, sold as fodder, or burned in the field. Retaining crop residues like corn stover would help retain carbon in the soils and reduce emissions associated with grazing, burning, or processing for further transportation to the end user.

By combining these practices, farmers can optimize carbon sequestration in the soil while reducing emissions. Industry-standard GHG tools are used to model future changes in farm management practices to estimate the changes in CO_2e emissions. These tools help stakeholders make informed decisions about agricultural practices by estimating and comparing the carbon footprint associated with different management strategies.

6.2.3.1 Carbon/GHG Modeling

Several accessible tools and models are available for comparing different management strategies to estimate changes in GHG emissions. These tools, such as the following, cater to a diverse audience, including farmers, researchers, and policy makers:

- **COMET-Farm Tool.** This online tool developed by USDA allows users to estimate GHG emissions and carbon sequestration in agricultural systems. It covers a range of management practices, including tillage, cover cropping, and nutrient management.
- **Agriculture and Land Use National Greenhouse Gas Inventory Software.** This software was developed by EPA and Colorado State University and is based on methods in the *[Intergovernmental Panel on Climate Change] IPCC Guidelines for National Greenhouse Gas Inventories*. It is designed to support an evaluation of mitigation potential using the inventory data as a baseline for projecting emission trends associated with management alternatives.[42]
- **DeNitrification-DeComposition (DNDC) Model.** This computer simulation models carbon and nitrogen biogeochemistry in agro-ecosystems. The model can be used for predicting crop growth, soil temperature and moisture regimes, soil carbon dynamics, nitrogen leaching, and emissions of trace gases, including N_2O, nitric oxide (NO), dinitrogen (N_2), ammonia (NH_3), CH_4 and CO_2. It is often used by researchers and requires some technical expertise.
- **Cool Farm Tool.** This is another widely used online platform tool that helps farmers, supply chain managers, and researchers estimate the carbon footprint of agricultural activities. The Cool Farm Alliance owns and manages the tool, requiring membership for use.

For the purposes of this EIS, an accessible and reproducible evaluation of alternative agricultural practices applicable to west central Minnesota was necessary to identify an applicable suite of strategies to avoid emissions from corn cultivation. The COMET-Farm tool noted above was chosen to run a matrix of farming management test cases to estimate the impact of adopting alternative agricultural practices on the CI score.

6.2.3.2 COMET-Farm Analysis Methods

USDA's COMET-Farm tool involves several key components. Users input specific data related to the agricultural operations, including planting and harvesting dates, crop species, livestock, tillage practices, cover cropping, irrigation, nutrient management, and energy use. COMET-Farm is a process-based model that simulates carbon and GHG dynamics in response to user data input. The modeling approach considers how different practices influence carbon sequestration and GHG emissions over time. The tool estimates GHG emissions, including CO_2, CH_4, and N_2O. It considers emissions from various sources, such as soil, livestock, and energy use.

The analysis was conducted using proxy farm locations assumed to be within a 40-mile radius of the ethanol plant in Fergus Falls. The results of this assessment were then proportionally scaled to account for the estimated total acreage of corn contributing to the feedstock of the ethanol plant. The ethanol plant's air permit (2019 Air Permit 11100077-101) was used to estimate the total maximum acreage required to supply an adequate feedstock. The air permit allows the ethanol plant to produce up to 65 million gallons of ethanol annually.

Approximately 2.9 gallons of ethanol are produced from each bushel of corn grain, which means a maximum of 22.4 million bushels of corn could be supplied to the ethanol plant per year. While the USDA's 2023 Minnesota state average for corn production was reported at 180 bushels per acre, the USDA's 2017 Census of Agriculture for Otter Tail and Wilkin Counties indicated a lower average yield of around 150 bushels per acre. Consequently, to meet the maximum allowable ethanol production, an estimated 125,000 to 150,000 acres would be required.

To assist with interpreting results, assumptions of historical, current, and future practices were established based on data derived from academic research findings, USDA reporting records, and suggested default values from industry standard models (specifically the GREET and COMET-Farm models). **Table 6-2** summarizes model assumptions and selected inputs. The next paragraphs describe these assumptions. See **Appendix M** for more details.

Looking ahead to future land management scenarios spanning the next 10 reporting years (2023–2032), potential alternative strategies include the adoption of no-till practices, the introduction of a nitrogen-fixing winter cover crop (such as clover), and a 50 percent reduction in synthetic nitrogen fertilizer application. Other assumptions include removing major sources of GHG emissions due to little evidence supporting their use in Otter Tail County or Wilkin County corn farming. This includes removing irrigation, liming, crop residue burning, and livestock grazing. Variations in crop residue emissions we held constant to simplify the model (assuming 50 percent corn stover removal). Therefore, all test cases were run with no liming application, no burning of crop residues, no livestock grazing, and 50 percent corn stover removal. See model assumptions in **Table 6-2** with correlating sources for each input value in **Appendix M**.

Table 6-2 COMET-Farm Model Assumptions

Section Name	Section Timeline	Description
Historical	Pre-2000	• Pre-1980: Upland, non-irrigated • 1980–2000: Non-irrigated, annual crops in rotation • 1980–2000: Intensive tillage
Baseline	2000–2022	• Continuous annual corn crop (no cover crop) • Intensive tillage • 170 pounds per acre total nitrogen (fertilizer + manure)
Future	2023–2032	• Corn crop with winter cover crop (clover [*Trifolium spp*.]) • No tillage • 50% reduction of fertilizer inputs
All	--	• 50% residue (stover) removal • Non-irrigated • Single harvest in fall (late September) • No burning • No lime application • 150 bushels per acre yield • No livestock grazing

To estimate the impacts of alternative agricultural practice adoptions, four future test cases were modeled. Each test case kept consistent historical and baseline scenario inputs, while future scenario inputs varied by 25 percent incremental increases in acreage that adopted a suite of accessible alternative agricultural practices. The chosen suite of alternative agricultural practice inputs was kept consistent across all four test cases to prevent variations from interfering with interpretation of the results because each practice impacts the CI score differently.

Each test case report provides results from the COMET-Farm model from all three scenarios: historical, baseline, and future. The historical and baseline scenario inputs were kept consistent across all test cases and represent conventional farming practices as described above. Future scenarios assumed implementation of a suite of accessible alternative agricultural practices listed in **Table 6-2**.

The emissions reported from the baseline scenarios assume the previous 10 years of management. The emissions reported from the future scenario are determined from the average annual metric tons of CO_2e per 1,000 acres of total simulated parcels (conventional and alternative) over a 10-year period; conventional parcels assume no management changes are made in the future scenario while the alternative agricultural practice parcels assume the change in input values are made in the future scenario. Test case 1 models only one 1,000-acre proxy parcel while the remaining scenarios have varying acreage between conventional and alternative parcels that sum to 1,000 acres. The COMET-Farm test scenarios are described in **Table 6-3**.

Table 6-3 COMET-Farm Alternative Scenario Test Matrix

Test #	Description	Proxy Farm Acres (Conventional)	Proxy Farm Acres (Alternative)	Historical	Baseline	Future
1	Current practices continue without change	1,000	0	Conventional	Conventional	Conventional
2	25% increase in acreage implementation of alternative practices	750	250	Conventional	Conventional	No till, cover crop, 50% reduced fertilizer
3	50% increase in acreage implementation of alternative practices	500	500	Conventional	Conventional	No till, cover crop, 50% reduced fertilizer
4	75% increase in acreage implementation of alternative practices	250	750	Conventional	Conventional	No till, cover crop, 50% reduced fertilizer

6.2.3.3 COMET-Farm Analysis Results

The COMET-Farm model was run for the four test cases described in **Table 6-4**. Results are presented in **Table 6-5** through **Table 6-8**. The information provided regarding estimated GHG emissions for each test case is intended for informational purposes only. It is important to recognize that various GHG accounting models may produce different outcomes due to differences in methodologies, assumptions, data sources, and other factors. Interpretations should consider the limitations, uncertainties, and potential biases associated with each model's results. The COMET-Farm model results are not linked to the CI score determined by the ethanol plant. The intent of the COMET-Farm modeling exercise is to estimate the potential reduction of CI score when alternative agricultural practices increase across cropland used to source feedstock. This approach allows for a quantifiable estimate of the impacts on GHG mitigation using alternative approaches to agricultural production of feedstock.

Table 6-4 COMET-Farm Model Results Summary of Test Cases (all proxy locations – total of 1,000 acres)

Test #	Description	Baseline Emissions[a] (metric tons CO_2e/year)	Future Emissions (metric tons CO_2e/year)	Change in Emissions (metric tons CO_2e/year)	Scaled Acreage Baseline Emissions (metric tons CO_2e/year)	Scaled Acreage Future Emissions (metric tons CO_2e/year)
1	Current practices continue without change	1677.4	1677.4	0	209,680–251,616	209,680–251,616
2	25% increase in acreage implementation of alternative practices	1876.0	1529.2	**(346.8)** [b]	234,501–281,401	191,154–229,385
3	50% increase in acreage implementation of alternative practices	1835.3	1178.2	**(657.1)**	229,412–275,296	147,274–176,729
4	75% increase in acreage implementation of alternative practices	1794.2	844.2	**(950.0)**	224,276–269,132	105,525–126,630

[a] The same location was chosen for all proxy parcels. Proxy parcel locations were chosen using a "point" method, which estimated soil information based on the point location. The selected soil data will impact all emissions estimations from biogeochemical processes on soil data derived from the USDA Web Soil Survey and the DayCent simulation model. Parameter sensitivity varies by input. Proxy parcel soil data is available in **Appendix M**. Differences in scenario emissions are a result of COMET-Farm modeling estimations based on varying parcel size.

[b] **(#)** = negative value

Table 6-5 COMET-Farm Model Results – Test Case 1: CI Score

Scenario Section	Proxy Total Emissions (metric tons CO_2e/year)	Project Scale Emissions (metric tons CO_2e/year)	CI Score (gCO_2e/MJ)
Baseline (all parcels)	1677.4	209,680–251,616	40.06–48.07
Future (all parcels)	1677.4	209,680–251,616	40.06–48.07
Change [+/-] (all parcels)	0	0	-

Table 6-6 COMET-Farm Model Results – Test Case 2: CI Score

Scenario Section	Proxy Total Emissions (metric tons CO_2e/year)	Project Scale Emissions (metric tons CO_2e/year)	CI Score (gCO_2e/MJ)
Baseline (all parcels)	1876.0	234,501–281,401	44.80–53.76
Conventional	1369.5	171,193–205,431	-
Alternative	506.5	63,308–75,970	-
Future (all parcels)	1529.2	191,154–229,385	36.52–43.82
Conventional	1369.5	171,193–205,431	-
Alternative	159.7	19,961–23,954	-
Change [+/-] (all parcels)	**(346.8)**	**(43,347) – (52,016)**	**(8.28) – (9.94)**
Conventional	0	0	-
Alternative	**(346.8)**	**(43,347) – (52,016)**	-

Table 6-7 COMET-Farm Model Results – Test Case 3: CI Score

Scenario Section	Proxy Total Emissions (metric tons CO_2e/year)	Project Scale Emissions (metric tons CO_2e/year)	CI Score (gCO_2e/MJ)
Baseline (all parcels)	1835.3	101,637.5–121,965	43.83–52.59
Conventional	917.7	114,710–137,652	-
Alternative	917.6	114,703–137,644	-
Future (all parcels)	1178.2	46,875–56,250	28.14–33.76
Conventional	917.7	114,710–137,652	-
Alternative	260.5	32,565–39,077	-
Change [+/-] (all parcels)	**(657.1)**	**(82,138)– (176,729)**	**(15.69) – (18.83)**
Conventional	0	0	-
Alternative	**(657.1)**	**(82,139) – (98,566)**	-

Table 6-8 COMET-Farm Model Results – Test Case 4: CI Score

Scenario Section	Proxy Total Emissions (metric tons CO_2e/year)	Project Scale Emissions (metric tons CO_2e/year)	CI Score (gCO_2e/MJ)
Baseline (all parcels)	1794.2	224,277–269,132	42.85–51.42
Conventional	496.0	61,995–74,394	-
Alternative	1298.3	162,281–194,738	-
Future (all parcels)	844.2	105,525–126,630	20.16–24.19
Conventional	496.0	61,995–74,394	-
Alternative	348.2	43,530–52,235	-
Change [+/-] (all parcels)	**(**950.0**)**	**(**118,752**)** – **(**142,502**)**	**(**22.69**)** – **(**27.22**)**
Conventional	0	0	-
Alternative	**(**950.0**)**	**(**118,752**)** – **(**142,502**)**	-

6.2.3.4 Discussion and Conclusion – Impact on CI Score

The results from the COMET-Farm model show that continuing conventional practices would be the most carbon intensive path, while the change in CO_2e emissions from test cases 2 through 4 show a negative change in CO_2e emissions, which indicates either a reduction in emissions or an increase in the carbon sequestered.

The 21.44 CI score is a measure of how much CO_2e emissions are associated with the current corn cultivation portion of the total CI score for the LCA of corn ethanol. To convert metric tons of CO_2e per year to CI score, each modeled emissions scenario output was quantified in units of metric tons CO_2e per year and multiplied by the maximum allowable gallons of ethanol produced by the plant, the energy content of undenatured ethanol, and a conversion factor for metric tons to grams CO_2e. The conversion equation per 1 metric ton of CO_2e/year to carbon intensity of gCO_2e/MJ is shown in the equation below:

$$\frac{1 \text{ metric ton CO2e}}{1 \text{ year}} \times \frac{1 \text{ year}}{65\text{M gal ethanol}} \times \frac{1 \text{ gal}}{80.53 \text{ MJ}} \times \frac{1\text{M gCO2e}}{1 \text{ metric ton CO2e}}$$

COMET-Farm results show the greatest impact to the CI score in test case 4 where a suite of alternative agricultural practices is adopted over 75 percent of the total acreage used to cultivate corn for feedstock production as shown in **Table 6-8**. Implementing these practices on 75 percent of the total acreage currently used to cultivate corn for feedstock production could lower the CI score for feedstock production into the range of approximately 20 to 24 gCO_2e/MJ, an estimated reduction of approximately 23 to 27 gCO_2e/MJ units from the baseline CI score (approximately 43 to 51 gCO_2e/MJ) associated with conventional farming. Assuming there can be a 75 percent increase in acreage change from conventional practices to implementation of alternative agricultural practices, the current corn cultivation CI score for the ethanol plant could be reduced from 21.44 gCO_2e/MJ to a range of -1.56 to -5.56 gCO_2e/MJ. These results are further discussed within the conclusion in Section 6.6.

The carbon sequestration potential of croplands varies based on soil quality and composition. High-quality soils, characterized by enhanced nutrient and water retention, large populations of beneficial microorganisms, and a deep soil profile, generally exhibit greater carbon sequestration potential than poorer-quality soils lacking these attributes.

Implementing additional alternative agricultural practices such as nutrient reduction practices and avoided conversion of unmanaged lands (peatlands, mineral wetlands, native grasslands) to cropland would further reduce the carbon intensity of corn feedstock production. Transitioning from conventional practices such as intensive tillage and heavy synthetic fertilizer use to alternative agriculture practices involves a multifaceted shift. If farmers opt to implement practices like no-till, adding cover crops, or reducing synthetic nitrogen application by 50 percent, they might encounter several challenges, summarized in the following paragraph.

The initial investment cost of adopting new practices requires farmers to invest in specialized equipment, seeds, and technologies. Gaining the knowledge and skills to implement these practices can be the first hurdle. Initially, a farmer might experience fluctuations in crop yields as the soil ecosystem adjusts to reduced tillage and nitrogen inputs. Farmers might need to develop alternative weed control strategies, such as cover cropping, crop rotation, or mechanical methods, to manage increased weed pressures effectively. The soil health must be managed and monitored to track progress, so farmers will need to assess soil organic matter levels, nutrient availability, microbial activity, and other soil health indicators regularly. Reducing synthetic nitrogen application by 50 percent necessitates careful nutrient management and balancing.

The economic implications of transitioning to alternative agricultural practices include changes in input costs, crop prices, and profitability. Farmers may need to evaluate the economic viability of transitioning their croplands. Engaging with local networks, agricultural extension services, and community organizations can support farmers’ transition to alternative agricultural practices. Addressing these challenges requires a combination of education, technical assistance, financial support, and community engagement to facilitate successful adoption and implementation.

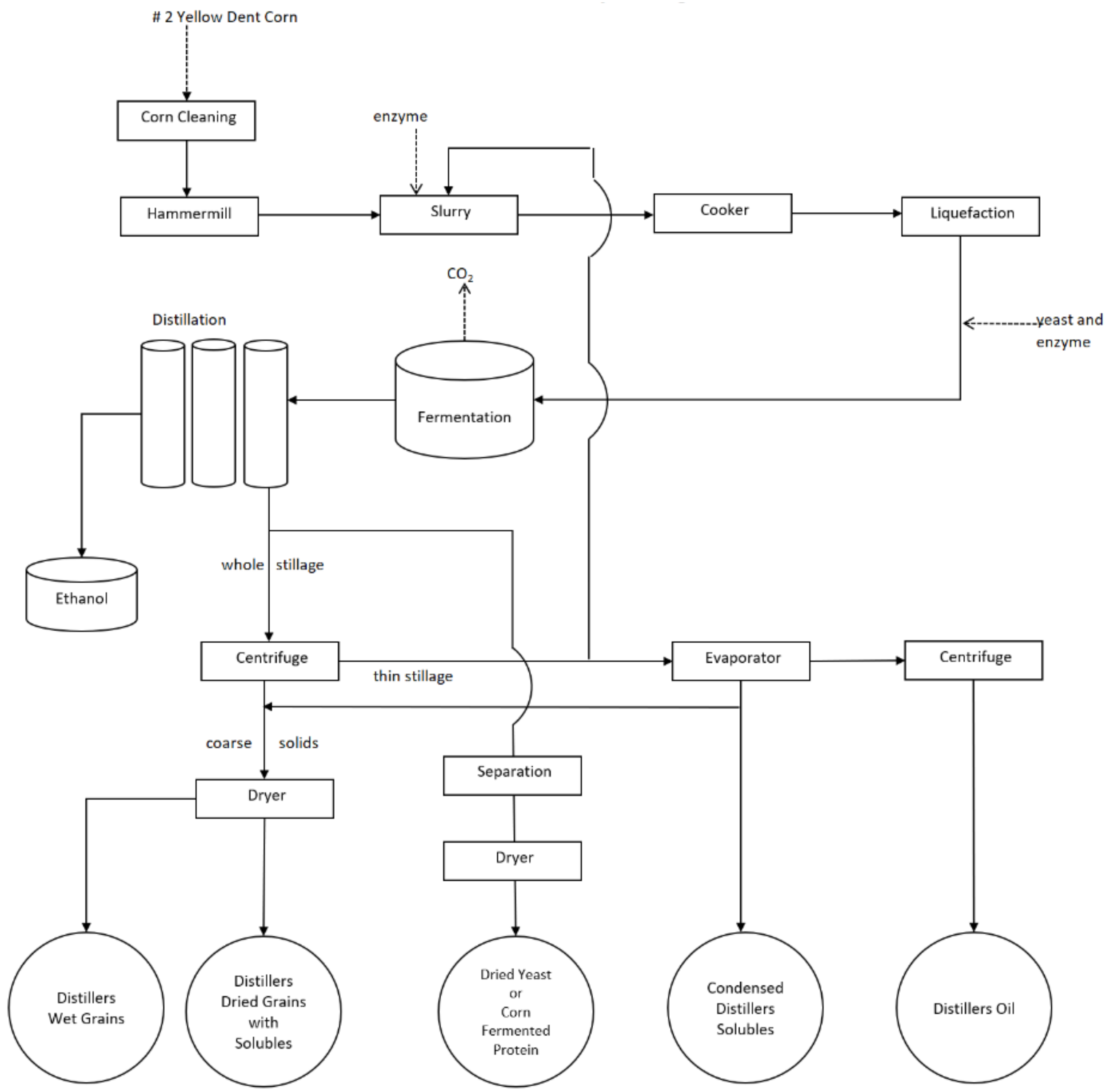
6.3 Energy Use and Efficiency Changes – Ethanol Plant

6.3.1 Summary of United States Ethanol Plant Energy Use and CI Score

The third life cycle stage of ethanol production is biorefining feedstock at an ethanol plant—essentially converting the feedstock (corn, sorghum, stover, etc.) into the final product for use as ethanol biofuel. Two different processes are conventionally used, namely wet milling and dry milling. About 91 percent of ethanol biorefineries are dry milling plants, including the Green Plains Ethanol Plant. Dry milling plants tend to produce a slightly lower yield per bushel of grain but consume up to 75 percent less energy.[43]

A typical dry milling process involves milling, cooking, liquefaction, fermenting, and distilling, as shown in **Figure 6-4** (see **Appendix I**). Energy in the form of electricity and process fuels, typically natural gas, is used throughout the refining process. On average, process fuels account for 90 percent of energy consumption at an ethanol plant, while the remaining 10 percent of energy needs comes from grid connected electricity.[44] Ethanol plants can also produce co-products such as distiller’s grain solubles, corn oil, and CO_2 by using what would otherwise be waste from the feedstock. Co-products require additional energy intensive refining processes such as drying. Therefore, energy consumed at an ethanol plant isn’t entirely attributable to the production of ethanol.

Figure 6-4 Corn Dry Milling Process Overview



CI scores related to energy use at ethanol plants take into consideration energy consumption and the source of energy generation. Factoring in those two parameters, a typical CI score for energy use ranges from 26.5 to 32.7 gCO_2e/MJ.[45]

6.3.2 Ethanol Plant Operational Energy CI Score

The CI score for the ethanol plant accounts for emissions associated with on-site combustion and GHG emissions, as well as emissions associated with the sources of electricity that are consumed on site. For the purposes of this EIS, biogenic emissions associated with the fermentation of corn grain and powering mobile heavy machinery have been excluded because they are considered carbon neutral. These biogenic emissions are considered carbon neutral because GHG emissions released from the biological resource – plants, trees, soil – would be sequestered by subsequent activities like replanting trees or cultivating the next season of corn.[46] In regard to mobile heavy machinery, these data are not available for the ethanol plant. Instead, the focus is on the stationary emissions associated with the ethanol plant's operational energy use.

To most accurately account for the CI score associated with ethanol production, a credit for co-products is introduced. This credit considers what product in the marketplace a given co-product displaces and whether the CI score of the co-product is indeed less than that of the product it displaces. Currently, the ethanol plant produces dry, wet, and hybrid distiller's grains; corn oil; and CO_2. Distillers grain solubles and corn oil are sold to customers, but produced CO_2 is currently not captured, processed, and sold. The information available is insufficient to reasonably assign co-product credits. As such, the alternatives assessment considers all operational energy use at the ethanol plant. **Table 6-9** summarizes the ethanol plant's operational energy CI score. By assigning co-product credits, this baseline operational energy score could be lower.

Table 6-9 Ethanol Plant Operational Energy Carbon Intensity Score

Source	Energy Use[a] (MWh/year)	Emissions Rate (pounds CO_2e/MWh)	GHG Emissions[b] (MTCO_2e/year)	CI Score (gCO_2e/MJ)[c]	Comments
Process Fuel	473,808	398[d]	0.086	19.3	Natural Gas=100%
Electricity	38,064	684.35[e]	0.012	2.7	Electrical Grid=100%
Total	**511,872**	**–**	**0.098**	**22.0**	

MWh = megawatt hour; MT = metric tons.

a Energy usage data provided by the applicant. Data was gathered over a 2-year period and averaged.

b GHG emissions based on a conversion factor of 2.2e+9 lbs/ Million Metric Ton (MMT).
GHG Emissions = (lb CO_2e/ MWh)*(1 MMT/2.2e+9 lb)(*MWh/year)

c. CI Score based on a conversion factor of 80.53 MJ/gallon of undenatured ethanol (source: CARB) and current ethanol production rate of 55 million gallons of ethanol per year.[47]
CI Score = MMCO_2e/year * (1e+12 g/MMT)*1 year/55,000,000 gallons) * (1 gallon/80.53 MJ)

d From United States Energy Information Administration Frequently Asked Questions.[48]

e Emissions rate was provided by the applicant. This is the rate used in its GREET models.

6.3.2.1 Process Fuel

Process fuel use accounts for approximately 88 percent of the ethanol plant's energy consumption, which closely aligns with the national average of 90 percent. The ethanol plant uses process fuel for various purposes. While the percentage of process fuel going to each end use is unknown, it is reasonable to assume the largest use is to create steam via industrial boilers. The steam is then used as heat during the mashing and cooking, distillation, and evaporation steps in the ethanol production process. Often, the distillation process consumes the most process fuel, followed by evaporation, and then cooking. Other minor end uses for process fuel include space heating and hot water for facility occupants. Regarding co-products, process fuel is assumed to be used for drying distiller's grains.

Natural gas is the sole source of process fuel for the ethanol plant and is provided by Great Plains Natural Gas Company. Utility bills from Great Plains Natural Gas Company indicate an average monthly natural gas consumption of 134,620 million British thermal units over the past 24 months. This unit has been converted to megawatt hours (MWh) per year in **Table 6-9** for consistency with electrical use.

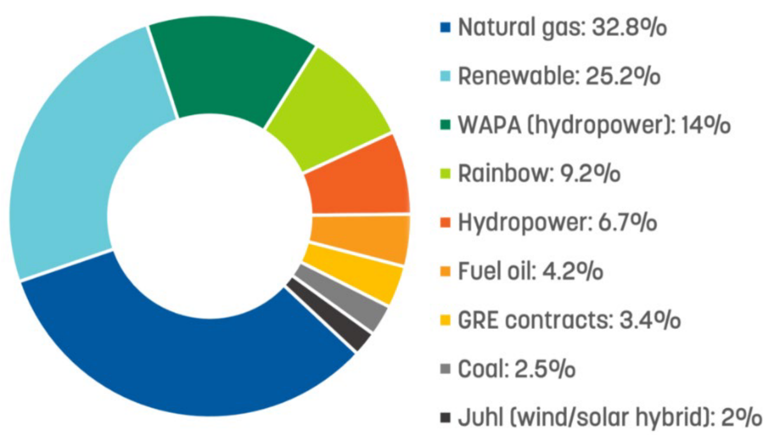
An accurate emissions rate for the natural gas burned at the ethanol plant is unavailable; therefore, the United States Energy Information Administration emissions factor representing the average emission rate for natural gas was used. Natural gas is a fossil fuel, and while “cleaner” than other fossil fuels like coal, it produces significantly more GHG emissions than alternative renewable energy sources. Combining the GHG emissions factor with the substantial volume of natural gas yields a CI score of 19.3 gCO_2e/MJ for the ethanol plant’s natural gas consumption.

6.3.2.2 Electricity

Based on the energy use quantities shown in **Table 6-9**, approximately 12 percent of energy use at the ethanol plant is derived from electricity generation. As with the process fuel, the end use breakdown for electricity at the ethanol plant is unknown and would require subsystem metering. Within the ethanol production process, electricity is used to power various pumps, fans, milling equipment, and agitators. Other minor end uses include lighting; heating, ventilation, and air conditioning; and products powered by standard outlets for building occupants. For co-products, electricity is assumed to be used predominantly to power a centrifuge for separating distiller’s grains. Also included is the electricity consumed for pumping and treating water used throughout the ethanol production process.

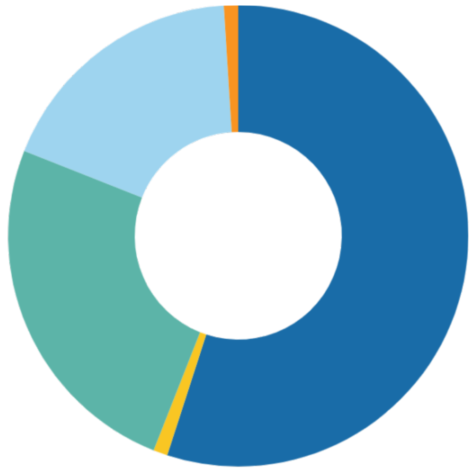
The ethanol plant’s electricity is provided by Lake Region Electric Cooperative. This utility provider has the grid mix shown in **Figure 6-5**.

Figure 6-5 Lake Region Electric Cooperative Grid Mix



Rainbow Energy Center, LLC is the owner of the Coal Creek Power Plant in North Dakota, which transmits electric generation to Minnesota. The Coal Creek Power Plant uses coal and currently does not have carbon capture infrastructure in place. Great River Energy’s (GRE) current grid mix is shown in **Figure 6-6**. As noted in **Figure 6-5**, 3.4 percent of Lake Region Electric Cooperative’s grid mix comes from GRE.

Figure 6-6 Great River Energy Grid Mix



Combining the weighted GHG emissions factors from each source with the electricity demand yields a CI score of 2.2 gCO_2e/MJ for the ethanol plant's electricity consumption.

6.3.2.3 Operations, Maintenance, and Improvements

The ethanol plant is in continuous operation. The flow of material and energy does not stop unless there are outages. Outages occur unintentionally or due to scheduled facility maintenance. Typically, ethanol plants schedule downtime for maintenance once each year. During the downtime, energy consumption is reduced while maintenance is performed on equipment. No information could be obtained regarding frequency and scope of inspections, energy auditing, and systems-scale energy performance assessments for the ethanol plant; however, it is assumed these activities occur.

In terms of energy performance upgrades, the ethanol plant has undergone improvements in the ethanol production process. Vacuum distillation was implemented in 2021. According to the applicant, this resulted in a process fuel reduction of approximately 10 percent. This corresponds to a 10 percent decrease in natural gas consumed and its associated emissions.

6.3.3 Ethanol Plant Energy Use and Efficiency Measures

Energy use and efficiency strategies can be defined and implemented individually. It is often most effective to define a sequence of strategies and implement them in a way that builds on the previous strategy or strategies to optimize energy use and efficiency. That sequence is as follows:

1. Repair equipment and prevent leaks (eliminate energy losses)
2. Adjust equipment parameters and maintenance (optimize equipment energy)
3. Implement energy conservation measures and upgrade equipment (improve energy efficiency)
4. Capture energy from one process for use in another (re-use energy)
5. Use low-carbon energy sources for remaining demand (use clean energy)

Several energy efficiency strategies can be implemented that would significantly reduce the ethanol plant's operational CI score. Using alternative clean energy sources for the remaining energy demand could then reasonably bring the ethanol plant's operational CI score to zero.[49]

6.3.3.2 Energy Efficiency Strategies

Table 6-10 lists strategies for energy reductions based on best available information and industry technologies and practices. Ranges are provided as appropriate to represent a distribution of possible energy reduction by each energy source. **Table 6-11** shows the current and revised CI scores after implementation of these strategies, assuming they are not already implemented.

Table 6-10 Energy Efficiency and Reduction Strategies

Strategy Type	Strategy	Energy Reduction (%)	Energy Source
Eliminate Energy Losses	Insulate steam pipes[50]	5–10	Natural gas
Optimize Equipment	Clean-in-place heat exchangers[51]	0–5	Natural gas
Optimize Equipment	Boiler tune-ups[52]	5–10	Natural gas
Improve Efficiency	Variable frequency drives[53]	30–40	Electricity
Improve Efficiency	All LED lighting	0–5	Electricity
Reuse Energy	Mechanical vapor recompression[54]	40–50	Natural gas
Reuse Energy	Let-down steam turbine[55]	20–30	Electricity

Table 6-11 Revised Carbon Intensity Score after Energy Efficiency Measures

Source	Reduction (%)	Energy Use (MWh/year)	Current CI Score	Revised CI Score[a]	Difference
Natural Gas	62.5[b]	177,678	19.3	7.2	12.1
Grid Electricity	62.5[c]	14,274	2.7	1.0	1.7
	Total	191,952	22.0	8.2	(13.8)

[a] Revised CI Score = Current CI Score x (100 - % central energy reduction)/100%
[b] Reduction ranged from 50 to 75%. Central value equals 62.5%.
[c] Reduction ranged from 50 to 75%. Central value equals 62.5%.

More significant energy reduction strategies are discussed in detail below:

- **Variable frequency drives for motors.** Variable frequency drives are motor controllers that can adjust the frequency and voltage to meet the load required to operate the motor at the minimum necessary speed. This saves energy because the motors no longer run exclusively at full speed and instead dynamically adjust speed as appropriate. Ethanol plants use motors throughout the ethanol production process, so compounding energy savings are possible as more variable frequency drives are installed.
- **Alcohol mechanical vapor recompression.** Heat from distillation and evaporation processes can be captured and the thermal vapors recompressed via mechanical means such as a heat pump. This process enables the energy to be returned as heat to the distillation and evaporation stage. In so doing, less natural gas is needed to produce steam via boilers. Additional electricity is required to operate the mechanical compression equipment.
- **Low-pressure let-down steam turbine.** Boilers produce high pressure steam that must be stepped down to low pressure to be used by the evaporators. The pressure is conventionally lowered via a pressure-reducing valve and desuperheater. However, if routed through a let-

down turbine, the high pressure can be lowered while simultaneously turning a turbine that generates electricity. A minor increase in process fuel energy is required to run the let-down turbine.

6.3.3.3 Alternative Energy Sources

If the ethanol plant implements energy efficiency strategies, the ethanol plant would have new annual energy consumption values for each energy type. The remaining energy demand could then be more reasonably met with alternative energy sources. To further reduce the CI score, the ethanol plant could implement alternative energy sources outlined in **Table 6-12** individually or in complementary ways.

Table 6-12 Potential Alternative Energy Sources

Current Energy Source	Alternative Energy Source	% Substitutable
Natural Gas	Anaerobic digester (animal waste, food waste, stover biomass, stillage)[56]	100
	Synthetic methane[57]	100
	Solar thermal[58]	5–10
	Electricity	Unknown
Grid Electricity	On-site combined heat and power[59]	100
	On-site solar photovoltaics[60]	100
	On-site wind turbine	50–100
	Renewable power purchase agreement	100
Natural Gas and Electricity	Geothermal[61]	100

Electricity generated from alternative energy sources is assumed to go into the utility grid while the ethanol plant continues to pull electricity from the grid. Electricity produced by the ethanol plant is subtracted from the electricity consumed by the ethanol. Therefore, even though some energy sources are intermittent, they overproduce electricity at other times, allowing the plant to fully offset its annual electricity consumption via alternative sources.[62]

Choosing the most appropriate alternative energy sources and associated energy generation depends on several factors, including financial, technical, logistical, and regulatory conditions. A more detailed analysis would be required to verify the feasibility and energy generating capacity of alternative energy sources. This cursory assessment concludes that a combination of energy efficiency strategies coupled with viable alternative energy sources can theoretically achieve the results shown in **Table 6-13**. Each alternative energy source is discussed in further detail in the following sections.

Table 6-13 Revised Carbon Intensity Score after Alternative Energy Source Implementation

Source	Replaced (%)	Current CI Score	CI Score: Energy Efficiency + Alt	Difference
Natural Gas	100	19.3	0	(19.3)
Grid Electricity	100	2.7	0	(2.7)
	Total	22.0	0	(22.0)

Natural Gas Alternatives

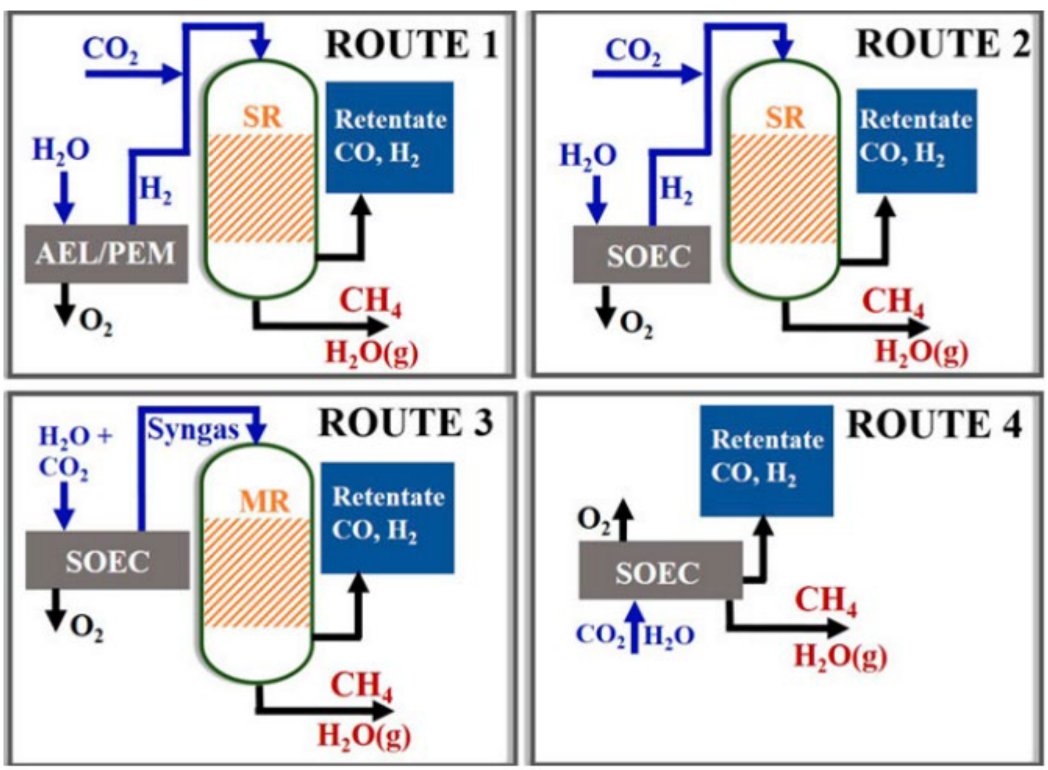
Anaerobic Digester

Anaerobic digestion is the use of microbial communities to facilitate breakdown of organic matter. The digestion process yields biogas, which can be captured and used as a process fuel in the same applications as natural gas. Several feedstocks can be used, including food waste; animal manure; wastewater sludge; biomass like wood, stover, or stillage; and comingled like stillage with manure. Anaerobic digestion reactors can be up to 100 feet in diameter, but there is ample space on site for necessary infrastructure at the ethanol plant.

Synthetic Methane

Synthetic methane is a manufactured form of methane that can be used in the same applications as natural gas. There are several ways to produce synthetic methane, as shown in **Figure 6-7**. Two pathways are more appropriate as it relates to an ethanol plant, namely Routes 3 and 4. Solid oxide electrolysis (that is, the use of electricity to produce a chemical reaction) of steam and CO_2 can be used to create synthetic gas (syngas) that is then transformed into synthetic methane through thermochemical means (that is, a chemical reaction combined with high heat).

Figure 6-7 Synthetic Methane Production Methods[63]



Note: AEL/PEM = Alkaline Electrolysis/Proton Exchange Membrane; SOEC = Solid Oxide Electrolyzer Cell

Alternatively, technologies are being piloted for in-situ methane synthesis through the electrolysis of steam and CO_2. In both pathways, process steam and CO_2 from ethanol fermentation can be captured and used. The synthetic methane can fully replace natural gas as process fuel. Because the CO_2 used in producing the synthetic methane comes from biofuel and would otherwise have been emitted, it is considered a carbon neutral resource.[64] Additional electricity is required to operate the equipment. This electrical demand can come from renewable electricity discussed below. Additionally, waste heat created from the synthetic methane production process can be captured and used to reduce electric energy input to perform the electrolysis.

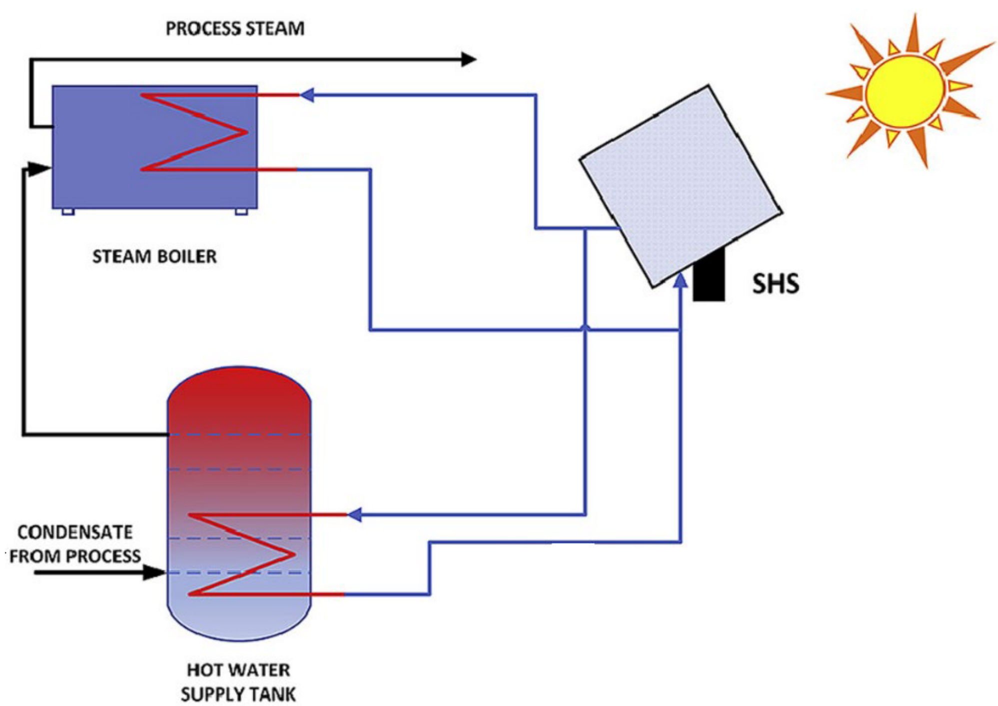
Lastly, the National Aeronautics and Space Administration (NASA) has developed a method of using solar photovoltaics, water, CO_2, and metal compounds to produce methane. This technology is still in development for commercializing.[65]

Solar Thermal

Non-concentrating solar collectors can be used to heat a fluid for use in the ethanol production process. One of the more efficient applications of this technology is to use solar thermal energy to pre-heat boiler make-up water (see **Figure 6-8**). This requires lower thermal energy from the collectors, allowing for heat loss in the system, and is particularly effective for the northern climate where the ethanol plant is located.

Solar thermal systems will not perform during the night or on especially cold and overcast days. Therefore, it is assumed energy would be produced one-third of the year, or approximately 2,900 hours/year. A 6-MWh system with 70 percent efficiency would therefore produce approximately 12,200 MWh/year, thereby displacing between 5 and 10 percent of the natural gas demand after implementing energy efficiency strategies. Assuming 65 watts/square foot, a system would need to be approximately 64,600 square feet. Based on review of satellite imagery, there appears to be sufficient area at the ethanol plant to mount a solar thermal system close to this size. Systems should be installed on rooftops first, and then the remaining capacity can be ground mounted. This conserves as much useable area as possible for other alternative energy sources.

Figure 6-8 Solar Thermal Heating Diagram[66]



Note: SHS = Solar Heating System

Electrification

There are likely to be several process-fuel end uses that could reasonably be converted to electricity, such as space heating for occupants and domestic hot water. Retrofitting systems to use electricity provides efficiency gains as well as the opportunity to use other energy source alternatives.

Grid Electricity Alternatives

On-site Combined Heat and Power

Combined heat and power is a way of converting process fuel into electricity, thus avoiding the need to draw electricity from the electric grid. Because the electricity is generated closer to the end use, there are efficiency gains. Additionally, the fuel used can be from a renewable resource as opposed to relying on the grid mix of the utility provider. One application is to burn biomass to create steam that turns a steam turbine (see **Figure 6-9**). The waste steam can be used for heating, while the turbine generates electricity. The second most common application is to use gas turbines (see **Figure 6-10**). Synthetic gas must then be combusted within a combustor, turning a gas turbine that generates electricity. Exhausted gas from the turbine passes through a heat recovery steam generator, enabling it to be used for heat loads as normal.

Figure 6-9 Combined Heat and Power with Steam Turbine[67]

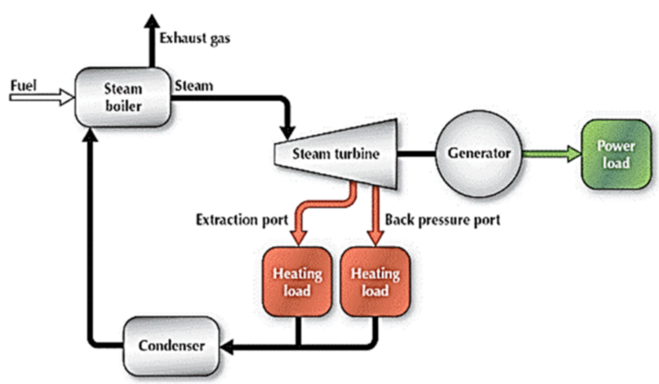
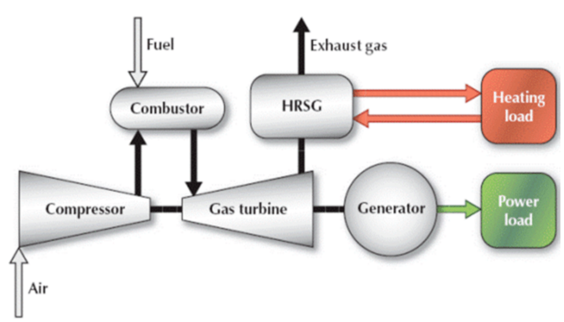


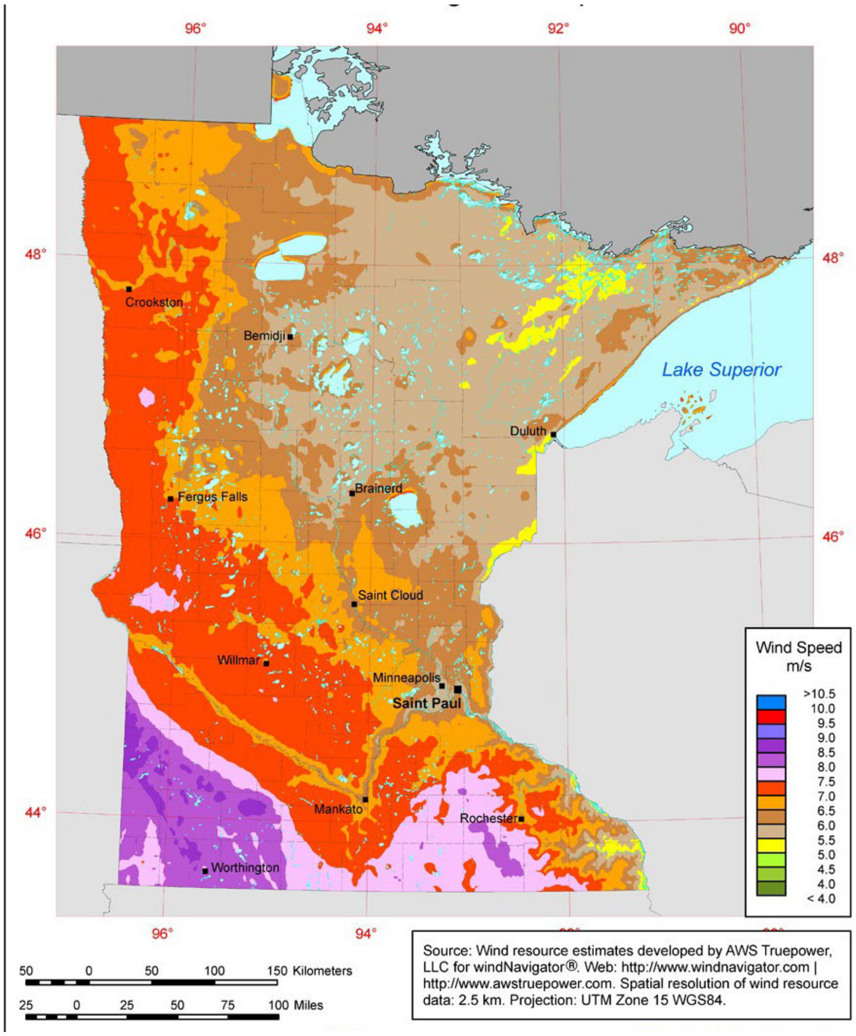
Figure 6-10 Combined Heat and Power with Gas Turbine[68]



Wind Turbine

Wind turbines have long blades extending outward from a central drive shaft. Kinetic energy from the wind contacts the blades and propels them in a circular motion, subsequently rotating the drive shaft. The drive shaft then turns an electric generator to produce electricity. The average annual wind speed dictates the effectiveness of a wind turbine. According to the National Renewable Energy Laboratory, in Otter Tail County, the annual average wind speed at 80 meters is 7 to 7.5 meters per second, as shown in **Figure 6-11**. While the wind speed and available acreage should be sufficient, this technology is likely not viable because the ethanol plant is prohibitively close to the Fergus Falls Municipal Airport-Einar Mickelson Field.

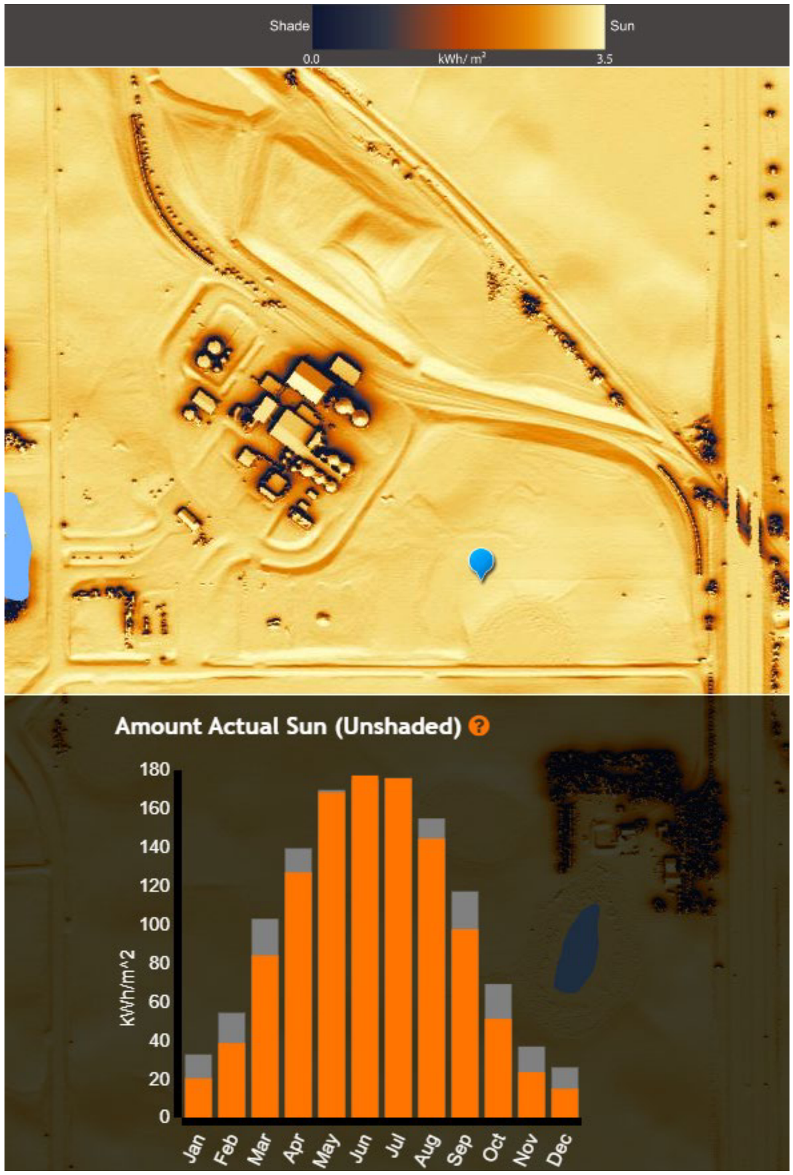
Figure 6-11 Annual Average Wind Speed at 80 meters for Minnesota



Solar Photovoltaics

Solar photovoltaic panels absorb the sun's energy to generate electrical charges. These charges follow an internal electrical field creating a flow of electricity. Assuming an energy reduction of 62.5 percent from employing the energy efficiency strategies described above, the ethanol plant would use approximately 14,300 MWh/year. PVWatts Calculator was used to determine that an 11-megawatt solar photovoltaic system would be required to produce this electricity annually. See **Appendix M** for more details. A system with this capacity would occupy between 15 and 25 acres. Based on review of satellite imagery, there appears to be sufficient area at the ethanol plant to install a photovoltaic array of this size with limited or no shading (see **Figure 6-12**).

Figure 6-12 Solar Radiation Exposure[69]



Renewable Power Purchase Agreements

A power purchase agreement is a type of contract made between a buyer and a utility provider wherein the provider agrees to build, maintain, and operate a renewable energy system and deliver the electricity to the buyer either directly on-site or via the electric grid. Conditions of the contract include an agreed upon fixed price per unit of energy generated, duration of supply, and whether the buyer has rights to the renewable energy credits associated with the electricity generated. Renewable energy credits are documents issued for every 1 megawatt of electricity generated via renewable sources. The owner of a renewable energy credit can claim the environmental and social benefits thereof, or sell it on the market for another entity to claim the benefits. In order for this source to be applicable, the ethanol plant would need to have possession of each renewable energy credit associated with the power purchase agreement.

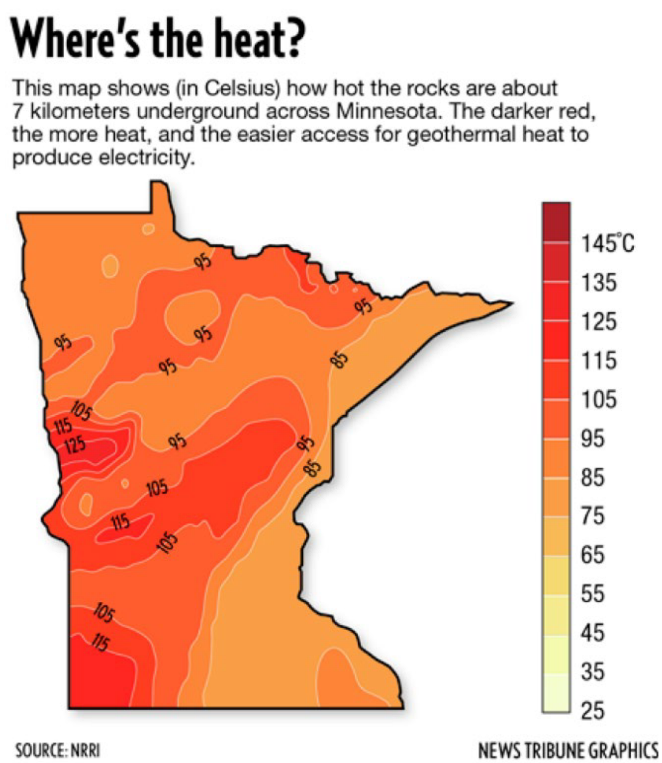
Natural Gas and Grid Electricity Alternative

Geothermal energy is the only viable alternative energy source that could replace both process fuel and electricity consumption at the ethanol plant. Geothermal energy involves capturing thermal resources from deep below the Earth's surface. This is conventionally achieved in three ways:

- directly recovering steam from underground reservoirs to turn a generator
- directly recovering hot water from underground reservoirs and converting to steam via flash steaming or binary cycling
- injecting water down to hot dry rock and recovering the created steam

The method used depends on several factors. Hot dry rock resources are present under Otter Tail County, making the third option—referred to as an enhanced geothermal system—technically viable. According to the Natural Resources Research Institute, temperatures of the rock 7 kilometers underground reach approximately 125 degrees Celsius, as shown in **Figure 6-13**. This may be sufficient to recover steam for direct substitution of process fuel as well as to generate electricity via a steam turbine.

Figure 6-13 Distribution of Hot Rock Resources beneath Minnesota



Geothermal power production has the smallest land surface footprint of any power plant, requiring only 404 square feet per 1,000 MWh.[70] A reasonable size for generating 5 MWh from hot dry rock geothermal energy would be between 200 and 400 square feet. Geothermal energy reserves are constant, reliable, renewable, and abundant; however, with current technologies and subsidies, initial capital costs tend to exceed that of the other options.

6.3.3.4 Operational Energy CI Score Scenarios

To accurately understand the CI score of the ethanol plant, it is necessary to evaluate emissions reduction over a defined period. The reason for this is twofold. First, utility grids are expected to decarbonize over time, meaning the CI score for the facility would decrease without making changes. Second, implementation of energy efficiency and alternative energy strategies would be expected to occur incrementally over time.

The assessment period starts in 2026 because that is when the CO_2 pipeline is anticipated to be operational. Because the CO_2 pipeline has a service life of 25 years, the assessment period ends in 2050. CI scores will be compared among the following three scenarios: (1) baseline; (2) energy efficiency; and (3) energy efficiency + alternative energy.

Baseline Scenario

Description: The ethanol plant will maintain the same energy usage and providers for electricity and natural gas across the assessment period.

Assumptions:

- There will be no additional energy demand over the 25-year assessment period.
- No co-product credits will be applied, thus deducting from the CI score.
- The electric utility provider will be decarbonized by 2040.
- The electricity emissions rate will decrease linearly from 684 in 2023 to 0 in 2040.
- The natural gas utility provider will be decarbonized by 2050.[71]
- The natural gas emissions factor will decrease linearly from 398 in 2023 to 0 in 2050.

Energy Efficiency Scenario

Description: The ethanol plant will gradually implement energy efficiency measures over the assessment period. Grid-connected utilities will continue to decarbonize.

Assumptions:

- All baseline scenario assumptions apply.
- Electricity consumption will be 62.5 percent more efficient by 2050 than present consumption. Energy efficiency strategies could reduce electricity consumption between 50 and 75 percent, where 62.5 percent is the median value.
- Efficiency of electrical end uses will increase by 2.5 percent annually. This will result in a 62.5 percent energy reduction in 25 years.
- Natural gas consumption will be 62.5 percent more efficient by 2050 than present consumption. Energy efficiency strategies are likely to reduce electricity consumption between 50 and 75 percent, where 62.5 percent is the median value.
- Efficiency of natural gas end uses will increase by 2.5 percent annually. This will result in a 62.5 percent energy reduction in 25 years.

Energy Efficiency plus Alternative Energy Scenario

Description: The ethanol plant will gradually implement energy efficiency measures as well as replace utility-provided energy sources with on-site renewable energy alternatives over the assessment period. Grid-connected utilities will continue to decarbonize.

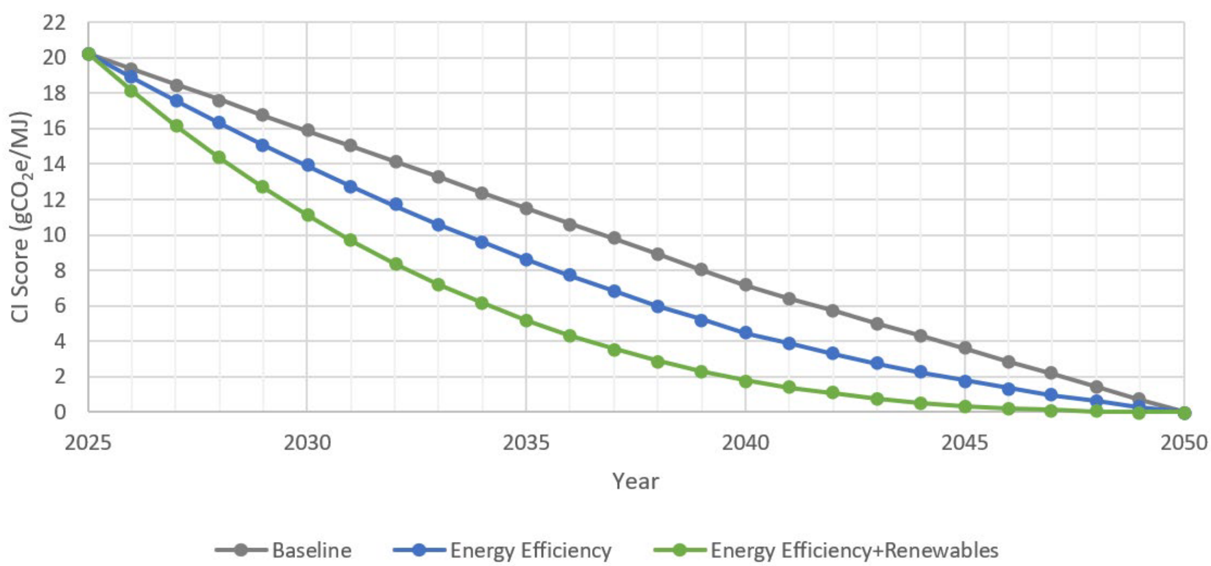
Assumptions:

- All energy efficiency scenario assumptions apply.
- By 2050, all electric and process fuel demand will be met from on-site clean energy sources.
- Each year, an additional 4 percent of energy demand will be met from on-site clean energy sources. The cumulative result will be 100 percent over 25 years.

Scenario Comparison

As shown in **Figure 6-14**, in all three scenarios, the ethanol plant could have an operational energy CI score of zero by the end of the assessment period. See **Appendix M** for detailed inputs and calculations.

Figure 6-14 Operational Energy Carbon Intensity Score Over Time



With a sequence of energy efficiency measures coupled with alternative energy sources, it appears feasible to eliminate GHG emissions associated with the energy use of the ethanol plant, bringing the CI score down from approximately 22 to 0. This conclusion has been corroborated by several studies.[72, 73, 74] Realistically, the necessary technology, infrastructure, operations and maintenance adjustments, sourcing of alternative resources, and financial investment would require time to mobilize and implement, both for the ethanol plant and for the utility providers. Once a project is implemented, there would be an associated drop in the CI score of the ethanol plant, followed by a flat line while resources were being organized for the next project. Thus, in practice, the graph would look more like a staircase rather than smooth lines.

Due to the significant capital investment associated with implementing energy efficiency measures and alternative energy sources, it is unlikely such strategies would be reversed within the assessment period.

6.4 Energy Use and Efficiency – Corn Feedstock Producers

Energy is used to accomplish various tasks during the cultivation and harvesting of corn grain. Energy use information by producers is not available, thus an analysis cannot be performed to approximate CI score reductions. However, generalizations can be made to inform opportunities for the ethanol plant to reduce the CI score of its product.

Most energy during feedstock production is consumed by heavy farming equipment. Mobile heavy machines (tractors, harvesters, etc.) are used to plant seeds, manage pests, harvest corn and corn residue, and till the soil. This heavy machinery predominantly runs on petroleum diesel fuel. Minnesota passed a law in 2018 requiring diesel fuel sold from April through September to contain at least 20 percent biodiesel. Between the months of October and April, diesel fuel sold must contain at least 10 percent biodiesel.

According to Argonne National Laboratory, the life cycle GHG emissions for biodiesel are 74 percent less than petroleum diesel.[75] As such, the CI score of ethanol produced could be lowered by corn producers using even higher percentages of biodiesel fuel during the cultivation and harvesting of corn for feedstock. Drying corn grain prior to transporting it also requires energy. While corn could dry naturally, often farmers will use industrial driers to bring the moisture of corn grain down to a level acceptable to the ethanol plant. These driers are typically fueled by propane or natural gas. Strategies for reducing the GHG emissions associated with the drying process include:

- allowing the grain to dry naturally;
- electrifying the drying process that then uses renewable electricity sources such as solar photovoltaic, wind, or hydropower; and
- using an alternative process fuel such as biogas from anaerobic digesters or steam from a solar heating system.

By reducing the time of mechanical drying and switching fuel sources, the CI score of ethanol produced at the ethanol plant could be reduced.

6.5 Impacts and Mitigation

What are the potential impacts on resources for each suite of technology alternatives?

This section identifies which of the resources addressed in Chapter 5 could be impacted by adoption of one or more of the alternative technologies described above. It describes the potential impacts in a qualitative manner and identifies applicable mitigation measures that could reasonably be implemented to avoid or minimize the impacts. Consistent with Chapter 5, the discussion is organized under four resource categories: human settlement, economies, archaeological and historic resources, and natural environment. Existing conditions are described generally in Chapter 5.

This analysis assumes that the alternative agricultural practices described in Section 6.2 would be implemented within the current cultivated land footprint; that is, no additional clearing of land would occur. As indicated in Section 6.3, the energy and efficiency changes could be implemented within the existing property lines of the ethanol plant, and thus, this analysis also assumes that no expansion of the ethanol plant site would be required.

6.5.1 Human Settlement

Implementation of the alternative technologies would be expected to have negligible impacts on cultural resources, populated areas, property values, public health and safety, public services and infrastructure, recreation, and Tribal treaty rights. Potential impacts on aesthetics, EJ, land use, noise, and socioeconomics are described below.

6.5.1.1 Aesthetics

The alternative agricultural practices (no-till or reduced tillage, cover cropping, fertilizer reduction, and retaining corn stover and residues) and energy efficiency strategies inside the ethanol plant would not be expected to impact aesthetics.

Potential impacts associated with alternative energy sources described in Section 6.3.3.3 would occur within the ethanol plant property boundary. These facilities would be expected to blend aesthetically with the industrial character of the existing facility.

6.5.1.2 Environmental Justice

The ethanol plant and some farms are within the census tract marked as an EJ area of concern by the MPCA screening tool. Alternative agricultural practices (no-till or reduced tillage, cover cropping, fertilizer reduction, and retaining corn stover and residues) would not have adverse impacts on EJ communities.

Implementation of energy alternatives at the ethanol plant would have similar impacts on EJ areas of concern as construction of the capture facility. The impacts could include increased traffic during construction, noise, and air impacts from construction and operation. As described in Section 5.4.3, these impacts would be unlikely to result in disproportionate adverse impacts for EJ areas of concern.

6.5.1.3 Land Use

The alternative agricultural practices (no-till or reduced tillage, cover cropping, fertilizer reduction, and retaining corn stover and residues) would not change the current land use of agricultural land. Additionally, the energy efficiency strategies inside the ethanol plant property boundary would not impact land use.

Enough space exists within the current property boundary of the ethanol plant that alternative energy sources could be added without the need for acquiring new land. However, if the ethanol plant were to expand in the future, the presence of alternative energy sources could preclude this expansion and require the ethanol plant to acquire additional land. An expansion beyond the current boundary could result in changes to land use.

6.5.1.4 Noise

The alternative agricultural practices and energy efficiency strategies would not be expected to have a noticeable effect on noise compared to existing conditions. No-till practices would reduce noise related impacts given less use of agricultural equipment. Impacts could be beneficial. Conversely, cover cropping would increase noise-related impacts from use of agricultural equipment.

Equipment installed for alternative energy technologies would be required to meet state noise standards at the nearest receptor. Implementation of these technologies would not likely result in a perceptible increase in the sound levels experienced at NSRs near the ethanol plant and generally would be indistinguishable from the noise already produced at the plant.

6.5.1.5 Socioeconomics

Alternative agricultural practices (no-till or reduced tillage, cover cropping, fertilizer reduction, and retaining corn stover and residues) and energy efficiencies would have negligible impacts on socioeconomic factors such as population, income, employment, or tax revenues.

Implementation of alternative energy sources at the ethanol plant would have similar impacts on socioeconomics as construction of the capture facility (see Section 5.4.11), although the magnitude would depend on the type of alternative energy source. Short-term beneficial impacts could include creation of local jobs as well as revenues from materials purchased locally and taxes.

6.5.2 Economies

Implementation of the alternative technologies would have no or negligible impacts on commercial economies, forestry, industrial economies, mining, or tourism. Potential impacts on agriculture are described below.

The alternative agricultural practices evaluated (no-till or reduced tillage, cover cropping, fertilizer reduction, and retaining corn stover and residues) would require some changes to existing agricultural practices. Some of these practices, such as reduced tillage, are likely already being used. These strategies can have beneficial effects on agriculture.

The costs to implement these practices would depend on several variables, including increases or decreases in the use of equipment and machinery; need for fuel, supplies, and transportation; and corn yield. For example, no-till or reduced tillage would eliminate or reduce the costs associated with tilling but might require more use of herbicides and result in lower corn production.[76] Similarly, reduced fertilizer use would reduce the costs of fertilizer and its application but could result in lower corn production if not implemented with one or more other alternative practices. Cover crops would require time and equipment to plant and purchase of seed, but as indicated in Section 6.2.2, cover cropping has been shown to increase corn yields. Retained corn stover and residue could not be used for grazing or sold to another user, but transportation costs would be avoided, and corn yields would likely increase.

Alternative energy use and efficiency technologies would have no or negligible impacts on agriculture.

6.5.3 Archaeological and Historic Resources

Because the alternative agricultural practices described in Section 6.2 would be implemented within the current cultivated land footprint and no expansion of the ethanol plant would be required for energy use and efficiency changes, the alternative technologies would be expected to have no or negligible impacts on archaeological and historic resources.

6.5.4 Natural Environment

Implementation of the alternative technologies would have no or negligible impacts on geology and topography, public and designated lands, rare and unique resources, vegetation, and wetlands. Potential impacts on air quality, climate change, soils, water resources, and wildlife are addressed below.

6.5.4.1 Air Quality

As described in Section 6.2, the alternative agricultural practices would reduce GHG emissions compared to existing practices by promoting soil carbon sequestration. The no-till or reduced till and fertilizer reduction alternatives would reduce emissions from fossil fuel combustion in farm equipment. Fertilizer reduction would also reduce GHG emissions from fertilizer production and transportation. Conversely, cover cropping would entail additional emissions from fossil fuel combustion in farm equipment. Corn stover and residue retainage would reduce emissions associated with grazing, burning, or processing for further transportation to the end user.

All energy efficiency measures described in Section 6.3 would reduce GHG and other air pollutant emissions compared to the current operations. Emissions associated with burning natural gas at the ethanol plant would be reduced by decreasing the volume of fuel burned per year. Emissions associated with fossil fuel electricity generation would be reduced by decreasing the electricity demand at the ethanol plant.

Alternative energy sources described in Section 6.3 would decrease GHG emissions for both process fuel and electricity. Anaerobic digestors would increase ammonia emissions and possibly nitrogen oxides. Synthetic methane and solar thermal systems would not be expected to have any additional air quality impacts. Combined heat and power and solar photovoltaics would reduce additional air pollutants emitted by displacing electricity from higher air pollutant emitting sources. These additional air pollutants largely come from burning coal, which emits sulfur dioxide, nitrogen oxides, mercury and other heavy metals, and particulate matter. Geothermal power would reduce all air emissions associated with both process fuel on-site and electricity generation off-site. They still may release traces of sulfur dioxide and carbon dioxide, but between 97 and 100 percent less than that of fossil fuels.

Overall, energy reduction and alternative energy sources would improve air quality at the site and surrounding area.

6.5.4.2 Climate Change

The alternative agricultural practices (no-till or reduced tillage, cover cropping, fertilizer reduction, and retaining corn stover and residues) would reduce GHG emissions. The MPCA estimates that while emission reductions per acre for such practices are small, the benefits would be significant if applied to the entire state of Minnesota. For example, 25 acres of cover crop remove as much atmospheric carbon as taking one car off the road.[77] Implementation of the agricultural practices described in Section 6.2.3 would contribute to efforts to reduce the effects of climate change. In addition, some strategies could help maintain soil health and reduce erosion, which MPCA states would help farmers adapt to warmer and wetter climate conditions.[78]

The strategies described in Section 6.3.3.2 to eliminate energy losses, optimize equipment, improve efficiency, and reuse energy could reduce GHG emissions by reducing the amount of energy used at the ethanol plant.

6.5.4.3 Soils

Some of the agricultural practice alternatives could help maintain soil health and reduce erosion.[79] This would be a beneficial impact on soils. For example, some types of cover crops are rich in nitrogen and can limit or wholly eliminate the need for nitrogen-based mineral fertilizer applications to cropland.[80] Additionally, cover crops can improve soil structure, reduce water and wind erosion of soils, decrease soil compaction, suppress weeds, and increase biodiversity. Corn stover and residue retention builds soil carbon stocks and increases soil N_2O production. Other beneficial impacts of crop residue retention include lower soil temperatures, greater soil water-holding capacity, improved soil nutrient status, and reduced wind and water erosion.[81] Alternative energy use and efficiency technologies would have no or negligible impacts on soils.

6.5.4.4 Water Resources

No-till or reduced tillage, cover cropping, and retaining corn stover and residues would help reduce soil erosion. Soil erosion and sediment transport can negatively impact surface water quality by increasing turbidity. Fertilizer reduction would help reduce the potential for impacts on groundwater and surface water resulting from infiltration and runoff of excess nutrients. Similarly, cover crops scavenge excess nitrate from cropland soils, thereby reducing the potential for nitrate leaching into groundwater and entering surface waters.[82] The agricultural practice alternatives would be unlikely to result in adverse impacts on water resources.

Energy efficiency strategies would have no or negligible impacts on water resources. Currently the ethanol plant consumes 131 million gallons of water per year in its ethanol production process. As described in Section 6.3.2.1, the water is heated with natural gas to create steam via industrial boilers. Some of the steam is re-condensed, heated, and sent back through in a closed loop. Geothermal and solar thermal are alternative energies that could be used in place of the natural gas for heating the water. Depending on how these systems are set up (for example, how much of the water evaporates and how much can be recirculated), the amount of water use could increase or decrease. The other alternative energy sources would have negligible impacts on water resources.

6.5.4.5 Wildlife

Cover cropping could provide additional temporary habitat for some wildlife species. In general, the alternative agricultural practices and energy efficiency strategies would have negligible impacts on wildlife and their habitats.

One of the alternative energy sources, solar thermal, has potential for impacts on wildlife such as habitat alteration and bird strikes. Installation of a solar array would take about 1.5 acres within the ethanol plant site boundaries. This area might include some low-quality habitat that could be affected by the installation.

6.6 Conclusions

The purpose of the project as defined in the final scoping decision is to capture and transport CO_2 from the ethanol plant via pipeline to permanent underground sequestration facilities in North Dakota and to reduce the CI score of ethanol produced at the ethanol plant and enhance its marketability in LCFS markets. As discussed in Section 6.1.2, there are several phases within the life cycle of ethanol production that offer opportunities to reduce the total CI score of ethanol produced. This analysis focused on the two phases contributing the most to the current CI score: (1) agricultural practices for corn feedstock cultivation and (2) energy use and efficiency strategies during the biorefining phase.

The CI score of corn feedstock cultivation could be reduced by reducing GHG emissions from various land management practices. Based on the analysis in Section 6.2, the corn feedstock cultivation CI score could be reduced by 23 to 27 gCO_2e/MJ by implementing the four discussed alternative agricultural practices (no-till or reduced tillage, cover cropping, fertilizer reduction, and retaining 50 percent corn stover and residues) across 75 percent of the total acreage of corn feedstock cultivation. If alternative practices should stop and GHG emissions increase, the CI score would also increase. For example, if no-till practices were to revert back to intensive tillage practices, then the associated release of GHG would occur. Each management practice has its own associated impact on GHG emissions.

Reducing the carbon emissions associated with operational energy use at the ethanol plant can be accomplished by reducing energy usage, using an alternative energy source, or a combination of both strategies. Reducing the energy use of the ethanol plant could result in reducing the CI score between 11 and 16 gCO_2e/MJ. Using renewable energy sources could potentially replace all of the ethanol plant's natural gas and grid-connected electricity demand after initially reducing energy consumption. This would reduce the CI score by approximately 22 gCO_2e/MJ. The energy efficiency and energy use strategies would require time to implement due to the impact on plant production, financial investment, and logistical challenges, among other constraints.

Combining alternative technologies as a CI score reduction strategy would result in an even greater reduction. Implementing both agricultural and operational energy strategies together could reduce the total CI score by approximately 45 to 49 gCO_2e/MJ. Currently the ethanol plant produces ethanol with a total CI score of 76 gCO_2e/MJ. The discussed alternatives, when combined, could theoretically reduce the CI score to 27 to 31 gCO_2e/MJ.

The project is estimated to accomplish a 30 gCO_2e/MJ reduction. In combination, the alternative technologies, renewable energy use, and the project (carbon capture and storage) could reduce the CI score to -3 to 1 gCO_2/MJ.

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Chapter 7 No Action Alternative

This chapter describes the conditions that would be expected if a pipeline routing permit were not issued and the project were not constructed.

If the project is not constructed, the impacts described in Chapter 5 would not occur—there would be no human or environmental impacts because of the project. There would be no potential risk from a pipeline rupture. Likewise, increased tax revenues would not be realized, and the ethanol plant would continue to emit CO_2 into the atmosphere as permitted.

Consistent with the scoping decision, this EIS does not predict future ethanol production. Ethanol production might increase, decrease, or remain the same without the project. It might fluctuate up and down. Such changes are expected to happen gradually. Future production will likely be influenced by a variety of factors, such as world events, oil prices, agricultural commodity prices, government policies, and weather. LCFS are also expected to play a role in future ethanol production. In the near term, however, this EIS assumes that ethanol use is not expected to decrease without a corresponding shift in world events or government policies concerning biofuels.

7.1 Project is Not Constructed

This section discusses what might occur if the project is not constructed under three scenarios: ethanol production at the ethanol plant decreases, remains the same, or increases with corn as a feedstock. Impacts of ethanol production are generally discussed in Section 7.2. As discussed in this EIS, the ethanol plant uses corn as feedstock to produce ethanol.

The analysis here assumes that farmers are influenced more by the price of corn than where it is sold. Corn prices are influenced by a variety of factors including supply and demand. Demand is global. Without an increase in global supply coupled with a decrease in global demand, corn prices are expected to stay relatively the same with or without sales at the ethanol plant. Other global factors include weather, such as extreme drought or prolonged rains during critical times in important corn-producing regions; world events; and government regulations and policies, such as tariffs.

Prices could also fluctuate based on location. “This is because in local markets, the futures price for a commodity is going to be adjusted [from the price indicated by the Chicago Board of Trade] for variables such as freight, handling, storage and quality, as well as supply and demand factors impacting that particular area. This price difference is known as the basis, which is calculated as the cash price minus the futures price.”[1]

For the purposes of this EIS, EERA staff assumes that potential impacts from ethanol production would rise and fall with the amount of ethanol produced. For example, the amount of corn used by the plant is directly related to the amount of ethanol produced. The amount of fertilizer, pesticides, and emissions would be directly related to the amount of corn produced and purchased by the ethanol plant. Any increase or decrease in ethanol production would result in a largely proportional increase or decrease in potential impacts. While this might not hold true for all impacts (for example, transportation) a proportional relationship is a reasonable assumption.

7.1.1 Production Decreases

Ethanol production might decrease. For example, should the ethanol plant not pursue alternative ways to lower its CI score, it might not be able to sell its product in LCFS markets, thereby decreasing its share in those markets. Likewise, the ethanol plant might not pursue other emerging markets such as sustainable aviation fuel.

Decreased ethanol production means lower energy and water usage and decreased GHG emissions from ethanol production and shipment. Shipping impacts would decrease. Production of corn would not be expected to decrease because farmers would sell their grain for use in other markets. Should corn prices fall, agricultural production would be expected to shift to soybeans or another crop—farm production would still occur on cultivated lands. It would be expected that farm practices would not change significantly, and fossil fuel, fertilizer, and pesticide use would continue with a trend toward less intensive agricultural practices, such as no-till, cover cropping, and precision fertilizer application, that would reduce impacts. Should corn prices fall significantly along with the price of other commodity crops commonly grown in the project area, it is possible, though unlikely, that some marginal crop land could be taken out of production and converted to other uses.

From a social and economic standpoint, a decrease in ethanol production would result in decreased corn sales to the ethanol plant. The ethanol plant purchases about 22.4 million bushels of corn grain per year. Given that Otter Tail and Wilkin Counties produce approximately 47 million bushels of corn for grain each year, the ethanol plant constitutes a significant regional demand.[2] It is expected that this corn would be sold for use in other markets. This could result in increased shipping costs for farmers depending on the location of these markets, which would decrease profits because shipping costs are not included in the value of a bushel of corn. Different crops could be grown, such as soybeans, if the farmer predicts the crop would perform better financially. Agricultural production is expected to remain steady. Prices are not expected to change significantly with or without sales to the ethanol plant but would likely be more directly influenced by world events.

The ethanol plant would remain in operation and compete in the fuel ethanol market if the project is not constructed. Other markets exist beyond LCFS fuel markets. The ethanol plant would be expected to compete in standard fuel markets.

7.1.2 Production Remains the Same

Ethanol production might remain stable as the ethanol plant continues to compete in standard fuel markets and sells by-products.

The status quo means steady energy and water usage and steady GHG emissions from ethanol production and shipment. Shipping impacts would not be expected to change. Production of corn sold at the ethanol plant would be expected to be steady. It would be expected that farm practices would not change significantly, and fossil fuel, fertilizer, and pesticide use would continue with a trend toward less intensive agricultural practices, such as no-till, cover cropping, and precision fertilizer application, that would reduce impacts. Yields might increase over time, meaning less land would be required to grow the corn needed by the ethanol plant; however, it is expected that this would not result in fewer cultivated acres.

From a social and economic perspective, corn sales would remain stable at the ethanol plant. Prices are not expected to change significantly with or without sales to the ethanol plant and to be more directly influenced by world events. Local jobs and tax revenues would continue at current levels.

7.1.3 Production Increases

Ethanol production might increase. The ethanol plant could pursue other means to compete in LCFS markets in the form of the agricultural and energy efficiency practices discussed in Chapter 6, pursuit of alternative carbon sequestration projects, or other actions that would decrease the CI score of the ethanol produced at the ethanol plant. Assuming the ethanol plant can lower its CI score and compete in LCFS markets, ethanol production could increase. Likewise, the ethanol plant could enter into other markets, increasing demand. Ultimately, maximum ethanol production is based on the air permit from MPCA, but the ethanol plant could request an increase.

Increased ethanol production means increased energy and water usage and, without carbon capture and storage, increased GHG emissions from ethanol production. Impacts from shipping would increase. Some emissions could be avoided by implementing carbon intensity reducing practices, and the source of electricity provided by Lake Region Electric Cooperative is expected to shift toward including more renewable energy. Production of corn would not be expected to increase if the ethanol plant were to increase production; rather, a shift in corn sales to the ethanol plant from other markets would likely occur. Should the ethanol plant pay a premium for corn, farmers might choose to grow and sell corn over other grains or expand the amount of cropland in production. As discussed above, farm practices would trend toward less carbon intensive agricultural practices, such as no-till, cover cropping, and precision fertilizer application that would reduce impacts.

From a social and economic standpoint, increasing ethanol production would result in increased corn sales to the ethanol plant. Prices are not expected to change significantly with or without sales to the ethanol plant. Local jobs and tax revenues would continue and might increase.

7.2 Ethanol Production Impacts

Section 7.1 discusses a no action alternative specific to the project. Section 7.2 discusses impacts from ethanol production at a broad scale based on varying levels of ethanol production. As discussed above, impacts from ethanol production are expected to be proportional to the amount of ethanol produced. An increase or decrease in ethanol production would result in a relatively proportional increase or decrease in potential impacts.

The scoping decision indicated that this EIS would “review existing studies of the human and environmental impacts of ethanol production and provide a synthesized analysis of potential impacts to human and environmental resources.” Ethanol production, transport, and use cause unique human and environmental impacts. The following sections summarize the regulatory framework of ethanol production, as well as review and discuss production (agriculture in-field and ethanol plant production facility), transportation, and end use impacts on human and environmental resources.

7.2.1 Regulatory Framework

Agricultural operations involving crop production are regulated under various federal, state, and local regulations.[3] Regulations apply to use of chemicals (pesticides and herbicides concerning use, application, worker protection, runoff, etc.), land application of biosolids (manure), impacts on land, conversion of land to agriculture (for example, wetlands, waterways), dredge and fill, drain tiles and ditches, irrigation and water use, air emissions (stationary engines, reciprocating internal combustion engines, etc.), dust and particulate matter, oil storage, storage tanks (underground and aboveground), used oil, oil spills, hazardous substances, building construction, toxic and flammable substances, and waste storage and disposal (manure, crop residues, solid or dissolved materials in irrigation return flows, etc.). Depending on the specific agricultural operation, feedstock, and location, some or all of these regulations may apply.

Ethanol production facilities are regulated under various federal, state, and local regulations.[4] Regulations apply to facility construction, air emissions (ethanol production, boilers/heating, stationary engines, reciprocating internal combustion engines, etc.), materials storage and handling (feedstock, ethanol produced, denaturant, etc.), loadout (rail, tanker truck, etc.), use of chemicals (concerning storage, use, handing, and worker protection of fertilizers, herbicides, pesticides, and equipment fuel), impacts on land, conversion of land at the production facility (for example, wetlands, waterways), dredge and fill, water use and supply, dust and particulate matter, storage tanks (underground and aboveground), spills and spill management, hazardous substances, toxic and flammable substances, and waste storage and disposal. Depending on the specific ethanol facility, operation, and location, some or all of these regulations may apply.

Federal regulations associated with ethanol facilities from the Oil Pollution Act of 1990 and Section 311 of the Clean Water Act require preparation of a Facility Response Plan for oil facilities (including ethanol facilities) with a storage capacity of greater than 1 million gallons and a Spill Prevention, Control, and Countermeasure (SPCC) Plan for facilities storing 1,320 gallons aboveground from EPA. EPA also requires a Risk Management Plan, and the Occupational Safety and Health Administration requires a Process Safety Management Plan for facilities handling hazardous chemicals above a certain threshold.

Other relevant plans for ethanol facilities include an Emergency Action Plan, a Stormwater Pollution Prevention Plan, and Oil Spill Prevention and Response Plans during transportation.[5] Required permits may include a NPDES permit (both construction and operation) and an EPA Title V Air Permit and/or equivalent state-issued air permit. The Renewable Fuels Association released technical guidance for plant and employee safety regulatory requirements specific to ethanol production facilities. This guidance details the process and safety procedures required by the Occupational Safety and Health Administration when handling hazardous chemicals such as denatured fuel ethanol, anhydrous ammonia, hydrochloric acid, denaturant, and chlorine dioxide.[6]

7.2.2 Production Impacts – Agriculture Operations

Biofuels are typically liquid fuels created by blending components produced from biomass materials, also known as feedstocks. The increase in production and consumption of biofuels has placed an increased demand on agricultural activities to produce such feedstocks. Ethanol is a biofuel that can be produced from a variety of feedstocks including corn, sorghum, barley, and sugar beets.[7] The following sections summarize human and environmental impacts typically associated with in-field agricultural operations in providing feedstock to ethanol production facilities in Minnesota.

7.2.2.1 Human Impacts

Agriculture operations have the potential to impact the following resources: health and safety, and socioeconomics. Potential impacts on these resources are discussed below.

Health and Safety

Agricultural operations can expose farmworkers to numerous health and safety hazards. In order to supply feedstock to ethanol plants, farmworkers must till and prepare the soil, sow seed, manage pests, fertilize, water, harvest the feedstock, process the feedstock, and typically deliver the feedstock. Each step in the cultivation process poses unique risks, but several risks are present throughout. Heavy machinery is used by farmworkers at each step, and this presents hazards such as falling, entanglement, fire, explosion, musculoskeletal injuries from vibrations and non-ergonomic positioning, noise, and air pollution from diesel exhaust.[8]

Pest management can expose farmworkers to toxic chemical compounds through inhalation, ingestion, or absorption through the skin.[9] Weather-related hazards such as lightning strikes, extreme heat, ice, and extreme cold are also experienced by farmworkers managing ethanol plant feedstock.

Available incident statistics broadly cover all agricultural operations. Therefore, they are not specific to ethanol feedstock production; however, some statistics are worth mentioning. According to the United States Bureau of Labor Statistics, workers categorized in the crop production industry had one of the highest fatality rates between 2015 and 2019 at 17.4 deaths per 100,000 full-time workers.[10] The rate for all industries was 3.8 deaths per 100,000 full-time workers. Non-fatal incidents resulted in 1.4 days away from work for every 100 crop production workers. The rate for all industries was 0.9. However, this industry is known to underreport injuries.[11]

Socioeconomics

Agricultural operations are anticipated to have a beneficial impact on the socioeconomics of the regional economy. Agricultural operations rely on growers' extensive social networks that extend from the local farm level to the national level across both private and public sectors.[12] Agricultural operations that support ethanol feedstock production have socioeconomic impacts on the farmers depending on the state of the market. The conversion of feedstock into ethanol is one market for farmers to sell their crops. Farmers have the potential to benefit economically from increased demand for biofuel feedstocks, which can lead to higher production and prices and ultimately can increase net farm income. As biofuel producers absorb a larger share of crop production, higher prices will affect domestic use and exports, inducing more intense demand competition between buyers of feed grains for livestock and grain for human consumption.

Higher commodity prices can reduce government payments to farmers. Corn prices would be affected by changes in demand for ethanol feedstocks. These impacts are expected to provide $21.2 billion in gross domestic product for the United States economy with $8.8 billion in gross domestic product and $6.1 billion in income for agriculture producers.[13]

"Section 45Z of the Inflation Reduction Act (IRA) provides a tax credit for the domestic product of clean transportation fuels including ethanol, biodiesel, and sustainable aviation fuels. Also known as the Clean Fuel Production Credit, the tax credit applies to fuels produced after December 31, 2024, and sold before Dec. 31, 2027."[14] A combination of operational changes by ethanol producers and increased use of low CI score corn feedstock can reduce the carbon intensity of ethanol leading to a per gallon tax credit. Because low CI score corn plays a substantial role in this reduction, ethanol producers are expected to pay a premium for qualifying feedstock, with $0.10 per gallon (3.3 cents per bushel) of the Inflation Reduction Act tax credit going to farmers supplying low CI score corn.[15]

7.2.2.2 Environmental Impacts

Agriculture operations have the potential to impact the following resources: soil and ecosystems, water availability, water resources (surface and groundwater), and air quality and GHGs. Potential impacts on these resources are discussed below.

Soil and Ecosystems

As indicated above, the increase in production and consumption of biofuels has placed an increased demand on agricultural activities to produce such feedstocks. This increase in agricultural activities can result in environmental impacts such as soil erosion and herbicide/pesticide runoff. Erosion diminishes soil quality and reduces the productivity of natural and agricultural ecosystems. Conventionally managed continuous corn cropping requires high pesticide and nutrient applications that can lead to extensive water impairments due to runoff. However, precision farming practices and conservation measures are becoming more commonplace. Such practices improve the efficiency of fertilizer, irrigation, and chemical usage in feedstock production as well as reduce constituent volumes running off into waterbodies.

Increases in corn production can create pressures to expand into areas previously conserved through USDA's Conservation Reserve Program (CRP), which was established for the purpose of reducing erosion, improving water quality, and reducing habitat loss. About 30 million acres throughout the United States are included in the CRP, which represents approximately one-third of the amount of land used for corn production.[16] Landowners who enroll in the federally funded CRP must commit to contracts of 14 to 15 years. When a CRP contract expires, the enrollee can re-enroll if there is room in the CRP, return the land to crop production or livestock grazing, leave the land unused, or develop the land for non-farm use. It has been estimated that if CRP contracts were to expire and there were no further enrollments, roughly 51 percent of the land currently under contract would return to crop production within 1 year.[17]

Conversion of grasslands to annual cropland typically negatively affects soil quality, with increases in erosion, and the loss of soil nutrients and soil organic matter, including soil carbon. Impacts of this conversion can be partially mitigated through the adoption of management practices such as conservation tillage. Overall, these land use trends suggest that negative impacts on soil quality from biofuel feedstocks have increased since 2011, but this has not been quantified, and the magnitude of effects depends predominantly on the relative areas of grasslands converted versus existing croplands attributable to biofuels.[18]

Land use changes for biofuel production have negative impacts on ecosystem health and biodiversity. For example, the loss of wetlands to row crops and related production practices is associated with reduced species habitat and associated food sources, including aquatic plants and invertebrates. Similarly, the degradation and loss of grasslands can negatively impact grassland bird populations. The type and severity of the environmental impact depends on the crop type, geographic location, and management practices. Pollinators are also affected by land use changes due to the use of insecticides on corn, such as neonicotinoids. Neonicotinoids travel through the soil food web and affect beneficial arthropods, which can disrupt biological control of crop pests. Increased applications of the pesticides imidacloprid and atrazine, resulting from corn and soybean expansion/intensification, have also been shown to have aquatic ecological effects.[19]

More recent scientific analysis links corn for ethanol to declining bee populations, with adverse implications for many other high-value agricultural crops (almonds, apples) that rely on these insects for pollination.[20] Declines in bee populations are greatest in primarily agricultural areas in the Midwest corn belt and California's Central Valley.

Water Availability

Corn irrigation makes up a relatively large portion of agricultural water usage. In an assessment of several fossil-derived and biomass-derived energy systems, it was determined that the water footprint of biomass-derived energy is 70 to 400 times larger than the water footprint of fossil energy systems on a life cycle basis.[21] The embodied water in ethanol can vary drastically from a low of 5 gallons of water to 1 gallon of ethanol in Ohio to 2,138 gallons of water to 1 gallon of ethanol in California. This depends on the large range of irrigation required to grow the feedstock. Most of this water is consumed during the agricultural phase (99 percent) and not at the ethanol production plant (less than 1 percent). Ethanol plants rely on a constant supply of water to operate, including process water and cooling water.

Sources of water are mostly from groundwater but also can come from third-party providers such as municipal water, including recycled municipal water.[22] Generally, corn ethanol plants use approximately 2.5 to 3 gallons of water per gallon of ethanol produced.[23]

Water Resources

EPA has found that corn production intensification was associated with higher levels of erosion, chemical loading to surface water, and eutrophication (excess nutrients).[24] Additionally, because ethanol is water soluble, while traditional hydrocarbon fuels (crude oil) are not, ethanol releases into the environment have the potential to result in greater impacts.

Because corn has the highest fertilizer use per acre of any biofuel feedstock, increased corn production can result in water quality concerns associated with nutrient pollution from spills or surface runoff of nitrogen and phosphorus fertilizers that infiltrate groundwater, surface water, wetlands, and floodplains. Both nitrogen and phosphorus are known to have negative effects on aquatic biodiversity. Conservation and crop management practices can help reduce these impacts.[25]

Increased nutrient loading to surface water can lead to eutrophication, which is the presence of excessive nutrients. Eutrophication promotes rapid algal growth. Once the algae stop growing, they die and decay. The decay process consumes dissolved oxygen in the waterbody, which can lead to hypoxia or an oxygen deficiency. Hypoxia usually occurs in estuaries and coastal waters.

Watersheds in heavily farmed areas have been found to have high levels of nitrogen, phosphorus, and suspended solids, which damage aquatic life and reduce recreational opportunities. In a 2009 report, the State-EPA Nutrient Innovations Task Group pointed out that nutrient-related pollution significantly affects drinking water supplies, aquatic life, and recreational water quality. Nitrogen contamination in drinking water could lead to cancer and reproductive effects, but the primary concern is methemoglobinemia (a blood disorder in which an abnormal amount of methemoglobin is produced) in infants.[26]

Air Quality and Greenhouse Gas Emissions

Upstream air quality impacts of biofuels include emissions associated with cultivation, harvesting, and transporting of corn or other feedstock; conversion to biofuels; and sale.

Several studies have speculated that land use change required for biofuel production might be counterproductive to the overall goal of reducing GHG emissions.[27] Conversion of certain land types, such as grasslands or peatlands, can create a biofuel carbon debt by releasing 17 to 420 times more CO_2 through land conversion than the biofuels would displace. However, biofuels made from biomass on degraded agricultural lands can achieve a net GHG benefit.[28]

Land Conversion

A study from UCLA evaluated how CRP re-enrollments were impacted in areas near ethanol plants after the ethanol mandate from the federal Renewable Portfolio Standard went into effect. UCLA researchers did not find a statistically significant relationship between ethanol capacity and CRP re-enrollment. In fact, more land was re-enrolled in CRP after the ethanol mandate took effect in ethanol intensive locations. Other factors including crop prices, CRP policy changes, state programs, soil quality, and parcel sizes were also considered.[29]

7.2.3 Production Impacts – Ethanol Plant Operation

7.2.3.1 Human Impacts

Ethanol production has the potential to impact the following resources: health and safety, and socioeconomics. Potential impacts on these resources are discussed below.

Health and Safety

As biofuel production and use have increased, the associated risk and number of incidents have correspondingly increased. Potential hazards of operating an ethanol plant include materials, material handling, and operations and maintenance and are described below.

According to incident statistical reports, hazards from materials used to produce ethanol include fire, explosion, overpressure releases, runaway and uncontrolled reactions, toxic substance exposure, and steam flashes. Ethanol remains highly flammable and easily ignited. Approximately six fire and explosion incidents are reported every year from the bioethanol and biodiesel industries in the United States.[30] Undenatured ethanol is toxic when ingested in large quantities. Ethanol ingestion has been linked to increased risk of cirrhosis of the liver, multiple forms of cancer, and alcoholism.[31]

Hazards from materials handling as well as operations and maintenance include storage of flammable and toxic materials and processing of hazardous materials. There is a potential for dust explosions during grain handling, especially if particles are allowed to accumulate close to sources of static charge build-up. Proper grounding, sealing, installation, and use of all electric equipment would reduce fire and explosion risk.[32] To further reduce the risk of ignition, a system for removal of tramp metal from grain shipments should be installed at the grain receiving areas. Screens, magnets, or other equipment items are required on facilities constructed after 1973.

To minimize the amount of ethanol vapors in the open workspace, tanks and railcars can be equipped with vapor recovery systems that collect ethanol vapors that would otherwise be released when tanks are filled with liquids.[33] Additionally, some storage tanks at tank farm facilities have fixed fire protection systems that will spray foam down inside of the tank wall and onto the top of burning liquids inside of the tank.[34]

Socioeconomics

An ethanol plant would increase tax revenues in the short-term and long-term, resulting in a beneficial impact on the area where it is located. The combination of gross domestic product and household income supported by the ethanol industry contributed an estimated $7.2 billion in tax revenue to the federal Treasury in 2022.[35] State and local governments also benefit from the economic activity supported by the ethanol industry, earning $5.1 billion in 2022. It is expected that an ethanol plant would generate property tax revenues where it is located during the life of the facility operations.

An ethanol plant would create job opportunities during construction and operation of the ethanol plant. Depending on the size of the ethanol facility, over 100 construction workers would be needed to build the facility over a relatively short timeframe of 1 to 2 years. In more than 200 communities across the United States, ethanol biorefineries continued to play an important role in driving economic growth in 2021.[36] More than 73,000 United States jobs were directly associated with the ethanol industry, which contributed just over $52 billion to the gross domestic product and $28.7 billion in household income in 2021.

7.2.3.2 Environmental Impacts

Ethanol production has the potential to impact the following resources: soil and ecosystems, water resources, and air quality and GHGs. Potential impacts are discussed below.

Soil and Ecosystems

Ethanol plants are often sited on a few dozen acres of former farmland near their source of feedstock. The construction of an ethanol plant initially displaces a large quantity of soil for facility foundations and prevents future soil building capacity. Topsoil is excavated and exported during the conversion of land to an industrial use. In addition, subsoil is capped by impervious surfaces, which prevents an exchange of nutrients, oxygen, moisture, microbes, and microorganisms. Vegetated areas that remain tend to be regularly mowed turf grass.

Ethanol plants often store large quantities of ethanol on site. Storage of ethanol increases the risk and severity of soil and groundwater contamination from the risk of storage tank corrosion. The oxidation of ethanol can lead to the creation of corrosive by-products, which can increase the risk of storage tank leakage. When ethanol biodegrades in water, it can also deplete dissolved oxygen, produce methane, and inhibit further biodegradation.[37] The accumulation of methane in some scenarios can produce a high-risk situation that may require emergency mitigation measures or the use of engineering controls.[38] The SPCC regulations establish guidelines and measures to prevent, control, and respond to oil spills, including those involving biofuels like ethanol-blended gasoline. The regulation considers factors such as containment measures, secondary containment, and proper management practices to mitigate the potential environmental impacts. Qualified facilities are required to assess and address the specific characteristics of the biofuel to prevent adverse effects on the environment in accordance with SPCC guidelines.[39]

Water Resources

Ethanol plants contain substantial expanses of impervious ground cover such as access drives, parking lots, and large processing structures, which create stormwater runoff. To receive a necessary stormwater discharge permit from the applicable regulatory agency, stormwater quantity and quality requirements must be adhered to. From a quantity perspective, ethanol plants must demonstrate that, at a minimum, peak stormwater runoff rates do not exceed the peak runoff rates prior to development for a prescribed design storm. This is often accomplished through retention or detention ponds. However, the volume of rainfall contributing to runoff will typically far exceed that of predevelopment land cover. This is because cropland would still allow for shallow and deep infiltration, as well as greater evapotranspiration. Shifting the hydrology creates several effects. Groundwater tables do not receive the same recharge volume. This in turn affects the available groundwater able to be drawn and used for ethanol production at the plant or for irrigation. Streams receive more frequent and larger magnitude flow rates; experience increased channel widths, increased downcutting, reduced bank stability, and disrupted sediment transport; and have altered in-stream hydraulics, which affect channel velocities and shear stress.[40]

From a stormwater quality perspective, the increased velocities and volumes can cause downstream erosion and increased turbidity. Additionally, impervious surfaces transfer heat to stormwater runoff that in turn increases temperatures of receiving waterbodies. Surfaces at industrial facilities can contain organic and inorganic pollutants. These substances can be suspended and conveyed into watercourses during a rain event, reducing the water quality of the receiving body.[41] Retention and detention ponds can also allow settling of substances, which can improve the quality of stormwater discharge from the ponds. Some regions have enhanced stormwater quality permitting requirements. This often consists of capturing and treating the “first flush” of stormwater prior to releasing runoff downstream. The “first flush” contains the largest concentration of pollutants. However, these requirements are not consistent across the United States.

An ethanol plant that produces 100 million gallons of ethanol per year can require between 300 and 400 million gallons of water.[42] An ethanol plant would need to obtain a water withdrawal permit from the applicable regulatory agency for water use.[43] The source of the water can vary but often comes from groundwater wells. Underground reserves of fresh water are limited. Recharge time is highly variable and can take between 100 years to tens of thousands of years to recharge.[44] Ethanol plants primarily use water for steam generation and cooling. The bulk of water for these end uses evaporates into the atmosphere.

Wastewater from operation of ethanol plants is primarily generated from cooling tower blowdown, boiler blowdown, and water softener discharge. This wastewater is often managed by ethanol plants in one of two ways: direct discharge to a receiving stream or discharge to a municipal wastewater treatment system.[45] If discharged directly into a receiving waterbody, a more involved NPDES permit from the applicable regulatory agency is required to demonstrate that pollutant concentration limits will not exceed a prescribed threshold. If discharged into a municipal wastewater treatment system, the ethanol plant may be required to receive a discharge permit from the applicable regulatory agency and commit to pretreating the wastewater prior to discharge. These additional measures are determined by the volume of discharge in relation to the size of the receiving plant, as well as the concentration of various pollutants being discharged.

Air Quality and Greenhouse Gas Emissions

As stated above, upstream emissions include cultivation, harvesting, transporting of corn or other feedstock, conversion to biofuels, and sale. This includes emissions from production of biofuels at a biofuel plant. Biofuel plants are typically more energy intensive compared to petroleum refineries because of the combustion of feedstocks in boilers compared to production and distribution of gasoline. Upstream emissions are considerably higher for corn ethanol than for gasoline for most criteria pollutants.[46]

Most of the GHG emissions (95 percent) associated with corn ethanol are from upstream sources in the agricultural fields and ethanol production at the plant. Overall, life cycle GHG emissions from corn ethanol have been declining. The CI score of corn ethanol has decreased from 58 gCO_2e/MJ in 2005 to 45 gCO_2e/MJ in 2019. Ethanol plants have used improved technologies to increase ethanol yield and reduce energy use, resulting in reduced ethanol production emissions by 30 percent (or 11 gCO_2e/MJ) over the 15-year period of 2005 to 2019. Farmers have reduced chemical and energy input intensities, which contributes to a 17 percent reduction in farming-related emissions (4.9 gCO_2e/MJ). Land use change GHG emissions were initially estimated to be very high in 2008, but the GREET model currently estimates the land use change GHG emissions rate at 7.4 gCO_2e/MJ for United States corn ethanol according to Argonne’s Carbon Calculator for Land Use and Land Management Change from Biofuels Production.[47]

As discussed in EPA’s *Biofuels and the Environment: Second Triennial Report to Congress*, air quality impacts are highly localized and dependent on feedstock type, land use change, land management/cultivation practices, and the energy source at the ethanol plant.[48] Facilities producing ethanol from corn and cellulosic feedstocks tend to have greater air pollutant emissions relative to petroleum refineries on a per-British thermal unit of fuel produced basis, but emission rates vary widely among facilities. Ethanol from corn grain has higher emissions across the life cycle than ethanol from other feedstocks. Ethanol plants relying on coal have higher air pollutant emissions than plants relying on natural gas and other energy sources.[49]

Air permits associated with ethanol plants identify particulate matter (PM) sources from grain receiving, milling, dried distiller's grains with solubles (DDGS), handling and drying, combustion of natural gas or propane (boilers, regenerative thermal oxidizer, DDGS dryer), and vehicle traffic on paved and unpaved roads. Nitrogen oxides (NO_X), carbon monoxide (CO), sulfur dioxide (SO_2), and GHG (primarily CO_2) are emitted from combustion of natural gas or propane. Volatile organic compounds (VOC) and hazardous air pollutants (HAP) are emitted from combustion of natural gas or propane, fermentation, drying and cooling of DDGS, wetcake production and storage, distillation, ethanol and denaturant storage and loadout, and volatile organic liquid piping leaks.[50] CO_2 emissions are a typical natural by-product of the ethanol fermentation process as sugars are broken down to create ethanol.

Control equipment at the facility includes fabric filters for control of particulate emissions from grain, flour, and DDGS handling operations; packed scrubbers for control of VOC and HAP emissions from fermentation and distillation; a regenerative thermal oxidizer for control of VOC and HAP emissions from DDGS drying and cooling; and a flare for control of VOC and HAP emissions from ethanol loadout into trucks and railcars.[51]

7.2.4 Transportation Impacts

Transportation-related impacts occur in three different phases: (1) transporting ethanol feedstock, such as corn, from farms to ethanol plants, (2) transporting ethanol from ethanol plants to finished motor gasoline blending terminals, and (3) distributing the ethanol-blended fuel to fueling stations. About 90 percent of ethanol produced in the United States is transported via train or large tanker truck. Barges are used for about 10 percent of all United States ethanol, and a very small percentage is transported through pipelines.[52]

7.2.4.1 Human Impacts

Transportation has the potential to impact the following resources: health and safety, and socioeconomics. Potential impacts are discussed below.

Health and Safety

Ethanol feedstock transported via truck or rail is susceptible to grain dust explosions.[53] According to Purdue University, 9 grain dust explosions were reported in the United States in 2022, which compares to the 10-year average of 7.8 explosions.[54] Such explosions could kill or injure workers and bystanders. Additionally, grain dust can become suspended in the air during transit, resulting in eye, skin, and respiratory effects.[55] Because ethanol is flammable and considered a hazardous material, railroad tanker car operators and truck drivers must adhere to strict safety guidelines from the USDOT and the Federal Motor Carrier Safety Administration. The Federal Motor Carrier Safety Administration requires truck drivers to carry a safety permit to transport hazardous materials including ethanol. There is risk associated with ethanol spills from truck, train, and barge accidents.

Socioeconomics

Transportation contributes to the regional economy, particularly in rural communities, by increasing the use of truck, rail, and barge transportation and the associated economic growth and job creation. Ethanol is primarily produced in the Midwest and is transported long distances by rail to reach facilities in coastal areas. Trucking is preferred over rail transport for shorter haul distances, resulting in more trucking jobs near ethanol plants. Feedstocks are most frequently delivered to ethanol plants by truck, typically from farms or grain storage locations within a 50-mile radius.[56] For example, a 100-million gallon per year facility would require an average of 160 trucks to deliver corn each day, which is over 41,000 loads per year.[57] These shipping employment opportunities can represent a major economic growth opportunity, not only for the community, but also for the larger regional economy surrounding the ethanol plant location.

7.2.4.2 Environmental Impacts

Ethanol is a clear, colorless liquid that is highly flammable, toxic in high concentrations, water soluble, and capable of moving through soil and into groundwater.[58] Transportation has the potential to impact the following resources: soil and ecosystems, water resources, and air quality and GHGs. Potential impacts are discussed below.

Soil and Ecosystems

Ethanol spills are rare during transportation, but they do occur in all three primary modes of transportation: rail, freight truck, and barge. Ethanol is almost entirely derived from natural materials and oxygen; as such, ethanol biodegrades rapidly in soil. In surface water and groundwater, ethanol will completely dissolve with low likelihood of volatilization or adsorption.[59] Once ethanol is depleted of oxygen, anaerobic biodegradation of ethanol produces methane. Elevated levels of methane in soils can harm and even kill plants. While biogenic methane gas is naturally present in soils, elevated concentrations reduce the availability of oxygen in the soil, thereby depleting oxygen availability to plant roots and other oxygen-dependent organisms.[60]

Impacts associated with transportation infrastructure vary by mode. Freight trucks have the largest physical footprint, requiring roadways that cap the soil, increase stormwater runoff, and decrease stormwater quality. This infrastructure fragments habitats and leads to premature species deaths via vehicle strikes. Railroads can also reduce habitat connectivity, but animal strikes by railcars are far less frequent than by vehicles, and the physical footprint of railways is significantly smaller than that of the road system. Barges traverse existing water courses and thus have a minimal impact on soil and terrestrial ecosystems. However, management of watercourses is increasingly centered around serving barge traffic rather than supporting marine ecosystems. This results in altering natural hydrology, removing habitat, polluting waters, and reducing populations of native species.[61]

Water Resources

In the case of an ethanol spill into the environment that is not otherwise contained, water resources may be impacted. Ethanol-blended fuel might have increased risk to water resources compared to petroleum hydrocarbons because of its ability to degrade rapidly. Once dissolved, ethanol is unlikely to volatize or be adsorbed. In aerobic environments, oxygen is depleted as a result of aerobic degradation. In anaerobic environments, anaerobic biodegradation of ethanol can produce methane, which creates the potential for an explosion hazard.[62] Methane generation may be delayed for months to years after a release and may persist for years after the ethanol is no longer present in groundwater. At some sites, methane might be the primary contaminant of concern and the risk driver for corrective action or long-term monitoring.[63]

Air Quality and Greenhouse Gas Emissions

Transporting ethanol causes increased truck, train, and barge traffic from fuel distribution. Because these modes of transportation would likely use diesel as their main fuel, there would be adverse air quality and GHG impacts along the transport routes. These transportation-related impacts on air quality would be similar for both ethanol-blended gasoline and regular gasoline depending on the distance travelled and mode of travel. Per energy unit, truck travel would create more emissions compared to train and barge because it would be the least efficient.

Diesel engines emit a complex mixture of air pollutants, including both gaseous and solid material. In particular, diesel particulate matter (DPM) is a known carcinogen. A large proportion of DPM is composed of black carbon. Black carbon is the second largest contributor to global warming after CO_2 emissions. Ninety percent of DPM is less than 1 micrometer in diameter and is thus able to travel deep within a person's lungs and bloodstream. Adverse health effects from DPM and other $PM_{2.5}$ emissions from diesel exhaust include cardiovascular and respiratory hospitalizations, and premature death. Environmental effects of DPM include haze and reduced visibility as particles in the air scatter and absorb sunlight. DPM exposure can be reduced through cleaner-burning diesel fuel, retrofitting engines with particle-trapping filters, alternative fuels, and advanced technologies to reduce particle emissions.[64]

7.2.5 End Use Impacts

A second source of emissions from use of ethanol-blended fuels used in the transportation industry is vehicular emissions (downstream emissions). Downstream emissions of corn ethanol and gasoline are similar. The following sections briefly summarize impacts from downstream emissions.

7.2.5.1 Human Impacts

End use has the potential to impact health and safety. Potential impacts are discussed below.

Health and Safety

Gasoline and diesel fuel are mixtures of hydrocarbon compounds and other additives such as ethanol. Ethanol is classified by USDOT as a Class 3 flammable liquid just like gasoline and diesel fuel. Ethanol is a member of the alcohol hydrocarbon derivative family of chemicals, which are all flammable and toxic. Use of ethanol can be a fire hazard, produce toxic fumes, and have both short- and long-term health risks. Short-term risks of exposure to ethanol include intoxication due to inhalation (vapors), headaches, difficulty breathing, and eye irritation. Long-term risks include liver damage, similar to alcohol consumption.

Combustion of gasoline and diesel fuels produces emissions of airborne pollutants that negatively impact human health. These pollutants include CO, NO_X, PM, VOCs, and CO_2.

Ethanol additions to gasoline can improve the combustion performance and reduce CO emissions by nearly 16 percent.[65] Blending ethanol with gasoline can increase or decrease NO_X emissions depending on the percentage of ethanol-gasoline mix. Studies have shown inconsistent NO_X emission results related to the variation of ethanol proportion in gasoline. However, many studies conclude that there is an increased NO_X emissions tendency with high-ethanol-content blends.[66] NO_X are harmful pollutants that can damage the lungs, cause respiratory diseases, reduce oxygen transport in the bloodstream, and disrupt cellular functions.[67]

Transportation sector employees, such as gasoline station workers who are in close proximity to fuel dispensing areas during working hours, are exposed to increased concentrations of combustion pollutants and longer exposure times. Long-term effects associated with combustion emissions exposure are chronic asthma, pulmonary insufficiency, cardiovascular diseases, and cardiovascular mortality.[68] These workers, as well as people living in urban areas, have potentially increased cancer risks compared to those living in rural areas or those with occupations outside of the transportation sector.[69]

7.2.5.2 Environmental Impacts

End use has the potential to impact the following resources: soil and ecosystems, and air quality and GHG emissions. Potential impacts are discussed below.

Soil and Ecosystems

End use of ethanol is typically in the form of a combustible liquid transportation fuel. Ethanol is used as a gasoline additive and is commonly blended in 10 and 85 percent mixtures, referred to as E10 and E85 blends, respectively. High ethanol blends, such as E85, pose a higher risk of contaminating soil and groundwater because ethanol causes both physical and chemical changes to gasoline. Storage of ethanol and ethanol-blended gasoline increases the risk and severity of soil and groundwater contamination by increasing the risk of tank corrosion. The oxidation of ethanol can lead to the creation of corrosive by-products, which can increase the risk of storage tank leakage. Because ethanol makes gasoline and associated contaminant compounds more soluble, it becomes easier for these toxic compounds to mix with groundwater and impact living organisms in soils and waterways. When ethanol biodegrades in water, it can also deplete dissolved oxygen and produce methane.[70]

The accumulation of methane in some scenarios can produce a high-risk situation that may require emergency mitigation measures or the use of engineering controls.[71] The SPCC regulations establish guidelines and measures to prevent, control, and respond to oil spills, including those involving biofuels like ethanol-blended gasoline. The regulation considers factors such as containment measures, secondary containment, and proper management practices to mitigate the potential environmental impacts. Qualifying facilities are required to assess and address the specific characteristics of the biofuel to prevent adverse effects on the environment, in accordance with SPCC guidelines.[72]

Air Quality and Greenhouse Gas Emissions

Ethanol use in transportation fuels results in vehicular emissions including both tailpipe and evaporative emissions. Tailpipe emissions result from fuel combustion in a vehicle's engine. For tailpipe emissions, introduction of ethanol into gasoline because of the Renewable Portfolio Standard was intended to reduce GHG emissions associated with gasoline. In addition to reducing GHG emissions, ethanol-blended gasolines decrease the amount of CO and PM exhaust. Changes to VOCs and NO_X exhaust emissions stay similar or increase depending on the blending percentage. Incomplete combustion in a vehicle's engine may occur when not all the fuel is burnt. When ethanol doesn't burn completely, it produces harmful pollutants like formaldehyde, VOCs which also contribute to formation of ozone and smog.[73]

Evaporative emissions are emissions that evaporate from fuel in open-air conditions. These emissions are highly dependent on temperature, vehicle activity, and vehicle system materials and mostly occur when the car is parked or refueling. Low-level ethanol blends evaporate more easily and can increase evaporative emissions, which contribute to the formation of ozone and smog. However, vapor pressure for low-level ethanol blends can be adjusted to adhere to the same volatility standards as gasoline. E85, a high-level gasoline-ethanol blend, is less volatile than gasoline and results in lower evaporative emissions.[74]

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Chapter 8 Accidental Release of CO_2

This chapter describes the potential for an unanticipated release of CO_2 from the capture facility or pipeline. It assesses the potential for adverse human and environmental impacts of an unanticipated release of CO_2. This chapter provides context regarding observations from historical incidents and relevant studies while focusing on the design characteristics of the project. Also described are prevention, preparedness, and response measures that could prevent or reduce the impacts of a release.

Chapter 5 describes the effects of construction and routine operation of the project. This chapter describes the effects of an accidental release of CO_2 from the project. A large rupture of the pipeline is unlikely to occur.

8.1 How could CO_2 be accidentally released?

CO_2 could be accidentally released by leak or rupture. For CO_2 pipelines, leakage is the main form of accidental release and rupture is the most unusual failure mode.

The piping and aboveground facilities associated with the project must be designed, constructed, operated, and maintained in accordance with the PHMSA federal safety standards in 49 CFR Part 195. The regulations are intended to ensure adequate protection for the public and to prevent accidents and failures. PHMSA specifies material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion.

As described in Chapter 2, the applicant has incorporated engineering and design elements into the project to reduce the likelihood of pipeline leaks or failure, including inspection and corrosion control facilities. A pipeline leak is defined by PHMSA as a “small opening, crack, or hole in a pipeline allowing a release of oil or gas. Pipeline operators periodically perform leak surveys as leaks may not be readily or immediately detected.”[1] PHMSA defines a rupture as “the process or instance of breaking open or bursting, as in the rupture of a pipe. Technically speaking: A rupture is the propagation or growth of a defect to such an extent that the pipe becomes completely unserviceable.”[2]

During the pipe manufacturing process, longitudinal seam welds join the edges of steel plate to form sections of pipe. During construction, girth (or circumferential) welds are used to join sections of pipe and other components such as MLVs to create a pipeline system.[3] Material or weld failures can lead to ductile or brittle fractures of the pipeline. A failure in a longitudinally welded seam can propagate for a distance along the pipe and can quickly release large quantities of product to the environment.[4]

Frost heave displaces soil vertically. It is the result of the formation of lens-shaped masses of almost pure ice, called ice lenses, that form in frozen soil or rock as the ground freezes.[5] Frost heave has the potential to lead to movement of the pipe, stress on the pipe, or deformation of the pipe. The applicant conducted a study on frost heave (see **Appendix I**). For frost heave to occur, soil freezing and ice lensing must occur below the pipe, pressing upward on it from below. It is anticipated that the pipeline would be buried deep enough that any ice lens would form above the pipeline rather than below it, preventing frost heave.

8.1.1 Pipeline Leaks

Pipeline leaks create a significantly lower hazard than pipeline ruptures. Leaks can be detected during routine pipeline inspections and are not necessarily hazardous depending on their location and size.

As described in more detail in Section 8.2.2, PHMSA maintains a database of accidental releases from CO_2 pipelines.[6] A 2023 article by Xi et al. in the *Journal of Loss Prevention in the Process Industries* analyzed PHMSA data from 2010 to 2021.[7] This analysis showed that, for natural gas pipelines, rupture is the most common form of accident. However, for CO_2 pipelines, between 2010 and 2021, 66 CO_2 pipeline accidents were reported to PHMSA. Of these 66 accidents, 56 were leaks, 2 were ruptures, and 8 were classified as "other."[8] The analysis showed that leaks are the leading form of accident and rupture is the most uncommon form of accident for CO_2 pipelines.

8.1.2 Pipeline Rupture

A rupture could occur if the pipeline is damaged. Most pipeline failures are ductile fractures, which is a type of fracture marked by permanent deformation prior to the failure of the pipe. Ductile fractures can result in leaks or ruptures of various lengths and sizes. One of the most impactful types of ductile fracture is a guillotine rupture, which is when the size of the pipeline break is the same or nearly the same as the full width of the pipeline. The effect is like suddenly uncorking a hose—all of the contents rush out in the shortest amount of time possible. Another serious type of failure is when a pipeline break rapidly propagates down the length of the pipe either in the seam weld or in the pipe wall. These longitudinal failures, when long enough, look like someone has "unzipped" the pipeline. The effect of this type of rupture is very similar to the effect of a guillotine rupture in that the contents of the pipeline rapidly depressurize and vent to the atmosphere. Pipeline designers prevent and mitigate these types of failure in different ways. Increasing pipeline thickness at select locations along the pipeline or adding crack-arrestors are two such strategies.[9]

8.1.3 What happens during a rupture?

When CO_2 is released from a pipeline in which it is transported as a pressurized liquid, such as the project, the release is characterized by a white plume or cloud containing a mixture of vapor and solid CO_2 (dry ice). CO_2 in its vapor state is not visible but becomes visible due to the condensed water vapor formed by the humidity of the air combined with the cold temperature of the CO_2 upon release that brings the surrounding air temperature below the dew point. CO_2 concentrations cannot be assessed only by looking at the size of the visible plume because what is visible is usually condensed water vapor generated by the low temperatures associated with the rapid depressurization of CO_2 during a rupture and is not representative of the concentration of CO_2.

The initial release associated with a rupture can be explosive in the immediate area. Near a rupture, liquid CO_2 would escape and immediately vaporize and expand. In the case of a rupture in a buried pipeline, CO_2 would escape by pushing the overlying soil upward at an explosion-like speed. The expansion of CO_2 would occur at sonic speed and continue until the pressure ratio between the CO_2 and the ambient air begins to equalize.[10]

After the initial release, the CO_2 plume would spread and eventually disperse. The CO_2 released from a pipeline would be heavier than air, and the high-rate release from a pipeline rupture would form cold dense gas plumes composed of dry ice particles and visible water vapor as the humidity in the air condenses from the extreme cooling. Such high-rate releases can produce areas of low visibility from "fog," both from dry ice particles and water condensation. The CO_2 "fog" or plume becomes transparent when eventually warmed by the surrounding environment. Upon warming, the CO_2 plume can flow unobserved for considerable distances from the pipeline. Because CO_2 is denser than air, a plume would settle into lower-lying areas, displacing oxygen.

Following a pipeline rupture, deposits of solid CO_2 are typically observed on the ground surrounding the release point. These deposits slowly transform into CO_2 vapor.[11]

8.2 What is the safety record of CO_2 pipelines?

A 2020 pipeline rupture in Mississippi caused 45 people to be hospitalized and 200 people to be evacuated. No fatalities occurred. PHMSA data indicates that 66 accidents involving CO_2 pipelines occurred between 2010 and 2021. Of these 66 accidents, 85 percent were classified as leaks, 12 percent as "other," and 3 percent as ruptures. CO_2 pipelines tend to have more accidents during their first decade of operation. The number of incidents per mile of CO_2 pipeline in the United States has declined over the past 5 years.

8.2.1 Historical CO_2 Releases

8.2.1.1 Lake Nyos, Cameroon

In August 1986, a large release of natural CO_2 from Lake Nyos in northwestern Cameroon killed 1,746 people and more than 3,000 livestock as well as an unknown number of wild animals and birds in the valley below the lake. The size of the release has been estimated between 100,000 tons[12] to 1.6 million tons of CO_2.[13] For comparison, the maximum amount that could be released by the project (the amount between two MLVs) is 52.5 tons.[14]

The Lake Nyos release caused deaths by asphyxiation as the CO_2 plume displaced oxygen, traveling downhill at more than 60 miles per hour.[15] After the 1986 eruption, scientists learned that CO_2 from a pocket of magma about 50 miles below Lake Nyos was naturally recharging and accumulating at the bottom of the lake.[16] A system of artificial degassing pipes was installed in Lake Nyos by an international team of researchers, and the system has been progressively scaled and fine-tuned since 1992 to siphon most of the CO_2 content from the lake.[17]

8.2.1.2 Satartia, Mississippi

On February 22, 2020, the 24-inch-diameter CO_2 pipeline known as the Delhi Pipeline operated by Denbury Gulf Coast Pipelines, LLC (Denbury) ruptured near Satartia, in Yazoo County, Mississippi. No fatalities occurred, but 200 people were evacuated and 45 people sought medical treatment at local hospitals. Information on this incident is provided from PHMSA's Pipeline Incident Flagged Files[18] and from PHMSA's 2022 Failure Investigation Report.[19]

The Delhi Pipeline is 24 inches in diameter, and its pipe wall thickness is 0.54 inch. The Delhi Pipeline is primarily used for transporting CO_2 from the Jackson Dome in Mississippi to Delhi, Louisiana, for Denbury's use in EOR at onshore oil wells. The pipeline was installed under Mississippi Highway 433 (MS 433) using HDD technology in 2009, and the depth of cover at the site of the rupture was 30 feet. The site of the rupture was on the northeast side of MS 433, about 1 mile southeast of the community of Satartia. At the time of the rupture, the pipeline was operating at an estimated pressure of 1,400 pounds per square inch gauge (psig). This pressure was below the maximum operating pressure of the Delhi Pipeline (2,160 psig) and above the 1,070 psig needed to maintain CO_2 in a supercritical state.[20]

When the pipeline ruptured, it released liquid CO_2 that immediately began to vaporize at atmospheric conditions. The vapor did not rapidly disperse because of weather conditions and steep topography. The topography at the site was described in PHMSA's 2022 Failure Investigation Report as "a steep hill that rises from the valley containing the Big Black River to the east, goes relatively flat across the crest of the hill containing MS 433, and then slopes downward toward the valley containing the Yazoo River to the west." A plume of CO_2 formed at the site of the rupture and flowed toward Satartia.[21]

Figure 8-1 shows the site of the rupture the day after the rupture. The photo shows a vehicle on MS 433, adjacent to the steep embankment and exposed ruptured pipeline. PHMSA investigators determined that a landslide had occurred on the slope below MS 433, which was caused by recent heavy rains, and that the force of the landslide placed strain on the pipeline and resulted in a full circumferential girth weld failure—a guillotine rupture.[22] PHMSA classified the cause of the incident as "Natural Force Damage" from heavy rains/floods.[23]

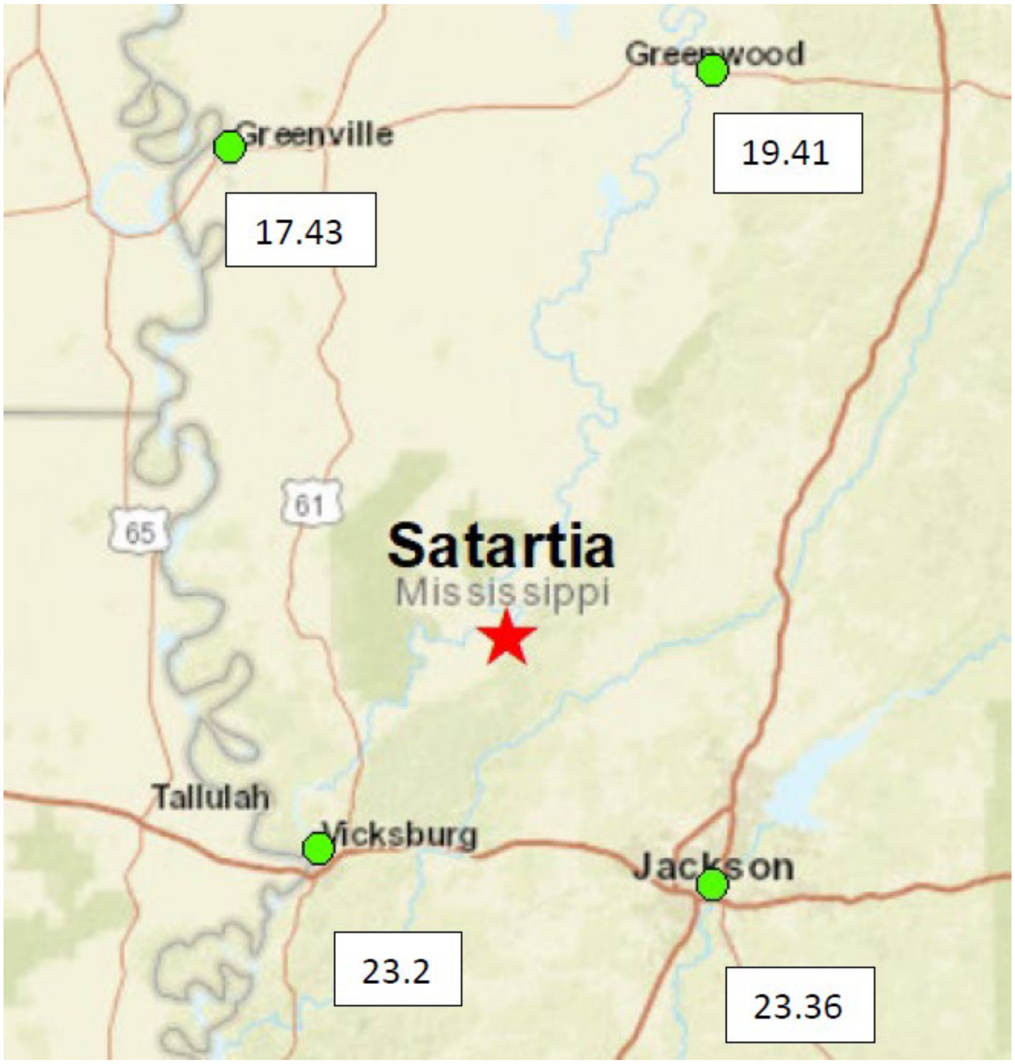
Figure 8-1 Photo of Pipeline Rupture Site near Satartia, Mississippi

Source: Aerial drone photograph courtesy of the Mississippi Emergency Management Agency, taken February 23, 2020. Photograph from PHMSA *Failure Investigation Report – Denbury Gulf Coast Pipelines, LLC – Pipeline Rupture/Natural Force Damage*, issued May 26, 2022.

The Satartia area had experienced unusually high rainfall during the days preceding the rupture. National Weather Service data indicates that accumulated rainfall amounts between January 1 and February 29, 2020, (60 days) for the cities of Greenville, Greenwood, Vicksburg, and Jackson, Mississippi, were between 7.4 and 13.6 inches above the annual historical average for the same 60-day timespan.

Figure 8-2 shows the amount of rainfall that was recorded in the cities surrounding Satartia between January 1 and February 29, 2020.[24]

Figure 8-2 January and February 2020 Rainfall, in Inches, in the Vicinity of Satartia



Source: PHMSA *Failure Investigation Report – Denbury Gulf Coast Pipelines, LLC – Pipeline Rupture/Natural Force Damage*, issued May 26, 2022.

Upon learning of the incident, the Yazoo County Office of Emergency Management closed MS 433 to all traffic and began to evacuate the area. About 200 people near the rupture, including the entire town of Satartia (around 50 residents) and three homes on the other side of the Yazoo River, were evacuated by local emergency responders.

According to Denbury's accident report, 45 people sought medical attention at local hospitals, including individuals who were caught in the vapor cloud while driving a vehicle. One individual was admitted to the hospital for reasons not directly related to the pipeline failure. There were no fatalities.[25]

The PHMSA Failure Investigation Report, issued May 26, 2022, did not identify any harm to wildlife or water resources from the CO_2 release.[26]

In addition to the heavy rains, PHMSA's investigation identified these additional factors that contributed to the accidental release:

- The pipeline operator did not consider geohazards in its plans and procedures.
- The pipeline operator's CO_2 dispersion model underestimated the potential affected area that could be impacted by a rupture. Pipeline operators are required to establish atmospheric models to prepare for emergencies. Denbury's model did not contemplate a release that could affect Satartia, and Satartia was not included in Denbury's Public Awareness Program. Moreover, Satartia was not considered in any emergency response plans. The rupture location was 1 mile from the center of Satartia, where the entire town was evacuated.
- The pipeline operator did not notify first responders to advise them of a potential failure. Local emergency responders were not informed by Denbury of the rupture and the nature of the unique safety risks of the CO_2 pipeline. As a result, responders had to make assumptions based on reports of a "green gas" and "rotten egg smell" and had to determine appropriate mitigative actions without knowing the nature of the risk.[27]

A summary of significant differences between the proposed project and the pipeline involved in the Satartia incident are listed in **Table 8-1**.

Table 8-1 Differences between the Pipeline near Satartia and the Proposed Project

Factor	Denbury Delhi Pipeline near Satartia, MS, that Ruptured in 2020	Proposed Project
Pipeline Diameter, inches	24	4
Topography	The rupture occurred in an area of steep topography.	The project would not cross areas of steep topography.
CO_2 Dispersion Model	Denbury did not correctly model impacts of an accidental release on the Village of Satartia.	The applicant conducted its dispersion modeling after PHMSA issued an updated nationwide advisory bulletin.
Public Awareness Program	Satartia was not included in Denbury's Public Awareness Program or considered in any emergency response plans.	EERA staff recommends as a special permit condition that the applicant provide a public education plan for Commission review prior to beginning construction. The public education plan must include specific safety information for neighboring landowners including what to do in case of a rupture (see Section 8.5.3).
Emergency Responder Awareness Program	Emergency responders did not know of the presence of the CO_2 pipeline.	The applicant has initiated coordination with emergency responders in Otter Tail and Wilkin Counties. EERA staff recommends as a special permit condition that the applicant prepare a plan in coordination with emergency responders for Commission review prior to beginning construction. The plan must include specific equipment,

Factor	Denbury Delhi Pipeline near Satartia, MS, that Ruptured in 2020	Proposed Project
		training, and reimbursement that would be provided to emergency managers. The plan must also list the names of the emergency responders (see Section 8.5.3).
PHMSA Regulations	Pipeline was constructed before PHMSA issued an updated nationwide advisory bulletin to all pipeline operators underscoring the need to plan for and mitigate risks related to land movements and geohazards that pose risks to pipeline integrity like the 2020 incident in Satartia.	The project would be constructed after PHMSA issued an updated nationwide advisory bulletin to all pipeline operators underscoring the need to plan for and mitigate risks related to land movements and geohazards that pose risks to pipeline integrity like the 2020 incident in Satartia.
Potential New PHMSA Regulations	Pipeline was constructed before PHMSA initiated rulemaking for updates to CO_2 pipeline safety regulations.	Project construction timing with respect to planned PHMSA updates to its CO_2 pipeline safety regulations is unknown, meaning pipeline construction might or might not incorporate these regulations.

In May 2022, PHMSA announced the following actions:

- Initiating a new rulemaking to update standards for CO_2 pipelines, including requirements related to emergency preparedness and response.
- Issuing a Notice of Probable Violation, Proposed Civil Penalty, and Proposed Compliance Order to Denbury for multiple probable violations of federal pipeline safety regulations. The proposed civil penalties amount to $3,866,734.
- Completing a failure investigation report for the 2020 pipeline failure in Satartia.
- Issuing an updated nationwide advisory bulletin to all pipeline operators, underscoring the need to plan for and mitigate risks related to land movements and geohazards that pose risks to pipeline integrity like the 2020 incident in Satartia.
- Conducting research solicitations to strengthen pipeline safety of CO_2 pipelines.[28]

8.2.2 PHMSA Data on Accidents Involving Liquids Pipelines

PHMSA collects data from pipeline operators to track the frequency of failures, incidents, and accidents, and then analyzes the causes and resulting consequences. PHMSA reports this data in various categories such as year, state, type, cause, and result.

PHMSA requires an accident report if one of the following occurs on a CO_2 or hazardous liquid pipeline:

- Explosion or fire not intentionally set by the operator
- Unintended release of 5 gallons or more of hazardous liquid or CO_2
- Death of any person
- Personal injury necessitating hospitalization

- Estimated property damage, including cost of clean-up and recovery, value of lost product, and damage to the property of the operator or others, or both, exceeding $50,000[29]

PHMSA records each accident report and maintains a publicly available database of pipeline accidents.[30] According to PHMSA, pipelines are the safest mode to transport products, including CO_2.[31] None of the CO_2 pipeline leaks or ruptures resulted in a fatality, impact on wildlife, or water contamination. Only one injury, to a pipeline contractor, has been reported in the past 20 years.[32] As noted in Section 8.1.1, a 2023 article by Xi et al. in the *Journal of Loss Prevention in the Process Industries* analyzed PHMSA data from 2010 to 2021.[33] During this timeframe, 66 CO_2 pipeline accidents occurred including 56 leaks, 2 ruptures, and 8 classified as "other." "Other" incidents typically involved multiple factors, but only one of these was caused by external forces (a truck collision).[34]

Xi et al. also studied the effect of the number of years a pipeline has been in service compared to the frequency of accidents. CO_2 pipelines that have been in service for 0 to 10 years have the highest frequency of accidents, accounting for about 70 percent of the total.[35]

Based on PHMSA annual reporting data, in 2022 there were 5,385 miles of CO_2 pipelines in the United States. This total includes 27 different systems in 11 states: North Dakota, Wyoming, Colorado, Utah, Montana, Kansas, Oklahoma, Texas, New Mexico, Mississippi, and Louisiana.[36] CO_2 pipelines have been operating in the United States for over 35 years.[37] As shown in **Figure 8-3**, CO_2 pipeline mileage has been relatively stable over the last 10 years.

Figure 8-3 Miles of CO_2 Pipelines in the United States[38]

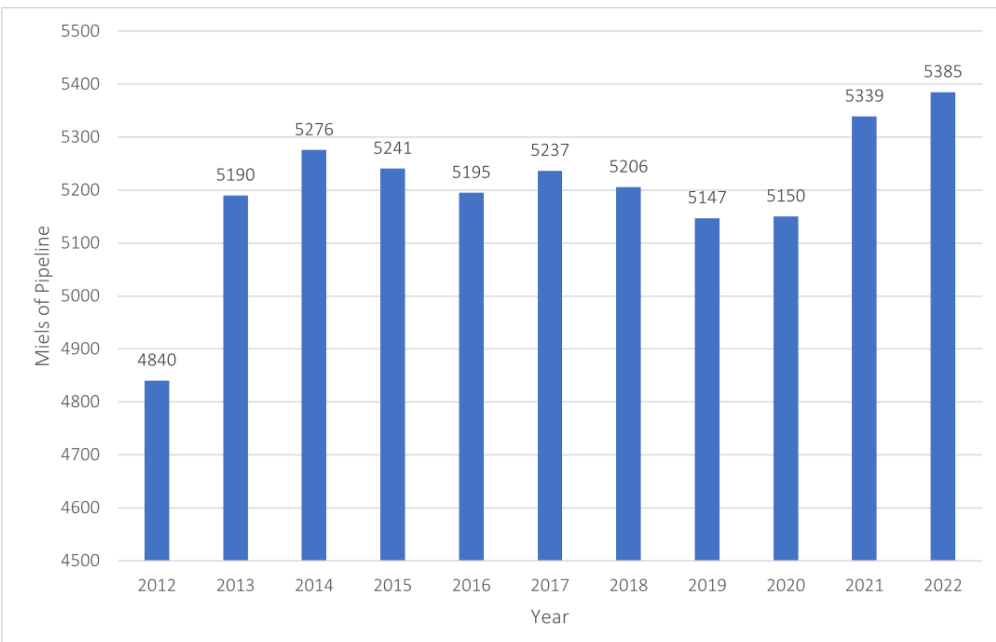
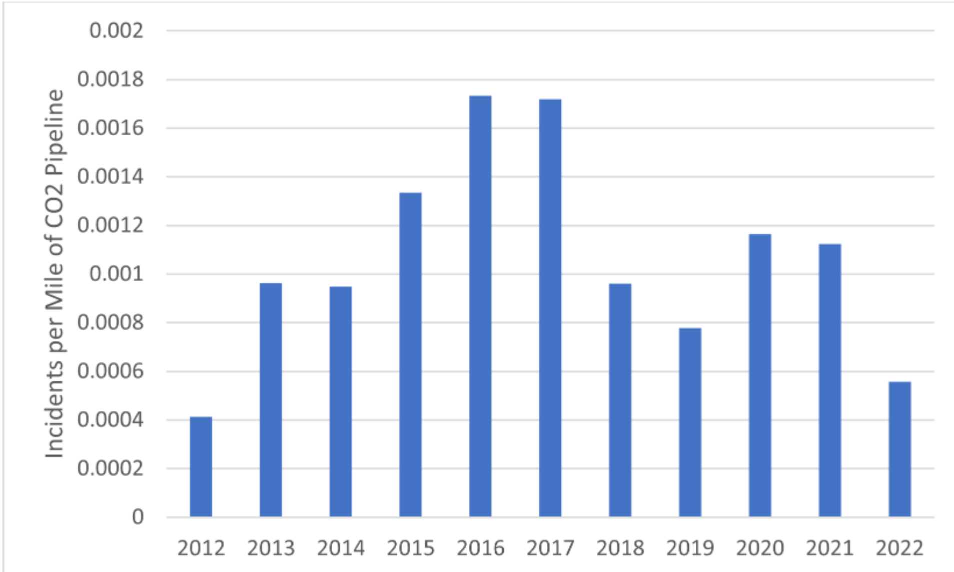


Figure 8-4 shows the number of pipeline incidents per mile for CO_2 pipelines for each year over the last 10 years. Incidents have decreased overall in the last 5 years. For example, in 2022 there were a total of three incidents (two classified as leaks and one as "other") reported on 5,385 miles of CO_2 pipeline, or 0.00056 incidents per mile of CO_2 pipeline in the United States.

Figure 8-4 Incidents per Mile of CO_2 Pipeline in the U.S.[39, 40]



There are currently no CO_2 pipelines in the state of Minnesota, but for comparison, there are 5,248 miles of other hazardous liquid pipelines in the state, as shown in **Figure 8-5**. These hazardous liquids are subject to the same PHMSA safety regulations as CO_2. There have been no safety incidents or loss of hazardous liquid on any hazardous liquid pipeline in the state of Minnesota since 2009.[41]

Figure 8-5 Hazardous Liquid Pipelines in Minnesota[42]

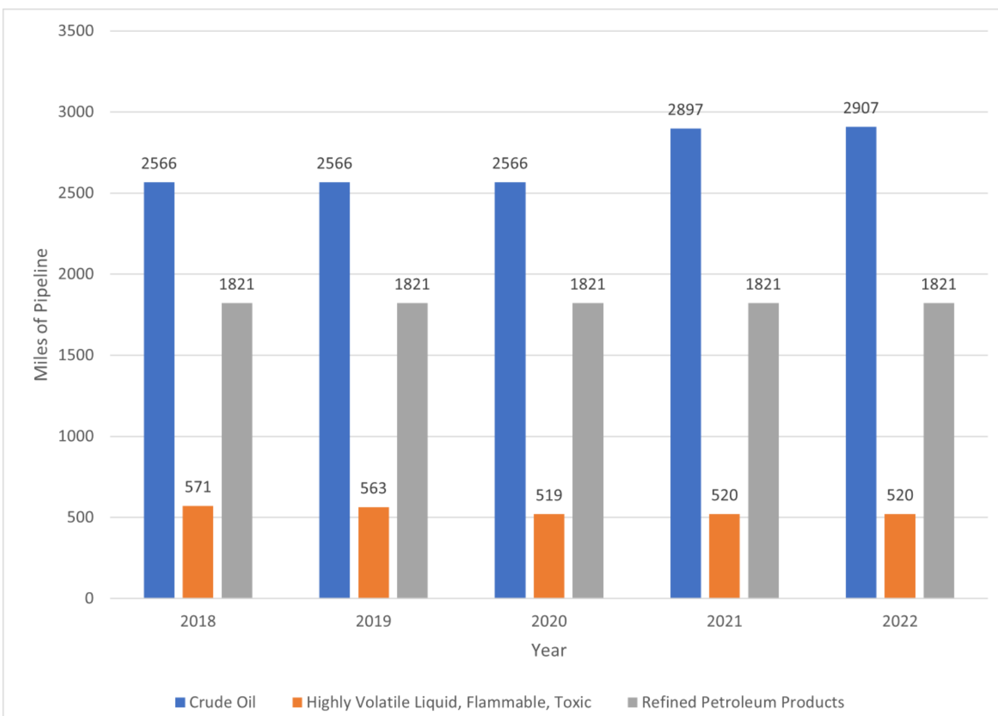
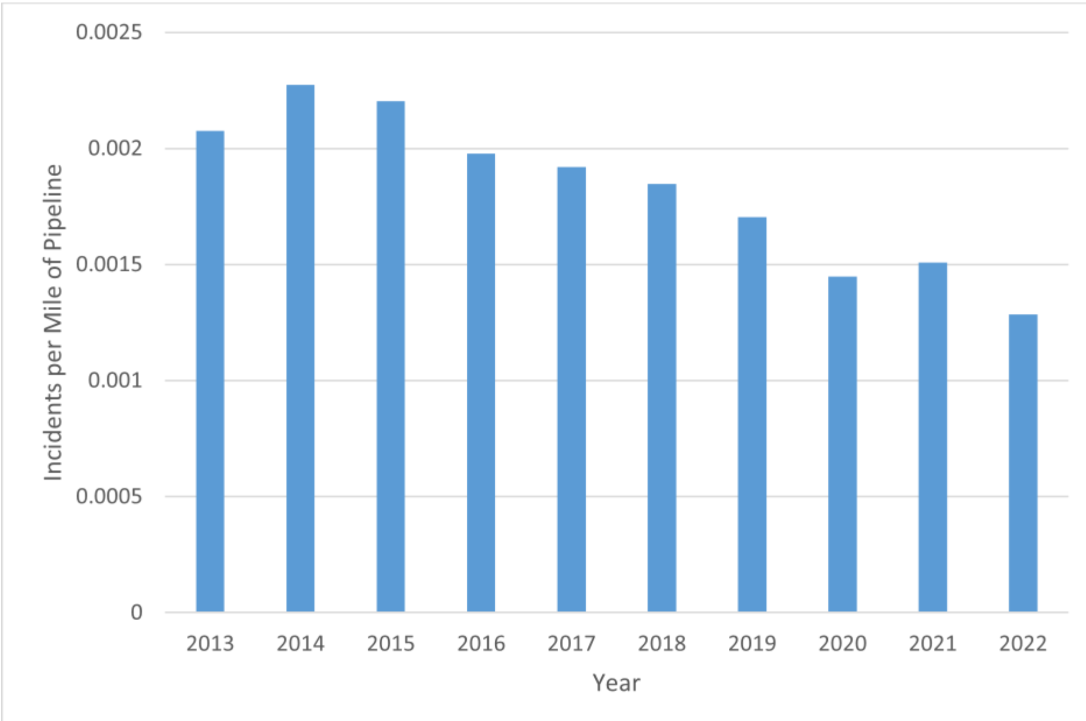


Figure 8-6 shows the number of pipeline incidents per mile for all hazardous liquid pipelines for each year over the last 10 years. Incidents have decreased overall in the last 5 years. For example, in 2022

there were a total of 295 incidents (247 classified as leaks, 8 as mechanical puncture, 14 as overfill or overflow, 11 as rupture, and 15 as "other") reported on 229,463 miles of hazardous liquid pipeline, or 0.0013 incidents per mile of hazardous liquid pipeline in the United States.

Figure 8-6 Incidents per Mile of Hazardous Liquid Pipeline in the United States[43]



8.2.3 Public Safety Services and Residences in the Vicinity of the Project

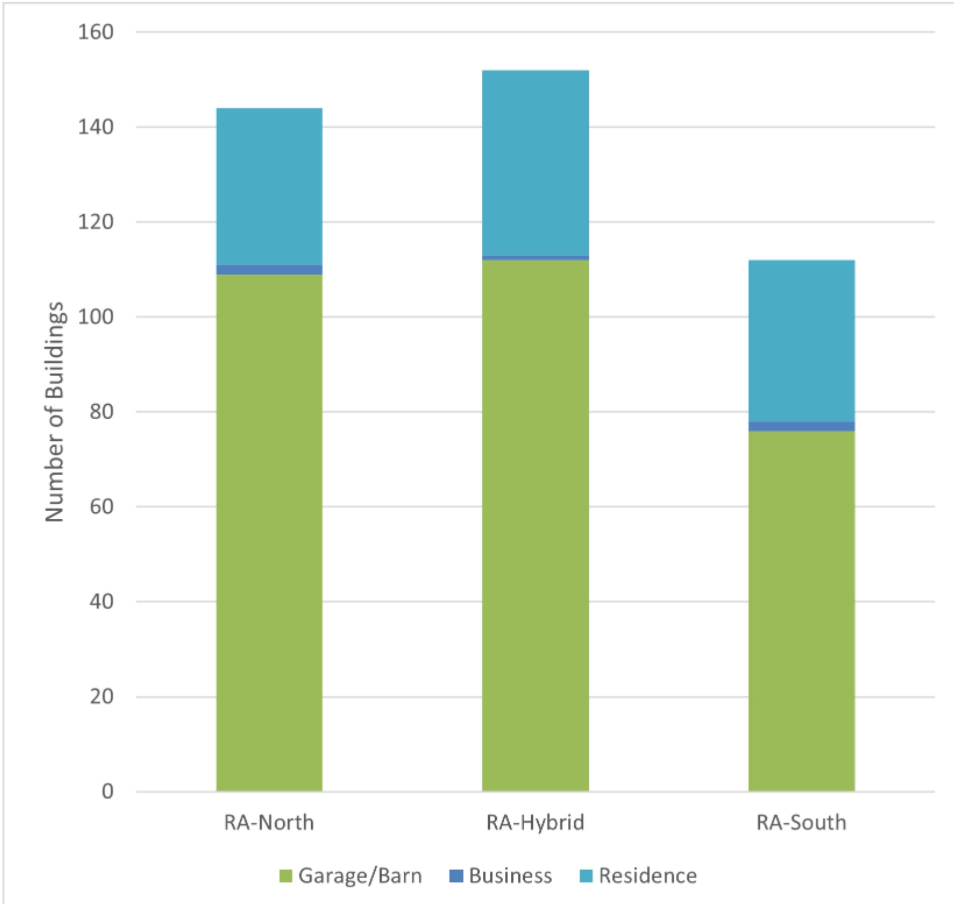
Table 8-2 lists hospitals, fire departments (career and volunteer), and law enforcement agencies (county sheriff and municipal police departments) in the counties crossed by the project. These agencies would respond to public health and safety issues during construction or operation. More information on public services is provided in Section 5.4.9. Based on this information, public services in Otter Tail and Wilkin Counties are expected to be adequate to respond to an accidental release caused by the project.

Table 8-2 Public Services within the Counties Crossed by the Project

County	Hospitals[44]	Number of Hospital Beds	Fire Departments (Career and Volunteer)[45, 46]	Law Enforcement Agencies (County Sheriff and Municipal Police Departments)[47, 48, 49, 50, 51, 52]
Otter Tail County	3	214	22	12
Wilkin County	1	105	6	4

Based on aerial photographs, RA-North has 33 residences, 2 businesses, and 109 garages/barns within the local vicinity (the area within 1,600 feet of the route width). RA-Hybrid has 39 residences, 1 business, and 112 garages/barns within the local vicinity. RA-South has 34 residences, 2 businesses, and 76 garages/barns within the local vicinity (see **Figure 8-7**). The closest residences to the CO_2 capture facility are about 1,300 and 1,500 feet away. These residences are listed in **Tables 5-6, 5-7, and 5-8** in Chapter 5 and are shown on the maps in **Appendix B**.

Figure 8-7 Buildings, Businesses, and Residences within the Local Vicinities of the Route Alternatives



8.3 What would be the effect on humans and the environment of an accidental release of CO_2?

Project design, installation, and operation would incorporate measures to minimize the risks of an accidental release. An accidental release of CO_2 from a rupture could expose humans and terrestrial and aquatic animals to dangerous levels of CO_2 resulting in asphyxiation (unconsciousness or death) from CO_2 gas, blast injury, or exposure to very cold solid CO_2. Vegetation in contact with a CO_2 plume would likely be frozen. Impacts on vegetation might be short-term (row crops) or long-term (trees). A pipeline rupture could damage previously unidentified buried archaeological and cultural resources. A large release of CO_2 into a stream or wetland could temporarily acidify water or soil. Minor leaks would have negligible to minimal impacts, depending on the resource.

8.3.1 Human Settlement

8.3.1.1 Aesthetics

A leak of CO_2 could kill vegetation, resulting in minimal to moderate short-term impacts on aesthetics, depending on the size, location, and duration of the leak. A rupture would result in localized and temporary areas of vegetation loss[53] that would diminish the aesthetic experience in the vicinity of the rupture. Explosive forces during a pipeline rupture could displace soil or other materials over the pipeline, lowering the visual quality of the area close to the rupture. Repairs and restoration following an accidental release of CO_2 would result in impacts similar to those during construction. These impacts would be short-term and minimal to moderate, depending on the location, extent of the damage, and time needed for repairs.

8.3.1.2 Public Health and Safety

Risks of Inhalation of CO_2

CO_2 is a colorless, odorless, non-flammable gas that naturally occurs in the atmosphere. CO_2 is produced by human, animal, and plant metabolism and is a normal component of respiration. It also results from natural sources such as volcanic eruptions and forest fires and from anthropogenic sources such as the burning of fossil fuels. CO_2 levels in outdoor air typically range from 300 to 400 ppm (0.03 to 0.04 percent) but can be as high as 600 to 900 ppm in urban areas. CO_2 levels directly next to an open bin of dry ice can be as high as 11,000 to 13,000 ppm.[54]

Liquid CO_2 vaporizes when released to the atmosphere. CO_2 vapor is 1.53 times heavier than air. Humans cannot smell CO_2 at low concentrations, but high levels of CO_2 (greater than 300,000 ppm or 30 percent) can activate receptors in nerve cells to produce a burning sensation in mucous membranes as CO_2 is converted to carbonic acid.[55] This level is well above the immediately dangerous to life and health level of 4 percent.

CO_2 is not toxic at low levels but can be a simple asphyxiant at higher levels. A simple asphyxiant is a gas that reduces or displaces normal levels of oxygen in breathing air. Mild CO_2 exposure could cause headache and drowsiness. At higher levels, rapid breathing, confusion, increased cardiac output, elevated blood pressure and increased arrhythmias could occur. Breathing air with high concentrations of CO_2 can lead to death by suffocation.

The National Institute for Occupational Safety and Health has established that a concentration of 40,000 ppm is immediately dangerous to life and health, and that workers should not be exposed to an average concentration of 30,000 ppm for more than 15 minutes (Short Term Exposure Limit).[56] The Occupational Safety and Health Administration has established 5,000 ppm as a permissible exposure limit, which is an 8-hour time-weighted average.[57] The symptoms of exposure to different levels of CO_2 are shown in **Table 8-3**.[58, 59]

Table 8-3 Symptoms of Exposure to CO_2 with Increasing Concentration

Concentration of CO_2	Symptoms of Exposure
5,000 ppm (0.5%)	Occupational Safety and Health Administration permissible exposure limit and ACGIH Threshold Limit Value for 8-hour exposure—likely no effects
10,000 ppm (1.0%)	Typically no effects, possible drowsiness
15,000 ppm (1.5%)	Mild respiratory stimulation for some people

Concentration of CO_2	Symptoms of Exposure
30,000 ppm (3.0%)	Moderate respiratory stimulation; increased heart rate and blood pressure; ACGIH Threshold Limit Value-Short Term; National Institute for Occupational Safety and Health Short Term Exposure Limit, which is a 15-minute time-weighted average exposure that should not be exceeded at any time during a workday
40,000 ppm (4.0%)	Immediately dangerous to life or health

MDH notes that workplace standards were developed for healthy working adults and might not be appropriate for sensitive populations, such as children and the elderly.[60]

The USDA Food and Safety Inspection Service also notes that the "response to CO_2 inhalation varies greatly even in healthy individuals. The seriousness of the symptoms is dependent on the concentration of CO_2 and the length of time a person is exposed. Since CO_2 is odorless and does not cause irritation, it is considered to have poor warning properties. Fortunately, conditions from low to moderate exposures are generally reversible when a person is removed from a high CO_2 environment."[61]

Because CO_2 is heavier than air, it can temporarily accumulate near the ground in low-lying outdoor areas, and in confined spaces such as caverns, tunnels, and basements until it dissipates into the atmosphere. CO_2 is not flammable, combustible, or explosive.[62]

The health effects of exposure to CO_2 are described in the scientific journal *Toxicological Reviews* as follows:

> Its main mode of action is as an asphyxiant, although it also exerts toxic effects at cellular level. At low concentrations, gaseous carbon dioxide appears to have little toxicological effect. At higher concentrations it leads to an increased respiratory rate, tachycardia, cardiac arrhythmias and impaired consciousness. Concentrations >10% may cause convulsions, coma and death. Solid carbon dioxide may cause burns following direct contact. If it is warmed rapidly, large amounts of carbon dioxide are generated, which can be dangerous, particularly within confined areas. The management of carbon dioxide poisoning requires the immediate removal of the casualty from the toxic environment, the administration of oxygen and appropriate supportive care. In severe cases, assisted ventilation may be required. Dry ice burns are treated similarly to other cryogenic burns, requiring thawing of the tissue and suitable analgesia. Healing may be delayed and surgical intervention may be required in severe cases.[63]

Other Risks of CO_2

Depressurization of CO_2, as would occur during an accidental release from the pipeline, can result in temperatures at or below -108°F within the pipeline system components and within the CO_2 release plume.[64] Persons or animals close to the rupture could experience tissue damage from the cold temperatures.

Rapid depressurization can also cause the CO_2 to expand with great force, causing physical trauma injuries. Blasts can crush or injure the body and internal organs, including the brain and lungs. The high pressures of the blast can also damage eyes, rupture eardrums, and injure the middle ear.[65]

Other risks from CO_2 ruptures could include vehicle issues for individuals caught in a vapor plume or trying to flee an incident. If enough oxygen is displaced by CO_2, internal combustion engines cannot operate. PHMSA's report on the 2020 Satartia incident noted that individuals on MS 433 and in the area of the migrating CO_2 vapor cloud experienced vehicle engine issues and required emergency assistance to be evacuated.[66]

Results of Dispersion Modeling

As described in **Appendix G**, both the applicant and an independent contractor, Allied, have conducted dispersion modeling to determine the extent and duration of a release of CO_2 during a potential pipeline rupture. The dispersion modeling assumed a guillotine fracture of the pipe because that is the scenario that would release the most CO_2 in the shortest amount of time. Allied analyzed local weather records and determined that a temperature of -22°F and a humidity level of 74.3 percent would result in the highest reasonable toxic impact distance if a rupture were to occur.

The dispersion modeling conducted by Allied calculated the maximum distance at which CO_2 concentrations from a pipeline rupture could reach toxic levels. The toxic impact distance at which CO_2 concentrations could reach 40,000 ppm (the immediately dangerous to life and health level) at -22°F and a humidity level of 74.3 percent was calculated at 617 feet, as shown in Table 4 in the Aerial and Thermal Dispersion Report (AD Report) in **Appendix G**. The toxic impact distance at which CO_2 concentrations could reach 30,000 ppm (the National Institute for Occupational Safety and Health Short Term Exposure Limit, which is the maximum time-weighted average concentration to which a person could be exposed over a 15-minute period without injury) would be 701 feet. The toxic impact distance at which CO_2 concentrations could reach 15,000 ppm would be 910 feet.

Some homes along the pipeline route could be within the toxic impact distances in the event of a pipeline rupture. Homes downslope and with barriers at ground level—would be at risk for greater impacts from gaseous CO_2, which would tend to stay near ground level initially.[67] This means that such a barrier would cause the concentration of CO_2 to build up, posing a higher risk to the health of people or animals in the area.

Staff and members of the public at the Fergus Falls Municipal Airport-Einar Mickelson Field could also be within the toxic impact distance and vulnerable to health effects in the event of a pipeline rupture. Because CO_2 gas is heavier than air, it would not be a problem for aircraft already in flight but could cause engine issues for planes taking off or landing if a rupture were to occur along the pipeline segment closest to the airport. Given the low risk of a pipeline rupture, infrequency of air traffic, and the limited length of the pipeline near the airport, the potential for impacts on aircraft operations is very low.

Results of CFD Modeling

The AD Report recommended an additional computational fluid dynamics (CFD) analysis to account for terrain changes and windbreaks along the pipeline. The CFD analysis showed that terrain along the proposed project did not significantly affect the impact distance of a potential CO_2 rupture. However, windbreaks did significantly decrease the impact distance. The analysis also showed that the total time for release and dispersion would be less than 7 minutes in a worst-case scenario. See the full CFD Report in **Appendix G** for details.

Results of Sensitivity Analysis

A sensitivity analysis was conducted to determine which variables would impact the dispersion of CO_2 after a pipeline rupture. The sensitivity analysis model included five variables: wind speed, air and ground surface temperature, pipeline pressure, volume of CO_2, and relative humidity.

The analysis demonstrates that wind speed has the biggest impact on a potential CO_2 rupture for the proposed project, followed by pipeline pressure, volume, air and ground temperature, and humidity. The full sensitivity analysis report (SA Report) is included in **Appendix G**. As indicated by these reports, the results of the AD Report, SA Report, and CFD Report must be interpreted in conjunction with each other as described above.

8.3.1.3 Public Infrastructure

Leaks would not affect public infrastructure. If a pipeline rupture occurs at a location that is near a road or railroad, this could require road or rail closures to ensure the health and safety of travelers and residents. Closures and an increase in traffic could also occur for the initial emergency response and investigation of the incident. However, CO_2 in gas form dissipates within hours, so closures resulting from nearby ruptures that do not damage infrastructure would be short-term, likely hours rather than days.

A pipeline rupture within a road or rail ROW would create longer closures for repairs. Ruptures near roads and train tracks could also result in the presence of debris and soil displacement that would need to be removed before road or tracks could re-open, as was experienced in the Satartia rupture.[68] Repairs to public infrastructure could result in additional traffic delays for crews to stage and conduct repairs. These closures would likely be intermittent and temporary, resulting in moderate short-term impacts.

Because the pipeline would not cross the Fergus Falls airport property, a pipeline rupture would cause no or minimal damage to the infrastructure of the airport.

8.3.1.4 Noise

A slight hissing noise could indicate the presence of a leak. A pipeline rupture would result in an extremely loud sound as pressurized CO_2 was released into the air and transitioned from a supercritical liquid into a gas or solid. After the immediate rupture event, the gas would make an audible hiss as it emptied from the pipeline. The sound of the CO_2 release would also serve as an alert to anyone nearby. If a rupture occurred, initial emergency response, investigation, and repair of the pipeline would also result in a temporary increase in noise similar to that of when the pipeline was initially constructed.

8.3.1.5 Recreation

Leaks would not affect recreation. A pipeline rupture below a waterway would result in a temporary increase in the CO_2 concentration in the water, which could result in localized reductions in aquatic wildlife, as discussed in Section 8.3.4. This reduction, or activities associated with clean-up and repairs following a rupture, could temporarily impact recreational use of the waterways for activities such as fishing, but impacts would be minimal and short-term. Potential impacts on tourism economies are discussed in Section 8.3.2.

8.3.2 Economies

8.3.2.1 Agriculture

Economies based on agricultural production such as crop and livestock raising could face impacts from an accidental release of CO_2.

The effect of CO_2 leaks would depend on the amount of CO_2 released and the duration of the leak. Studies have shown that higher concentrations of atmospheric CO_2 have beneficial effects on crops. Elevated CO_2 levels increase crop yields by increasing the rate of photosynthesis, which spurs growth, and they reduce the amount of water that crops lose through transpiration.[69] Conversely, increased CO_2

concentrations in soil result in negative effects on root water absorption, chlorophyll, starch content, and total biomass.[70] Localized impacts on crop production could be greater from a long-term leak than a singular rupture event.[71]

The effect of a rupture, as described in Section 8.3.4, would be to damage vegetation and soil in the immediate area of a rupture, with the roots and aboveground portions of plants frozen and soil pH reduced (becoming more acidic). Soil microbes and soil structure would be killed and destroyed in the immediate area. These impacts could lead to an immediate economic loss of crops that are frozen, as well as future losses to the ability to cultivate crops in the more acidic soil. Effects on vegetation that are not frozen in the initial release of CO_2 would be temporary and localized, and related to an increase in CO_2 in the soil.[72]

Livestock in the area of a release would face similar physiological effects as described in Sections 8.3.1 and 8.3.4 for humans, which could result in the deaths of livestock if they were in the immediate area of the rupture or unable to escape a concentrated gas plume. Loss of livestock would have an associated economic loss. As described in Section 8.5.3, EERA staff recommends as a special permit condition that the applicant provide an accidental release plan that must identify how the applicant would pay for costs of any repair to public infrastructure or private property (including crops and livestock) that could occur during an accidental release.

8.3.2.2 Tourism

CO_2 leaks would not affect tourism. Tourism economies based on recreational facilities could be adversely impacted by a rupture (see Section 8.3.1 and Section 5.4.10). A closure of the King of Trails Scenic Byway could negatively impact the tourism economies of communities on either side of the closure because travelers could not drive all the way through. A rupture near the scenic byway would likely result in minimal short-term impacts until the area was restored and any damage to the highway was repaired.

8.3.3 Archaeological and Historic Resources

Because the project would avoid construction through or near identified archaeological and historic resources, minor leaks of CO_2 from the pipeline would have no impacts on identified archaeological and historic resources. A rupture of the pipeline could create physical blast effects associated with a rapid depressurization of CO_2 that have the potential to damage previously unidentified buried archaeological sites if any are adjacent to the area where the rupture occurred. These sites could have cultural significance.

8.3.4 Natural Environment

This section discusses the potential impacts of a CO_2 pipeline rupture on terrestrial and aquatic fauna, including both common and sensitive and/or listed species, as well as on upland and wetland vegetation.

As described in Section 8.3.1, low concentrations of CO_2 typically have limited effects, but extreme CO_2 concentrations can lead to death by asphyxiation. Because CO_2 is denser than air, upon a large release it would form a cloud or fog that would settle into lower-lying areas, displacing oxygen. Such an event would have varying degrees of impact on natural resources, from individual lifeforms to natural systems.

Limited information is available pertaining to the potential impact of CO_2 on wildlife or organisms, specifically in the region of this project. Animals exposed to elevated CO_2 concentrations would likely experience similar effects as humans, such as hypercapnia (buildup of CO_2 in the bloodstream) and asphyxiation resulting in respiratory distress, impaired consciousness, and mortality.[73] The impacts would be different across species and would depend on behavior, such as ability to evacuate the area or state of hibernation.

In a recent study investigating CO_2 tolerability and toxicity in rats and men, van der Schrier et al. (2022) concluded that rats were able to tolerate concentrations of 30 percent and higher, but these concentrations were associated with CO_2 narcosis, epilepsy, poor oxygenation, and at 50 percent CO_2, spontaneous death.[74] Lung hemorrhage and edema were observed in the rats at inhaled concentrations of 30 percent and higher. Euthanasia using CO_2 has been studied in feral swine (18 percent chamber volume per minute for 5 minutes),[75] rabbits (30 to 60 percent, but typically 45 percent for at least 1 hour),[76] and birds (percent CO_2 not measured),[77] thus underpinning the fact that when exposed to high concentrations of CO_2, some mortality among these species would be expected. In the 1986 Lake Nyos incident described in Section 8.2.1, fatalities were noted to have included mammals, birds, amphibians, and reptiles.[78]

Studies of long-term leaks of CO_2 are mainly focused on migration of CO_2 from long-term underground storage sites.[79] Impacts of a leak from a pipeline are less studied; however, a study from a natural CO_2 vent in Italy found greatly decreased vegetation and lower pH within an approximately 10-foot radius around the point where the leak broke the soil surface.[80] Nevertheless, most current research on CO_2 leakage into near-surface environments is limited, especially with respect to pipelines. The potential effects of slow, persistent leakage of CO_2 from pipelines are discussed further below within specific natural resource topics.

8.3.4.1 Water Resources and Wetlands

Leaks of CO_2 into water would increase the water's acidity. When CO_2 dissolves in water, about 1 percent of it forms carbonic acid (H_2CO_3), which almost immediately dissociates to bicarbonate anions (HCO_3^-) and protons (H^+). Because surface waters are in equilibrium with atmospheric CO_2, there is a constant concentration of carbonic acid in the water. The presence of limestone and other calcium carbonate rock in lakes and streams acts to maintain a constant pH because the minerals react with the excess acid. The impact a of leak of CO_2 into water resources and wetlands would be negligible for the same reasons described above. Any potential acidification of surface waters and wetlands would be offset by the relatively high pH of soils and water in the part of Minnesota where the project would be located.

At crossings of large rivers and wetland systems, the pipeline would be installed by HDD, and the pipeline would be at a minimum of 25 feet below the lowest point of the river (see **Table 2-2** in Chapter 2). Leaks from the pipeline under the Pelican, Otter Tail, and Bois de Sioux or Red Rivers would not be likely to reach the water in these perennial rivers, and the effects of a pipeline rupture would have to travel through a minimum of 25 feet of rock and soil before potentially reaching the water. In the event of a rupture of CO_2 from the pipeline into a waterbody, the CO_2 would seek equilibrium and move to lower pressure, resulting in the majority of the gas passing through the water column and into the atmosphere.[81] Because the pH of soils, rocks, and water in this part of Minnesota are naturally basic,[82] the carbonic acid formed after a rupture would quickly revert to CO_2 and water in the abundance of the surrounding water column, or in the presence of water in a wetland. Effects from a pipeline rupture would be short-term.

8.3.4.2 Wildlife

Impacts on wildlife from leaks of CO_2 would be negligible. Forage vegetation in the vicinity of a leak would not be impacted to a level that would affect wildlife.

Any terrestrial wildlife species—mammal, reptile, bird, or insect—regardless of size, would be at risk of injury or death due to blast injury if present in the immediate proximity of a pipeline rupture. Blast injury is a complex type of physical trauma resulting from direct or indirect exposure to an explosion. Blast injuries range from internal organ injuries, including lung and traumatic brain injury, to extremity, hearing, and vision injuries.[83]

After the initial explosive release, the risk to wildlife would come from the CO_2 plume. Individual animals would be subject to the respiratory, cardiac, and impaired consciousness effects described above[84] and potentially to death by asphyxiation. The degree of risk and potential effects on wildlife would vary depending on the class of wildlife affected; wildlife are described by class below.

Mammals

CO_2 leaks would not affect mammals. In the case of a pipeline rupture, large mammals with a high degree of mobility and range would most likely be able to avoid the plume of CO_2 if they were not too close to the point of rupture. Smaller mammals, including both those with limited mobility and range such as mice, voles, and shrews and those with moderate mobility and range such as groundhogs and skunks, would be less likely to escape and, depending on the intensity of the release, might die or suffer respiratory and/or cardiac distress. Similarly, mammals in burrows might be unable to avoid the CO_2 release because the CO_2 cloud would likely settle into and fill burrows.

Time of day would also influence potential impacts, regardless of the animal's mobility. If a rupture were to occur at night, when many mammals are inactive or bedded down, the CO_2 plume could envelop some individuals before they could react and move away, regardless of their mobility.

Bat species would be more likely to survive a large CO_2 release because they are able to fly, they carry their newborn young with them, and their daytime roosts are off the ground. Young bats (3 to 10 weeks in age) can frequently be left at drop-off points within about 1 mile of maternity roost trees while mothers feed further away,[85] leaving them vulnerable at the time of a release. However, these drop-off points are usually well above the ground. Combined, these factors make it less likely that bats would be injured or killed by a CO_2 release.

Birds

Birds would not be impacted by a leak.

While all North American birds have some degree of flight capability, individual species vary in their flight behavior and habitat preferences. In the event of a rupture, most mature or fledged perching birds (birds who fly frequently and visit numerous locations, normally well above the ground) would be able to avoid a CO_2 plume and would likely flee the area or would roost well above the CO_2 plume.

Ground-nesting species with low to high flight capability might be more vulnerable to a CO_2 plume. If the rupture were to occur outside of a species' nesting season, ground-nesting species would be more likely to survive a release because they would tend to flee the area. When eggs or newborns are present in a nest, adult ground-nesting birds might have higher rates of injury or death from a CO_2 plume. This is because the adult on the nest would be expected to remain and protect the eggs or young. The effect of elevated CO_2 on eggs is uncertain and would depend on the size and duration of the CO_2 plume on the eggs.[86]

Aquatic birds and wading birds typically have very good flight capabilities and could avoid a CO_2 plume. However, there are two additional factors to consider: time of day and landscape position of aquatic features. The time of day of a release would affect the survival and injury rates of aquatic birds. This is because at night, ducks mostly sleep floating on water or in near-shore vegetation. Water features and adjacent vegetation occur in lower elevations in the landscape, where a CO_2 plume is more likely to settle and displace oxygen. Therefore, a nighttime CO_2 release would likely have a greater impact on aquatic bird populations than a daytime release.

Reptiles and Amphibians

CO_2 leaks would not affect reptiles and amphibians. However, due to their generally small size, limited speed, and body statures close to the ground, reptiles overcome by a CO_2 cloud would likely die or experience respiratory trauma and disorientation. Reptiles are cold-blooded. Therefore, the lower temperatures in a CO_2 cloud could also slow reptile metabolism and their ability to escape the area.

As with reptiles, amphibians are generally small, with limited speed and body statures close to the ground. However, amphibians tend to live in or adjacent to water sources and would be better able to initially escape a CO_2 plume by temporarily submerging. However, waterbodies and wet habitats are found in lower elevations, where a CO_2 plume would be more likely to settle. As a result, some individuals from amphibian species might eventually be overcome by a large, persistent CO_2 plume and would likely die or experience respiratory trauma and disorientation.

Insects

CO_2 leaks would not impact insects. Flight-capable insects would be best suited to survive a large CO_2 rupture. Slower moving insects, as well as those species whose habitat preferences are in aquatic, wetland, or other low-lying areas, would be most susceptible to the effects of a CO_2 plume. Regardless of mobility, all insects would be sensitive to the lower, initially near-freezing temperatures of a CO_2 plume. Insects are cold-blooded animals whose metabolic functions slow rapidly in cold temperatures. As a result, the ability of insects to escape a CO_2 plume would be related to the size and extent of the plume. Insects present in the immediate vicinity at the time of a CO_2 pipeline rupture would likely die due to the sudden release of near-freezing air and ice solids.

The ability of aquatic insects to survive near a CO_2 release depends on the size and location of the release. Like other animals, insects breathe in oxygen and respire CO_2. Aquatic insects can have gills like fish or will breathe through snorkel-like tubes. If a CO_2 plume were to settle over a pond or other low-lying aquatic site, aquatic insects present would experience oxygen depletion for the duration of the plume's presence. Therefore, aquatic insects are potentially susceptible to an oxygen-depleted atmosphere.

Fish and Freshwater Mussels

CO_2 leaks would be unlikely to impact fish and freshwater mussels. As described above, an increase in water acidity from a CO_2 leak would be buffered by limestone and calcium carbonate naturally present in the lake or stream. Fish appear to be less sensitive to the physiological impacts of acidification than invertebrates with carbonate shells, and adult fish are less sensitive than eggs and juvenile fish. Additionally, fish are mobile and could avoid the bubble stream from a leak. Increased CO_2 concentrations from a leak beneath a waterbody that continues over a long period might result in localized adverse impacts on freshwater mussels because of their inability to change locations.

The impact of a CO_2 rupture on fish and freshwater mussels would vary depending on the location and duration of the rupture. A rupture below or adjacent to a stream would kill fish and freshwater mussels in the immediate area through the force of the blast. The escaping CO_2 could be at or below a temperature of -108°F, which would lower water temperatures rapidly. This could cause death or tissue damage to fish and mussels due to exposure to extremely cold water.

The most probable adverse effect of a CO_2 rupture into a flowing stream is a lowering of pH and direct toxicity effects. A temporary oversaturation could occur adjacent to a rupture site, with CO_2 concentrations potentially reaching toxic levels. CO_2 concentrations at high levels would be toxic to fish and result in morbidity or mortality for fish in the immediate area. Mobile adult fish unaffected by the force of a rupture would likely move away from the release.[87] Toxic levels of CO_2 concentrations near the source would result in morbidity or mortality for immobile invertebrates. Most impacts on surviving fish would be short-term, improving soon after the rupture is stopped. Re-colonization by invertebrates could take 1 year or longer.

Fish and freshwater mussels in streams or lakes outside of the immediate area of a rupture would not be affected. A plume reaching a stream or lake from a rupture occurring at a location away from the waterbody would no longer be at extremely cold temperatures and would not notably acidify the waters.

8.3.4.3 Vegetation and Wildlife Habitat

Undetected leaks of CO_2 into soil would slow plant growth. Although higher levels of CO_2 in the atmosphere may stimulate plant photosynthesis, high soil concentrations are usually detrimental. New CO_2 releases into vegetated areas cause noticeable die-off,[88] and pipeline inspections typically look for dead vegetation as an indicator of a potential leak.[89] A study of CO_2 leakage from deep storage sites found damage, including reduced root and shoot growth and seed yield, in vegetation above the leakage.[90] Leaks from the project would be smaller in volume than leakage from the long-term, deep-storage site studied.

Impacts on vegetation and habitat from a CO_2 leak would be largely localized above the pipeline and might result in a reduction of local plant growth .[91] In one study, measurements made after treating plants with CO_2 gas indicated that recovery of vegetation was close to complete after 12 months.[92]

In the event of rupture, impacts on vegetation and specific habitat types would be limited to the immediate area of the rupture. Soils around the rupture site would be instantly frozen due to the thermodynamics of sudden loss of pressure in a pressurized gas and the ensuing formation of dry ice solids. This phenomenon can be seen in **Figure 8-1**, which shows a 30-foot-wide crater with ground that is frozen and covered in white ice solids.[93] The sudden freezing of soils would instantly kill all herbaceous ground vegetation. Local soil microbes, mycorrhizae, and soil animals such as worms, arachnids and insects would also die; however, these would re-colonize after the area is restored.

8.4 What steps would be taken in the event of an accidental release?

In the case of a rupture, the applicant would follow the steps in its Emergency Response Plan mandated by PHMSA. The network of local emergency services providers would respond along with applicant personnel. The National Incident Management System (NIMS) provides a framework for responding to emergencies, and EPA's National Response Center provides support in case of an emergency related to a release of hazardous substances when requested or when state and local first responder capabilities have been exceeded.

PHMSA regulates the safety of pipelines that transport hazardous liquids, including CO_2, in accordance with the regulations in 49 CFR Part 195. It develops safety regulations and other approaches to risk management to ensure safety for emergency response associated with a leak or rupture of pipeline facilities. This work is shared with state agency partners and others at the federal, state, and local levels.

Homeland Security Presidential Directive 5, Management of Domestic Incidents, directed the development and administration of NIMS. NIMS provides a consistent nationwide template to enable federal, state, local, and Tribal governments; non-governmental organizations; and the private sector to work together in case of an incident such as an accidental pipeline release. The NIMS template provides measures to prevent, protect against, respond to, recover from, and mitigate the effects of incidents, regardless of cause, size, location, or complexity. NIMS includes:

- a unified approach to incident management called the Incident Command System;
- standard command and management structures; and
- an emphasis on preparedness, mutual aid, and resource management.[94]

As required by PHMSA and noted in Section 8.5.1, the applicant must develop a plan to respond to an accidental release of CO_2 that follows federal guidelines. The applicant's draft Emergency Response Plan is included as **Appendix N**. The Emergency Response Plan would detail the steps for using the federal NIMS Incident Command System to respond to any emergency on the pipeline, including a rupture.[95] This includes the designation of a Company Qualified Individual who would be available 24 hours per day, 7 days per week and would have the expertise and authority to respond to a release and begin the Incident Command System process, including ensuring that EPA's National Response Center receives the mandated report.[96] Additionally, the first company employee on the site of the release would initially act as the person-in-charge and Incident Commander until relieved by an authorized person. The Incident Commander, as part of a local response team would initially manage the incident with support from the Company Support Team as needed. The Company Support Team would be equipped to coordinate all aspects of the response to a release in the long-term.[97]

According to the applicant's draft Emergency Response Plan (see **Appendix N**), the applicant's planned response to any incident involving the accidental release of CO_2 would consist of the following actions:

- Employees initially on site would call 911 if appropriate, and the control center would contact relevant emergency services and other agencies.
- The pipeline segment involved would be shut down immediately. On-site employees would communicate with the control center to ensure that the proper MLV is closed either manually or remotely to limit the CO_2 released.
- Identification of the location of the release would involve the identification of evidence of CO_2 release by company personnel as well as area emergency services and aerial patrol.[98]
- The control center would determine the need for notification of external parties, including those located downwind of the incident, and law enforcement and fire departments to assist with evacuation and any roadblocks.
- A Company Response Crew would be sent by the control center to investigate the incident, conduct an initial response to the release, and make a risk assessment, leading to the formation of a Local Response Team based on specific needs of the incident.
- The applicant would notify the railroad dispatcher if the release is near active railroad tracks.
- The Company Qualified Individual or Incident Commander would work with local emergency response agencies including 911 dispatchers and county emergency mangers instead of coordinating with each individual emergency service department.

- Based on the specific incident and local capabilities, a Company Support Team could be activated.

8.5 What steps would be taken to prevent an accidental release?

PHMSA sets pipeline safety standards to reduce the possibility of an accidental release. The applicant proposes the additional measures below to further reduce the potential for an accidental release. Additional mitigation measures are provided in this section to protect against an accidental release and to limit limiting impacts if one should occur.

8.5.1 Applicant Measures

The applicant would take measures to prevent unexpected and abnormal conditions that could result in an accidental release of CO_2 through the methods discussed below. The applicant would also train and coordinate with emergency managers and educate the public on the dangers of a pipeline rupture and what residents should do if one occurs.

8.5.1.1 Design, Construction, and Operation Measures that Exceed PHMSA Regulations

The applicant has proposed measures related to the design, construction, operation, and maintenance of the pipeline that would mitigate safety hazards, as described in Chapter 2.

As described in Section 2.3.2.1, the applicant would install five MLVs along the pipeline to isolate segments of the pipeline to contain the CO_2 during normal operations and maintenance. In the event of a release, closing an MLV would limit the amount of CO_2 released. The applicant would be able to operate MLVs manually or remotely.

Ductile fractures can run hundreds of feet and result in a pipeline rupture. The applicant has committed to installing heavier wall pipe and including fracture arrestors throughout the system if needed.

The applicant’s maintenance and inspection program would be designed to detect internal and external anomalies in the pipe, such as corrosion, dents, and other irregularities, and to clean the pipeline. As described in Section 2.6.1, the applicant would monitor operation of the project continuously from its control center. The applicant would also use a leak detection system, incorporating a real-time hydraulic model of the pipeline system that would run in parallel with monitoring pressure and volume with system instruments.

In its response to Supplemental Information Inquiry #9 (see **Appendix I**), the applicant committed to the following measures during the design, construction, and operation of the project that would exceed PHMSA safety standards:

- “Exceed the requirements of 49 CFR 195.234 by requiring 100 percent of all girth welds to be nondestructively tested and incorporating auditing of nondestructively test results, records, and procedures.”
- “Exceed the requirements of 49 CFR 195.214 by incorporating additional mechanical testing in excess of API 1104 Section 5 and 12 by conducting Charpy V-Notch Testing, Vickers Hardness Testing and Cross Weld Reduced Section Tensile.”
- “Exceed the requirements of 49 CFR 195.304 hydrotesting requirements by testing all pipe systems for (8) hours at 125 [percent] maximum operating pressure (MOP) prior to operations.”

- "Exceed the requirements of 49 CFR 195.112. [The applicant's] pipelines will be specified to API 5L, PSL-2 standards which mandates the additional metallurgical requirements, inspections, and record retention. In addition, all pipelines will be manufactured in accordance with SCS developed Line Pipe Specification with considerations to more stringent requirements for mechanical properties for fracture control design, stringent dimensional requirements where applicable for improved constructability and stringent inspection and testing criteria to include non-destructive evaluation of the welded pipes."
- "Exceed the requirements of 49 CFR 195.111 by engaging the services of ITI and Microalloy to assist with an extensive fracture propagation and ductility analysis to determine the required metallurgical properties for the proposed pipeline system as well as utilizing crack arrestors."
- "Exceed the requirements of 49 CFR 195.250 by utilizing a 24-inch clearance between the outside of the pipe and the extremity of any underground structure, including drain tiles, where feasible. In the event a 24-inch clearance cannot be achieved, [the applicant] will meet the minimum requirements stated in 49 CFR 195."
- "Exceed the requirements of 49 CFR 195.406 by implementing redundant pressure indicator (transmitter or PIT) on pump discharge, overlapping over pressure protection control logic, soft high pressure alarms well below MOP, and pump shutdown control logic below MOP. Additionally, [the applicant] performed a comprehensive surge study that showed anticipated surge pressures to be well within regulation even when only local controls were considered."
- "Exceed the requirements of 49 CFR 195.407 by implementing a system wide dual communication path to all pump stations, mainline valve sites, PLR sites, and capture sites."
- "[Perform] inspections on all phases of the pipe manufacturing process at each pipe mill to ensure full compliance with all QC measures."
- "Perform a factory acceptance test for each premanufactured component for facilities (pumps, compressors, dehydration units)."
- "[Place] interior and exterior infrared cameras…at the capture facility to detect a potential carbon dioxide leak."
- "[Place] interior carbon dioxide and oxygen detectors…at pump facilities to detect both the presence of hazardous vapors and confirm that there is sufficient oxygen for a safe environment."
- "Conduct aerial patrols along the pipeline system to monitor and identify surrounding environmental conditions."

The applicant states it has consulted with two separate engineering consultants to review valve soft composite material compatibility with the applicant's product composition standards. In addition, all PHMSA-regulated facilities are designed to be "piggable" with inline inspection tools.

8.5.1.2 Emergency Response Plan

PHMSA's minimum standards for operating and maintaining pipeline facilities include the requirement to establish a written plan governing these activities. Each pipeline operator is required under 49 CFR Section 195.402 to establish an emergency plan that includes procedures to minimize the hazards of a hazardous liquid pipeline emergency. The plan must include procedures for:

- receiving, identifying, and classifying emergency events, accidental release of CO_2, operational failure, or natural disaster;

- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- emergency system shut-down and control of released CO_2 at an accident scene;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- minimizing harm to the public by assisting with the evacuation of residents and assisting with traffic control, or other appropriate actions.[99]

For accidents that could occur during operation of the project, the applicant has developed a draft Emergency Response Plan, provided as **Appendix N**, that describes the actions the applicant and local first responders would take to minimize human health and safety impacts in the event of release of CO_2 from the project. This plan was described in Section 8.4.

8.5.1.3 Coordination with Emergency Managers and Responders

PHMSA requires that each operator establish and maintain a liaison with appropriate fire, police, and other public officials who might respond to a CO_2 pipeline emergency and to coordinate mutual assistance. Operators must also establish a continuing education program to enable emergency response personnel to recognize a CO_2 pipeline emergency and handle it appropriately.

The applicant would work with the local police departments, ambulance districts, and local and rural fire departments to develop response plans in case of a rupture. These plans would be based on the estimated volume of a release, topography, proximity of habitable structures, and weather conditions and include site maps, haul routes, schedules, contact numbers, training, and plans for orderly evacuation of the public in the event of a release. The applicant indicates that its employees, contractors, and agency responders would be equipped with tools, supplies, and equipment available to be used in cases of emergency conditions existing on or near the pipeline system. Self-contained breathing apparatus might be required pending results from site-specific hazards and monitoring results. Emergency response organizations would be notified to help control traffic, establish danger zones to control sightseers, and determine if roadblocks are necessary for pedestrian, automotive, or train traffic.

The applicant met with the Otter Tail and Wilkin County Commissioners and Emergency Managers to discuss planning for emergencies and scheduling training of first responders in their respective areas. These meetings occurred on September 12, 2023, for Wilkin County and September 25, 2023, for Otter Tail County.

8.5.1.4 Public Education

The applicant hosted several public open houses during the application development process to introduce the surrounding communities and agencies to the project and educate them on the potential safety risks associated with the unlikely event of an accidental CO_2 pipeline rupture. The applicant also sent out direct mail communications to landowners, Tribal leaders, agencies, local units of government, and elected and public officials to explain the project.

The applicant would implement a damage prevention and public awareness program to educate the public, first responders, and other stakeholders; help protect the pipeline from damage from third parties; and help prevent or mitigate effects on public health and the environment.

8.5.1.5 Training and Equipment Reimbursement

The applicant would train workers in roadway safety, and certain workers would also be trained in first aid and safety to provide an immediate response.

The applicant has committed to provide CO_2 air monitoring equipment to first responders and to pay all costs associated with CO_2 response training and air monitoring equipment. The applicant states that the "distance to which the equipment, training, and reimbursement would be provided will be discussed and decided with Emergency Managers and first responders during preparedness training, based on the location of nearest residents and the capabilities of the first responders" (see **Appendix N**).

The applicant has committed to work with county emergency managers to plan for training of first responders prior to and during construction so that emergency responders would be prepared once the project goes into operation. Training would include discussions of CO_2 pipeline operations and initial response tactics in case of an emergency. The training would also cover the use of CO_2 and oxygen monitoring equipment and potential response actions, and would incorporate tabletop exercises and drills. Handheld CO_2 and oxygen monitors would be provided by the applicant to first responders. The applicant states that additional needs for each county would be discussed on a case-by-case basis.

8.5.2 Mitigation Proposed During Scoping

Many commenters suggested that the applicant provide emergency preparedness education to the public and pay for emergency response training, safety equipment, and emergency vehicles with non-internal combustion engines for use in the event of a pipeline rupture. One individual recommended adding an MLV at the Pelican River crossing to protect nearby populations, and another recommended valves at every stream crossing. Another commenter recommended that the applicant provide education, pipeline markers, and instructions in case of rupture to landowners along the pipeline. Another individual recommended that the applicant be required to obtain adequate insurance to cover all costs of a potential pipeline rupture.

Several commenters requested that the pipeline be routed more than 50 feet from residences to mitigate risks from a potential pipeline rupture. This mitigation would not be consistent with PHMSA regulations, which set out standards for the design and safety of liquid and gas pipelines but do not specify any setback or minimum distance between the pipeline and a residence.

Many commenters recommended that the pipeline be buried deeper than the proposed 54 inches so that frost would not over time cause premature failure of the pipeline.

During scoping, comments were received about possibly adding an odorant to the pipeline. Odorants are required by PHMSA in certain natural gas pipelines,[100] such as distribution lines and some transmission lines in high population areas, so that the combustible gas is readily detectable by a person with a normal sense of smell. The regulations do not specify what odorant is to be used, but natural gas utilities typically use various organosulfur compounds because of their strong and distinct odor, high degree of chemical stability to persist in the natural gas system and the environment, high vapor pressure to avoid condensation, and low freezing point. There are no PHMSA regulations that require use of odorants in CO_2 pipelines or in other hazardous liquid pipelines, and the applicant does not propose to add an odorant (see **Appendix I**).

CO_2 is odorless at low concentrations but has a sharp, acidic odor at very high concentrations.[101] The applicant states that addition of an odorant would require multiple injection facilities and would introduce additional logistic and design changes needed for the safe storage and overland transport of the odorant (see **Appendix I**). Staff did not verify these statements.

The Pipeline Safety Trust commented that PHMSA should prescribe the maximum concentration of water, hydrogen sulfide, and other impurities allowed in CO_2 pipelines. The Commission cannot set safety standards, including impurities allowed in CO_2 pipelines. Another commenter recommended redundant monitoring of water before the CO_2 is placed into the pipeline.

Commenters recommended that the Commission require a detailed safety plan from the applicant and detailed plans on the type of system to be used to detect leaks.

8.5.3 Mitigation Recommended by EERA Staff

EERA staff believes that applicant-provided indoor CO_2 detectors for residences within 1,000 feet of the project is a reasonable mitigation measure. This distance was chosen based on the most impactful scenario as described in **Appendix G**.

EERA staff believes that a special permit condition requiring the applicant to file its Emergency Response Plan that is filed with PHMSA with the Commission is reasonable.

EERA staff believes that a special permit condition requiring the applicant to provide an accidental release plan, developed in coordination with local emergency responders, for Commission review 30 days prior to submittal of the Plan and Profile is reasonable. The accidental release plan could include the specific equipment, training, and reimbursement that could be provided to emergency managers. The plan could also list the names of the emergency responders and a provision to update contact information as needed. The plan could discuss the feasibility of a “reverse 911” notice that goes out to landowners’ telephones in the event of an emergency shutdown or rupture. The release plan could identify how the applicant would pay for costs of any repair to public infrastructure or private property (including crops and livestock) that might occur during an accidental release.

EERA staff believes a special permit condition requiring the applicant to identify locations of fracture arrestors and any locations of thicker-walled pipe on the Plan and Profile filed with the Commission is reasonable.

EERA staff believes a special permit condition requiring the applicant to provide its public education plan for Commission review 30 days prior to submittal of the Plan and Profile is reasonable. The public education plan could include specific safety information for neighboring landowners, including what to do in case of a rupture.

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Chapter 9 Unavoidable Impacts and Irreversible and Irretrievable Commitments of Resources

This chapter describes unavoidable project impacts and irreversible and irretrievable commitments of resources.

9.1 Unavoidable Impacts

Resource impacts are unavoidable when an impact cannot be avoided even with mitigation strategies.

Pipelines are infrastructure projects that have unavoidable adverse human and environmental impacts. These impacts and measures to mitigate them are discussed in Chapter 5. However, even with mitigation strategies, certain impacts cannot be completely avoided.

9.1.1 Construction

Unavoidable adverse impacts associated with construction of the project include minor traffic delays due to construction equipment or material hauling. In addition, some fugitive dust could be generated during dry conditions at unpaved travel surfaces and soil stockpiles. Conversely, very wet conditions could result in soil erosion impacts. Soil compaction would be unavoidable in unpaved areas of equipment and vehicle operation. Soils would be decompacted during restoration, but some compacted soils could remain.

Cultivated land within the construction workspace would be taken out of production for a growing season. The land would typically take 2 to 3 years, but could take up to 5 years, to return to full production.

Except for areas between the HDD entry and exit points, vegetation and wildlife habitat in both upland areas and wetlands would be cleared in the construction workspace, resulting in unavoidable minor vegetation and habitat loss. Vegetation loss generally would be short-term, lasting until the area is restored, but impacts in wooded areas would be long-term. The cleared vegetation could also result in minor temporary to long-term aesthetic impacts.

Temporary construction noise from vehicles and equipment would be unavoidable. Additionally, construction activities would be visible to nearby residents and travelers of adjacent roadways.

Intermittent waterbodies such as drainage ditches would experience temporary and unavoidable increases in turbidity during open cut construction. Wildlife could experience temporary disturbance from noise and displacement during construction. Individuals of small, less mobile species could be inadvertently crushed or buried.

Finally, emissions, including GHGs from internal combustion engines used for construction, would be unavoidable.

9.1.2 Operations

Unavoidable impacts during operations include emissions, including GHGs, from the capture facility and operation of mowers or other equipment used for maintenance of the pipeline. The operational easement would entail some restrictions for landowners. For example, trees could not be grown over the pipeline, and structures would not be allowed. The MLVs along the pipeline route and the capture facility would be visible. The capture facility would contribute additional noise to the area of the ethanol plant.

9.2 Irreversible and Irretrievable Commitments of Resources

Resource commitments are irreversible when it is impossible or very difficult to redirect that resource to a different future use; an irretrievable commitment of resources means the resource is not recoverable for later use by future generations.

Irreversible impacts include establishment of the operational pipeline ROW. While it is possible that the pipeline could be abandoned and the operational ROW restored to previous conditions and the easement vacated, this is unlikely to happen in the reasonably foreseeable future. Conversion of forested wetlands within the operational ROW could be considered irreversible because replacing these wetlands would take a significant amount of time after the pipeline is abandoned and the operational ROW is no longer maintained.

For project construction, irretrievable commitments of resources include the use of fuel, water, aggregate, steel, concrete, electricity, and other consumable resources. The commitment of labor and fiscal resources is also considered irretrievable. During operations, irretrievable resources would include energy and groundwater use by the capture facility and the fuels used in equipment and vehicles for maintaining the capture facility and pipeline.

Chapter 10 Cumulative Potential Effects

Chapter 10 summarizes the cumulative potential effects of the project and other projects.

10.1 Cumulative Impacts

Consideration of cumulative potential effects is intended to aid decision-makers so that they do not make decisions about a specific project in a vacuum. Effects that might be minimal in the context of a single project might accumulate and increase when all projects are considered.

Cumulative potential effects are impacts on the environment that result from “the incremental effects of a project in addition to other projects in the environmentally relevant area that might reasonably be expected to affect the same environmental resources, including future projects actually planned or for which a basis of expectation has been laid, regardless of what person undertakes the other projects or what jurisdictions have authority over the projects.”[1] The environmentally relevant area includes locations where the potential effects of the project coincide with the potential effects of other projects to impact the elements studied in this EIS. Generally, this area includes the ROIs for the different resource elements, as defined in Chapter 5.

Cumulative effects are discussed here for projects that are foreseeable in the next 5 years. The applicant proposes to construct the pipeline from March to July 2025 and to construct the capture facility from May to August 2025. Therefore, construction impacts could be cumulative with other projects being constructed during that same time frame, depending on the proximity of the projects and resource being considered.

The following websites were searched for current or upcoming projects:

- City of Fergus Falls, Minnesota
- City of Breckenridge, Minnesota
- City of Wahpeton, North Dakota
- Otter Tail County, Minnesota
- Wilkin County, Minnesota
- Richland County, North Dakota
- Minnesota EQB Interactive Database/Map
- *EQB Monitor* (recent issues)
- MnDOT State Transportation Improvement Program 2024–2027
- MnDOT 10-Year Capital Highway Investment Plan 2024–2033
- North Dakota Department of Transportation
- Bureau of Land Management National NEPA Register

No relevant projects were found in the EQB interactive project database. Funding recipient lists of various USACE, DNR, EERA, and MPCA programs were reviewed, and a general internet search was conducted.

Current and reasonably foreseeable future projects are summarized in **Table 10-1** and shown in **Figure 10-1**. Most of these projects are infrastructure-related. Several support recreational opportunities and would benefit surrounding lakes, watercourses, and natural areas.

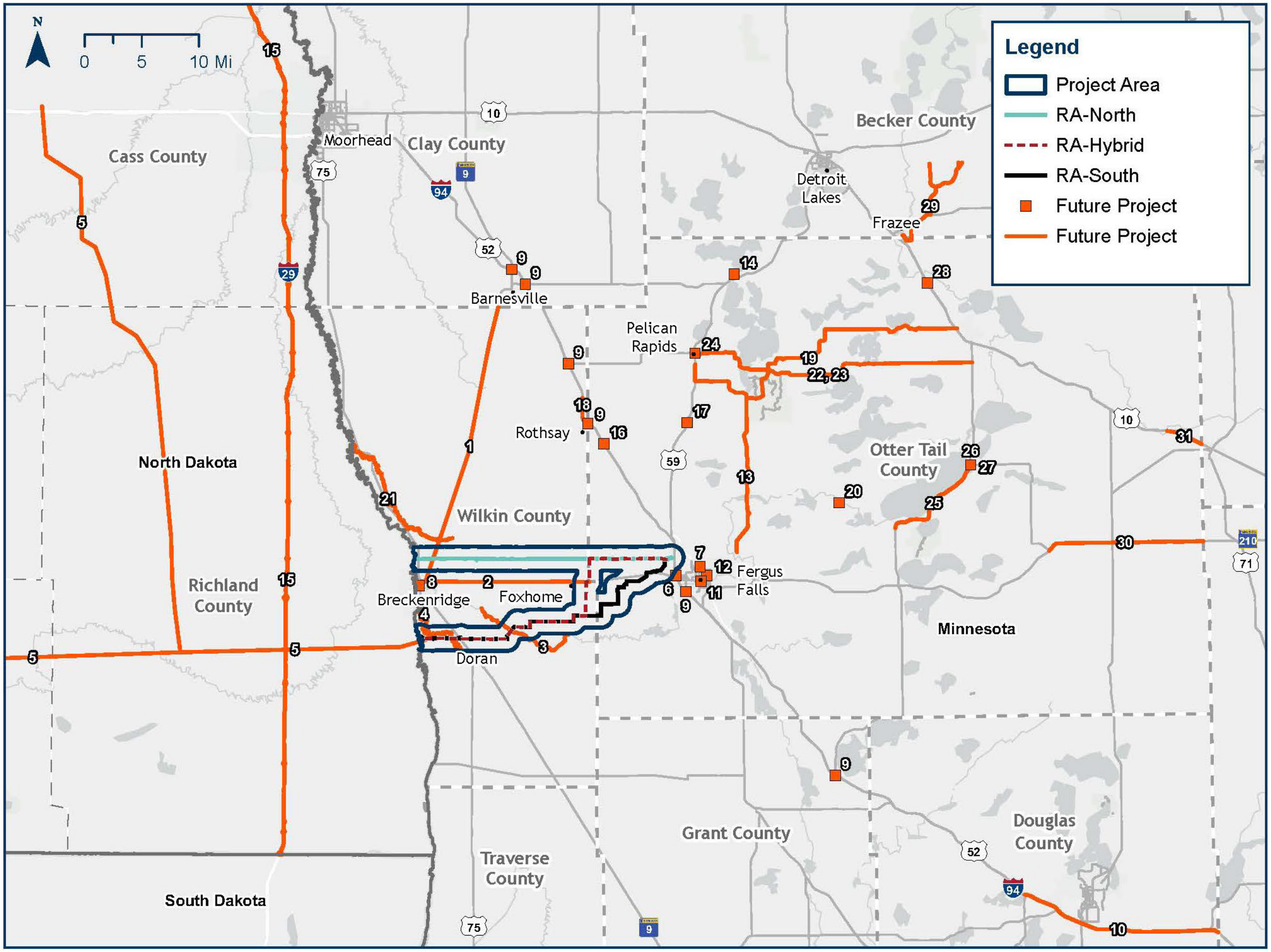
Table 10-1 Current and Reasonably Foreseeable Future Projects

Project Number and Name	Location	Anticipated Construction Schedule	Description
1 – Resurface MN 9[2]	Wilkin County, MN	2028	Resurface MN 9 from Highway 210 to 6th Street in Barnesville
2 – Resurface MN 210[3]	Wilkin County, MN	2029	Resurface MN 210 from Highway 75 to 110th Avenue
3 – Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River, Wilkin County, Minnesota (USACE)[4]	Wilkin County, MN	Construction Q1 2024 – Q4 2025; Project Partnership Agreement with non-federal sponsor anticipated to be signed in spring 2024	Ecosystem restoration project along the Lower Otter Tail River that will implement overflow structures, rock riffles, toe wood sod mats, and channel excavation. The project will reestablish and stabilize the river to a more natural condition.
4 – Doran Creek Stream and Ecological Restoration[5]	Wilkin County, MN	Construction anticipated 2024–2025[6]	Rehabilitation of 15 miles of Doran Creek to improve function of the riparian corridor
5 – Midwest Carbon Express (MCE) Project[7]	Richland County, ND	Currently in planning and permitting phase	System of pipelines to capture and sequester CO_2 across Minnesota, North Dakota, South Dakota, Iowa, and Nebraska. The project is part of this system.
6 – Highway 210 Bridge Reconstructions[8]	Otter Tail County, MN	2026	Reconstruct and replace bridges from Hwy 210 from west of Hwy 94 to Junction Hwy 94
7 – Union Avenue Mill and Overlay and Pedestrian Improvements[9]	City of Fergus Falls, MN	Completed September 2023	Continued improvements to market structure, street, sidewalks, and parking lot along N Union Avenue
8 – Electrical Distribution System Upgrade[10]	City of Breckenridge, MN	Phase 2 – 2022 to 2024 Phase 3 – 2025 to 2028	Construction of two new substations adjacent to existing substations, and increase distribution voltage
9 – I-94 Interchange Lighting Replacement[11]	Otter Tail and Wilkin Counties, MN	2024	Replacement of I-94 interchange lighting at Exits 22 and 24

Project Number and Name	Location	Anticipated Construction Schedule	Description
10 – Resurface I-94[12]	Otter Tail County, MN	2025	Concrete resurface east-bound lanes from west of CR 11 to Hwy 59
11 – Downtown Riverfront Improvement Project: Phase 2[13]	City of Fergus Falls, MN	Began in May 2023, expected to finish late spring or early summer 2024	Parking lot reconstruction, improvements to concrete areas, and construction of a splash pad along the Otter Tail River
12 – Aquatic Center[14]	City of Fergus Falls, MN	Contractor selected in August 2023, timeline being developed	Construction of an aquatic park including a 4-lane lap pool, leisure pool, bath house, and concessions area
13 – Glacial Edge Trail Extension[15]	Otter Tail County, MN	Master plan finalized in 2021, state legislature passed bonding bill summer 2023[16]	Construction of a 10-foot-wide, 14-mile extension to Glacial Edge Trail
14 – Echo Bay Regional Park[17]	Otter Tail County, MN	In planning phase – no master plan made public or announcement of contractor bidding yet	Development of a new, 165-acre park along Fish Lake and the Pelican River
15 – I-29 SMART Corridor[18]	Richland County, ND	Recommendations will be provided in 2024, with implementation over a 5- or 10-year period	A program to increase the safety of I-29 by managing the network of devices and sensors; expand roadway monitoring and condition reporting to an around the clock, year-long schedule; and streamline the deployment of advanced technologies
16 – Westbound I-94 Repair[19]	Otter Tail County, MN	2024	Westbound I-94 emergency repair near the county line
17 – Resurface US 59[20]	Otter Tail County, MN	2027	Resurface US 59 from I-94 to south of 5th Avenue in Pelican Rapids; bridge replacement
18 – Snow Fence Installation[21]	Otter Tail and Wilkin Counties, MN	2025	Snow fence installation near Rothsay
19 – Heart of the Lakes Trail[22]	Otter Tail County, MN	September 2022 – September 2023[23]	Construction of 6.83-mile-long, 10-foot-wide trail addition to Perham to Pelican Rapids Regional Trail

Project Number and Name	Location	Anticipated Construction Schedule	Description
20 – Phelps Mill County Park Improvements[24]	Otter Tail County, MN	Funding provided late 2022 for fiscal year 2024[25]	Improve and increase trails, boardwalks, water access, parking, and recreation areas within Phelps Mill County Park
21 – Whiskey Creek Restoration Project: Phase 3[26]	Wilkin County, MN	Active construction as of summer 2023[27]	Sediment removal project and creation of a water management district along Whiskey Creek
22 – Highway 108 Sign Replacements[28]	Otter Tail County, MN	2024	Sign replacement on Hwy 108 from Pelican Rapids to Hwy 78
23 – MN 108 Reconstruction[29]	Otter Tail County, MN	2024–2026	Reconstruction of MN 108 from 4th Street in Henning to Junction of Hwy 210
24 – Pelican Rapids Street Reconstruction[30]	Pelican Rapids, MN	2024	Complete street reconstruction in Pelican Rapids; resurface bridge
25 – Resurface MN 78[31]	Otter Tail County, MN	2030	Resurface MN 78 from Wagon Trail to County Road 54
26 – Ottertail Sidewalk and Pedestrian Improvements[32]	Ottertail, MN	2024	Sidewalk and pedestrian improvements along TH 78 in Ottertail
27 – Railroad Signal Replacements[33]	Otter Tail County, MN	2026	Replace existing signal system at Soo Railroad and MN 78
28 – US 10 - County Road 60 Intersection Revision[34]	Otter Tail County, MN	2024	Revise intersection between US 10 and County Road 60
29 – Frazee to Erie Transmission Line[35]	Otter Tail County, MN	Substation construction complete; Construction will resume in 2024 and is anticipated to conclude in spring or summer 2024	Construction of new 230/115 kV Erie Substation, 9.4 miles of new 115 kV transmission line, and 1.7 miles of transmission line conductor added to existing structures
30 – Resurface Hwy 210[36]	Otter Tail County, MN	2025–2027	Resurface Hwy 210 from Hwy 29 to west of Hwy 71 near Hewitt, then New York Mills to Bluffton
31 – US 10 Road Reconstruction[37]	Otter Tail County, MN	2025	Road reconstruction on US 10 from 1.3 miles west of CSAH 75 into Wadena County

Figure 10-1 Current and Reasonably Foreseeable Future Projects in Otter Tail and Wilkin Counties, Minnesota, and Richland County, North Dakota



10.1.1 Impacts Anticipated to be Negligible

The project would have no or negligible impacts on commercial economies, forestry, or mining (see Section 5.3).

10.1.2 Human Settlement

10.1.2.1 Aesthetics

Potential Effects of Project on Aesthetics

Potential impacts on aesthetics are expected to be minimal to moderate, with the greatest impacts occurring during construction of the pipeline. Construction impacts would mainly consist of visible trenching, dirt piles, equipment laydown areas, and increased traffic and presence of construction vehicles, machinery, and equipment. Vegetation removal would likely increase the visibility of construction to some residences along the routes; however, aerial imagery indicates that these residences already have a view of the potential routes. Aesthetics impacts from operation of the pipeline would be minimal because the majority of the pipeline would be underground, where it is not visible. The capture facility is located at the existing ethanol plant, where the aesthetics of the area are already impacted (see Section 5.4.1).

Cumulative Effects of Project on Aesthetics

Five projects listed in **Table 10-1** are in the local vicinity of the project (an area within 1,600 feet of the route width). The Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River, are stream restoration projects that would improve aesthetics of the local vicinity once completed. The resurfacing projects for MN 9 and MN 210 would not have a cumulative impact on aesthetics with the project because their construction schedules would not overlap with the project's schedule. A portion of the MCE Project in North Dakota is also within the local vicinity and would have visual impacts similar to the proposed project. The cumulative effects of the project on aesthetics, when considered with the projects listed in **Table 10-1**, would be short-term and minimal.

10.1.2.2 Cultural Resources

Potential Effects of Project on Cultural Resources

Potential impacts on cultural resources are expected to be minimal. Construction impacts on cultural resources, such as plants and wildlife of Tribal cultural interest, would be temporarily affected during the construction of the project until reclamation is complete. The project is not anticipated to impact or alter the work and leisure pursuits or land use of residents within the project area (area within 1 mile of the route width) of each route alternative in such a way as to impact the current underlying culture of the area. No impacts on cultural resources are expected from operation of the project, since the majority of the pipeline would cross agricultural land that could be returned to agricultural use following construction. The capture facility would be at the ethanol plant (see Section 5.4.2).

Cumulative Effects of Project on Cultural Resources

There are five projects within the project area: Resurface MN 9; Resurface MN 210; Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River, Wilkin County, Minnesota; Doran Creek Stream and Ecological Restoration; and the MCE Project. Two of these projects, the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River, would improve leisure pursuits, land use, and Tribal-identified plants and fauna in the local vicinity once completed. These projects would therefore not contribute to adverse cumulative impacts.

If construction is occurring on the project while road resurfacing is occurring for MN 9 and MN 210, residents could have limited access to cultural resources, such as work and leisure pursuits and land use. This could result in cultural resource impacts. However, these effects would be temporary and would end once the projects and restoration are complete.

A portion of the MCE Project in North Dakota is also within the local vicinity and would have short term and minimal effects to land use, work and leisure pursuits, and to Tribal cultural resources and Tribally important plants and wildlife. The cumulative effects of the project on cultural resources would be short-term and minimal.

10.1.2.3 Environmental Justice

Potential Effects of Project on Environmental Justice

Potential impacts on environmental justice are expected to be minimal to moderate and short term. All three route alternatives cross only one census tract that has been identified as an EJ area of concern, Census Tract 9609. Factors that could affect this EJ area of concern include increased traffic during construction, noise, and air impacts from construction and operation. Traffic impacts are expected to be minimal since the local roadways can support the required number of construction vehicles, and because the applicant would cross all roadways by HDD or boring techniques. Noise impacts would be minimal along most areas of the project, as the work would primarily occur in rural agricultural areas and during daylight hours. The census tracts crossed by the route alternatives have air quality indexes below health benchmarks (meaning the air quality is good), and construction emissions are not expected to result in significant impacts on air quality during construction or operation of the project (see Section 5.4.3).

Cumulative Effects of Project on Environmental Justice

Census Tract 9609 overlaps five projects: the Aquatic Center, the Downtown Riverfront Improvement Project: Phase 2, the I-94 Interchange Lighting Replacement, the Highway 210 Bridge Reconstruction, and the Union Avenue Mill and Overlay and Pedestrian Improvements. Because the construction phase of the Union Avenue Mill and Overlay and Pedestrian Improvements has already been completed, this project would not contribute to cumulative impacts. The Aquatic Center and the Downtown Riverfront Improvement Project would both benefit Census Tract 9609 by providing more aesthetic improvements and recreational opportunities. Neither the Highway 210 bridge reconstruction project nor the I-94 Interchange Lighting Replacement project would have cumulative impacts with the project because their anticipated construction schedules do not overlap. Cumulative effects of the project on environmental justice are expected to be minimal.

10.1.2.4 Land Use and Zoning

Potential Effects of Project on Land Use and Zoning

Potential impacts on land use are expected to be minimal to moderate during construction. Minimal impacts would occur during operation of the project. The land use for the majority of all three route alternatives is agricultural. The effects of construction would be moderate on agricultural land use, as the land would be taken out of production during construction. However, the land would revert to agricultural use following construction, so long-term impacts on land use would be minimal. The project would not affect zoning (see Section 5.4.4).

Cumulative Effects of Project on Land Use and Zoning

Four projects intersect the route width one or more of the alternative routes. Of these projects, two are the resurfacing projects on MN 9 and MN 210. The resurfacing projects would not affect land use or zoning of those areas because the roads already exist. The other two projects are the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects, which aim to maintain and improve current land use. Cumulative effects of the project on land use and zoning are expected to remain moderate in the short term and minimal in the long term.

10.1.2.5 Noise

Potential Effects of Project on Noise

Potential impacts on noise are expected to be minimal for most portions of the three route alternatives. Construction of the pipeline would occur in primarily rural agricultural areas, creating distance between NSRs and noise-generating construction equipment. Most construction noise impacts would occur near HDD areas, which are primarily rural but do contain some NSRs within 0.5 mile. Impacts would be minimal during operation of the project because the capture facility would not result in a perceptible noise increase from the existing ethanol plant, and the pipeline, MLVs, launcher, and cathodic protection system would not generate noticeable noise (see Section 5.4.5).

Cumulative Effects of Project on Noise

There are five projects within the local vicinity of the project. Two of the projects are the resurfacing projects on MN 9 and MN 210. These projects would not be constructed at the same time as the project, so they would not contribute to cumulative construction noise impacts, and they would not have long-term noise impacts. The other two projects are the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects, which would occur in rural areas where noise increases would not be near NSRs. A portion of the MCE Project in North Dakota is also within the local vicinity and would have noise impacts similar to the proposed project. Once the projects are completed, there would be no cumulative impacts as noise would return to pre-construction levels. The cumulative effects of the project on noise would be short term and minimal.

10.1.2.6 Populated Areas

Potential Effects of Project on Populated Areas

There would be no impacts on populated areas because no populated areas, as defined in this EIS, are within the local vicinity of any of the three route alternatives (see Section 5.4.6).

Cumulative Effects of Project on Populated Areas

Because the project would not affect populated areas, it would not have cumulative effects when considered with other reasonably foreseeable projects.

10.1.2.7 Property Values

Potential Effects of Project on Property Values

Potential impacts on property values are anticipated to be minimal, but impacts on individual properties can vary. While there are no studies on the relationship between property values and CO_2 pipelines, studies reviewed in the EIS do not indicate a conclusive, quantitative relationship between property values and proximity to natural gas pipelines. Specific changes to a property's value are difficult to predict, but the existence of a pipeline easement can generally be compatible with future landowner desires to continue activities on their property (see Section 5.4.7).

Cumulative Effects of Project on Property Values

Five projects are in the local vicinity of the route alternatives. Two projects, the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects, are stream and ecosystem restoration projects, which would not impact property values. Any impacts, if they occur, would be beneficial. Two other projects are the road resurfacing projects on MN 9 and MN 210, which would have no impacts on property values. Finally, a portion of the MCE Project in North Dakota is also within the local vicinity and would have property value impacts similar to the proposed project. The cumulative effects of the project on property values would be minimal.

10.1.2.8 Public Health and Safety

Potential Effects of Project on Public Health and Safety

The potential impacts of project construction and normal operation on public health and safety are expected to be minimal. Local healthcare facilities should be able to manage minor increases to healthcare needs during construction. Most health and safety impacts would occur during unexpected and abnormal operating conditions associated with an unplanned release of CO_2. Impacts of an accidental release of CO_2 could range from negligible, in the case of a small leak, to significant, in the case of a large CO_2 rupture (see Section 5.4.8 and Chapter 8).

Cumulative Effects of Project on Public Health and Safety

Of the projects listed in **Table 10-1**, it is expected that only the MCE Project would require a large number of workers. If these projects are constructed sequentially, there would be a negligible cumulative impact. Health and safety incidents during construction and normal operation of the project would be handled by services in Otter Tail and Wilkins Counties, and incidents on the portion of the MCE Project in North Dakota would be handled by services in Richland County.

None of the other anticipated projects would require a significant workforce, and most of the anticipated construction time frames do not overlap with this project. Impacts on local facilities and emergency services from the construction of these projects would be spread out over a period of years, limiting the cumulative effects felt by local health facilities, law enforcement, and fire services. Therefore, cumulative effects from construction and normal operation of the project on public health and safety would be short-term and minimal.

The largest potential impact on public health and safety would occur in the event of a pipeline rupture. Significant effects could occur if a rupture occurs within the same time frame as an accident on another project. The extent of the effect would vary depending on the size and the location of the rupture and the nature of the accident on the other project.

10.1.2.9 Public Services and Infrastructure

Potential Effects of Project on Public Services and Infrastructure

Potential impacts on public services and infrastructure are expected to be negligible to minor. Impacts on paved roads and railroads would be minimal as the applicant proposes to cross these features using the HDD or bore method. The existing road network is anticipated to be able to accommodate construction vehicles and operational traffic. The existing water and sewer capacity would be sufficient for the influx of temporary workers (see Section 5.4.9).

Cumulative Effects of Project on Public Services and Infrastructure

Five reasonably foreseeable projects would occur within the local vicinity of the project. The Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower

Otter Tail River projects, would use small, specialized crews that would have minimal to no impacts on public services and infrastructure. Two projects are the road resurfacing projects on MN 9 and MN 210, which would require larger crews that might create minimal to moderate temporary impacts on existing traffic patterns and health services. These road resurfacing projects would create long-term beneficial impacts on public services. A portion of the MCE Project in North Dakota is also within the local vicinity and would have public services and infrastructure impacts like the project. The cumulative effects of the project on public services and infrastructure would be minimal to moderate and temporary. Long-term impacts would be beneficial.

10.1.2.10 Recreation

Potential Effects of Project on Recreation

The project would have minimal to moderate impacts on recreational resources during construction. The impacts would vary depending on the route selected. Impacts would result from the presence of construction equipment in the viewshed and increased noise while equipment is operating. The removal of vegetation in construction workspaces and placement of construction vehicles and equipment would alter the viewshed temporarily. Operation of the project would not impact recreation (see Section 5.4.10).

Cumulative Effects of Project on Recreation

There are five projects in the local vicinity of the project. Two projects, the road resurfacing projects on MN 9 and MN 210, could have minimal to moderate temporary impacts on recreation if recreational traffic is affected. The Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects could cause additional minimal to moderate cumulative effects on recreation as vegetation would be removed during the construction of either project. The size of the effect on recreation would vary, with a larger impact occurring if restoration was occurring in the same location as construction on the project and within the same time frame. A portion of the MCE Project in North Dakota is also within the local vicinity and would have recreational impacts similar to the proposed project. There are no recreational resources in North Dakota within the local vicinity of the proposed project. Cumulative impacts of the project on recreation are expected to be minimal to moderate and short term.

10.1.2.11 Socioeconomics

Potential Effects of Project on Socioeconomics

The project would have moderate short-term and negligible to minimal long-term beneficial impacts on socioeconomic resources. Half of the workforce needed for the project would come from local unions, and the applicant and its contractors would purchase some goods and services locally. The project would also increase tax revenues over the long term, benefitting Otter Tail and Wilkin Counties (see Section 5.4).

Cumulative Effects of Project on Socioeconomics

The projects listed are expected to create local jobs in both North Dakota and Minnesota. Non-local workers could require lodging, goods, services, and fuel that would bring money into the local economies. It is expected that local union labor would be used for the MCE Project, which would benefit local labor unions. Other projects might also use union labor. These beneficial impacts would diminish as projects are completed. The cumulative effect of the project on socioeconomics would be minimal to moderate and beneficial.

10.1.2.12 Tribal Treaty Rights

Potential Effects of Project on Tribal Treaty Rights

The project would not impact Tribal treaty rights. There are no government-recognized usufructuary hunting or gathering rights within the lands the project proposes to cross that were ceded by treaty (see Section 5.4.12).

Cumulative Effects of Tribal Treaty Rights

Because the project would not affect Tribal treaty rights, it would not have cumulative effects when considered with other reasonably foreseeable projects.

10.1.3 Economies

10.1.3.1 Agriculture

Potential Effects of Project on Agriculture Economies

Potential impacts on agriculture would be primarily limited to the 6-month construction period and would be minimal. During that time frame, construction would be using agricultural land as a temporary workspace, and the land would be unavailable for crops. Short-term impacts would typically extend for 2 to 3 years but could take up to 5 years, depending on impacts to soils from the construction disturbance. Impacts would be mitigated through easement payments. Impacts during operation would be negligible (see Section 5.5.1).

Cumulative Effects of Project on Agriculture Economies

There are five projects in the local vicinity of the project. The Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects would not occur on agricultural land and would not contribute to any cumulative effects. The road resurfacing projects on MN 9 and MN 210 would also not have any effects on agricultural land, although agriculture-related traffic might experience delays in the short term. The long-term impacts of road improvements would be beneficial. A portion of the MCE Project in North Dakota is also within the local vicinity and would have similar agricultural impacts as the proposed project. There would be minimal short-term and negligible long-term cumulative effects on agriculture economies.

10.1.3.2 Industrial

Potential Effects of Project on Industrial Economies

Potential effects of the project on industrial economies would be negligible. Temporary increases in traffic and short-term, localized traffic delays during construction could have minimal temporary impacts on industrial facilities. The construction of the capture facility and the operational pipeline easement would preclude construction of new industrial properties in those locations (see Section 5.5.4).

Cumulative Effects of Project on Industrial Economies

There are five projects in the local vicinity of the project: road resurfacing projects on MN 9 and MN 210; the Doran Creek Stream and Ecological Restoration; the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects; and a portion of the MCE project. There would be no cumulative impacts from the road resurfacing projects because the construction timelines do not overlap with the proposed project's schedule.

Temporary traffic impacts from construction of the restoration projects would be negligible given the small size of the work crews. A portion of the MCE Project in North Dakota is also within the local vicinity. Industrial facilities were not identified within the local vicinity of the project in North Dakota. The cumulative effects of the project on industrial economies would be short term and negligible.

10.1.3.3 Tourism

Potential Effects of Project on Tourism Economies

Potential impacts of the project on tourism would be minimal to moderate during construction and negligible during operation. During construction, the project would result in short-term, minimal visual and noise impacts on recreational facilities. The project would not cause any impacts on noise levels or the surrounding viewshed at recreational facilities or other tourist attractions during operation (see Section 5.5.6).

Cumulative Effects of Project on Tourism Economies

Five projects - road resurfacing on MN 9 and MN 210, the Doran Creek Stream and Ecological Restoration, and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects, and a portion of the MCE project in North Dakota - are in the local vicinity of at least one route alternative. None of the projects overlap with locations identified as places of interest for tourism. There might be minimal impacts created by temporary increases in traffic; however, there would be no effects at the locations themselves. The cumulative effects of the project on tourism would be short term and minimal to none.

10.1.4 Archaeological and Historic Resources

Potential Effects of Project on Archaeological and Historic Resources

The potential effects of the project on archaeological and historical resources are expected to be minimal; however, not all sites within the route widths have been evaluated for NRHP eligibility. Of the sites that have been evaluated, none are eligible for or listed in the NRHP, so impacts on those sites would be minimal. If any of the sites are determined to be eligible, the project would result in permanent, moderate impacts on the resources. None of the three route alternatives have been surveyed entirely, so unknown archaeological resources could be discovered and potentially impacted. Historic architectural resources are within the route widths of all three route alternatives; however, none have been determined to be eligible for the NRHP, so impacts would be minimal. Because not all of the three route widths have been surveyed for historic architectural resources, the potential exists for unknown resources to occur within all three route alternatives (see Section 5.6.3).

Cumulative Effects of Project on Archaeological and Historic Resources

There are five projects in the project area: Resurface MN 9; Resurface MN 210; Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River, Wilkin County, Minnesota; Doran Creek Stream and Ecological Restoration; and the MCE Project. The two road resurfacing projects would be unlikely to affect archaeological and historic resources, other than temporary minimal visual impacts. The other three projects could directly impact previously identified and unknown, buried resources during ground disturbing activities; however, these projects would likely have survey requirements and inadvertent discovery protocols to minimize potential adverse impacts on archaeological and historic resources. Because these projects are unlikely to introduce new, permanent aboveground facilities, visual impacts would be none to minimal. Therefore, these projects would not contribute adverse cumulative impacts on NRHP-listed and NRHP-eligible archaeological and historic resources where NRHP integrity of setting is important. The cumulative effects of the project on known archaeological and historic resources would be short term and minimal.

10.1.5 Natural Environment

10.1.5.1 Air Quality

Potential Effects of Project on Air Quality and Greenhouse Gas Emissions

Construction of the project would result in temporary and intermittent air quality and GHG impacts. Operation of the project would include GHG emissions while capturing and processing CO_2 from the ethanol plant at the capture facility, dust and exhaust emissions from occasional work vehicles, and fugitive leaks from the pipeline. The project would provide a net benefit to GHG emissions because the emissions sequestered from ongoing annual operations would outweigh construction and operation emissions (see Section 5.7.1).

Cumulative Effects of Project on Air Quality

Of the listed projects in **Table 10-1**, many, such the Fergus Falls Aquatic Center, would have minimal air quality impacts due to the small project footprints. The road reconstruction and resurfacing projects would have the largest air quality impacts due to the use of construction equipment and the creation of dust and exhaust emissions. All projects involving construction vehicles and equipment would contribute, along with the proposed project, to cumulative air quality impacts. Because air quality in these counties is good, and the projects would not all occur at the same time, impacts would be negligible to minimal. The cumulative impacts of the project construction on air quality are anticipated to be short term and negligible to minimal.

10.1.5.2 Climate Change

Potential Effects of Project on Climate Change

Climate change might result in increasing temperatures and a greater frequency and intensity of extreme weather events. In Minnesota, climate models have identified the potential for increased rainfall, heat, localized flooding, and persisting drought conditions. The project would have a net beneficial effect on climate change because it would capture and store CO_2 emissions from the ethanol plant (see Section 5.7.2). All three route alternatives would have similar impacts regarding climate change.

Cumulative Effects of Project on Climate Change

The portion of the MCE Project in Richland County would also contribute toward a beneficial effect on climate change because it would continue to carry CO_2 from the ethanol plant to the sequestration site in North Dakota.

10.1.5.3 Geology and Topography

Potential Effects of Project on Geology and Topography

Potential effects of the project on geology are expected to be minimal and related to topography. Construction of the pipeline and capture facilities would result in minimal and temporary impacts on topography due to grading and excavation. Disturbed areas would be regraded to original surface contours and revegetated (see Section 5.7.3).

Cumulative Effects of Project on Geology and Topography

There are four projects in the construction workspace of the project. Of those four projects, two are the resurfacing projects on MN 9 and MN 210, which would not have any impact on geologic features or topography. The other two projects are the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects. These projects would require grading and excavation to return the areas to their original contours and stream beds. This work would have a long-term beneficial impact on geology and topography. The cumulative effects of the project on geology, specifically topography, would be minimal and short to long term.

10.1.5.4 Public and Designated Lands

Potential Effects of Project on Public and Designated Lands

Potential impacts on public and designated lands are expected to be minimal. All three route alternatives cross at least one WPA, where conservation easements are limited to the wetland areas of the crossed parcels. However, construction would avoid all wetland areas in the WPAs, creating minimal to no impacts. The three route alternatives do not cross any other public and designated lands (see Section 5.7.4).

Cumulative Effects of Project on Public and Designated Lands

Four projects—the road resurfacing projects on MN 9 and MN 210, the Doran Creek Stream and Ecological Restoration, and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects—are within the route width of one or more of the alternative routes. However, none of the projects would cross the project at locations that are public and designated lands, limiting any cumulative effects that could occur. The cumulative effects of the project on public and designated lands would be negligible.

10.1.5.5 Rare and Unique Resources

Potential Effects of Project on Rare and Unique Resources

Potential impacts on rare and unique resources would be localized and would vary by habitat, time of year, and type of species. Project activities within the route alternatives would not have a significant direct impact on state and federally listed species but could result in indirect impacts due to habitat and resource loss when vegetation is cleared during construction (see Section 5.7.5).

Cumulative Effects of Project on Rare and Unique Resources

There are five projects in the project area. Of those five projects, two are resurfacing projects on MN 9 and MN 210, which would have minimal impact on rare and unique resources. Two other projects are the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects. There could be cumulative indirect impacts on federal species as vegetation is removed for the projects. There could also be cumulative direct impacts on state-listed species due to incidental take, which could occur during any of the projects. However, the long-term cumulative impacts would be beneficial as the stream and ecosystem restorations would provide enhanced habitat. This could offset impacts in areas not allowed to fully revegetate (wooded areas). A portion of the MCE Project in North Dakota is also within the project area and would have rare and unique resource impacts similar to the proposed project. The cumulative effects of the project on rare and unique resources would be short term and moderate to long term and minimal.

10.1.5.6 Soils

Potential Effects of Project on Soils

Potential impacts of the project on soils are expected to be minimal and short term during construction, depending on the route alternative selected. Soils could be lost through wind and water erosion, or backfilling could alter biological and chemical properties. Impacts on soils during construction would be minimized through BMPs, including erosion prevention and sediment control practices. Negligible impacts on soils are anticipated during the operational phase of the project (see Section 5.7.6).

Cumulative Effects of Project on Soils

There are four projects that intersect with the construction workspace of the project. Of those four projects, two are resurfacing projects on MN 9 and MN 210, which would have minimal impact on soils and would not occur at the same time as the proposed project. The other two projects are the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects. These projects would require grading and excavation to return the areas to their original contours and stream beds, increasing the potential for soil loss through runoff and erosion. This could create moderate cumulative effects on soils when combined with impacts of the project construction. These effects would be temporary and would decrease as construction was completed and the areas were recontoured and revegetated. The cumulative effects of the project on soils would be short term and minimal to moderate.

10.1.5.7 Vegetation

Potential Effects of Project on Vegetation

Potential direct impacts on vegetation would occur primarily during the clearing of grain and seed crops during site preparation and construction. All vegetated areas within the construction workspace would be exposed to localized, short-term crushing or matting of plants under construction equipment. This would be a short-term, seasonal, negligible direct impact during construction and a long-term minimal impact during operation of the project. Direct impacts from the removal of existing vegetation would occur in forested areas, non-agricultural open areas, and wetlands; however, the impacts would be minimal due to the small acreage impacted. Routine maintenance and operation of the pipeline would result in long-term, localized, minimal to moderate impacts on vegetation (see Section 5.7.7).

Cumulative Effects of Project on Vegetation

There are four projects in the construction workspace of the project. Of those four projects, two are resurfacing projects on MN 9 and MN 210, which would have minimal impact on vegetation. The other two projects are the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects. The stream and ecosystem restoration projects would require some vegetation to be cleared, crushed, and temporarily removed as the work is completed, which could have minor cumulative impacts in combination with the vegetation that would be cleared and crushed as part of the work on the project. However, these cumulative impacts would be temporary because the areas would be restored. The cumulative effects of the project on vegetation would be short term and minimal.

10.1.5.8 Water Resources

Potential Effects of Project on Water Resources

Potential impacts on surface water could occur during construction activities. These impacts would be temporary and short term, occurring only during construction. Once in operation, the project would have minimal impacts on waterbodies. Impacts associated with maintenance and repair would be rare and infrequent. Operational impacts on surface waters could occur during the first few years of operation as vegetation and restoration methods establish (see Section 5.7.8).

Cumulative Effects of Project on Water Resources

Five reasonably foreseeable projects are within the project area. Two of those projects are the resurfacing projects on MN 9 and MN 210, which are not anticipated to have any effects on water resources. Two other projects are the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects. These projects could have a cumulative impact with the project on surface waterbodies, as all three projects would include work such as clearing and grading of stream banks, topsoil disturbance, and in-stream trenching. Any cumulative effects would be temporary, as there would be no effects of the project on water resources during operation, and the stream and ecosystem restoration projects would improve water resources in the project area where restoration had occurred. A portion of the MCE Project in North Dakota is also within the project area and would have water resource impacts similar to the proposed project. The cumulative effects of the project on water resources would be short term and minimal.

10.1.5.9 Wetlands

Potential Effects of Project on Wetlands

Potential impacts of the project on wetlands would be minimal and mostly short term. Construction in wetlands would result in minimal short-term impacts and minor changes in plant species composition in emergent wetlands. Construction activities would convert about 0.2 acre of forested wetlands to emergent wetlands, a long-term, moderate impact. The amount of wetlands that would be impacted by any of the three route alternatives is minimal, and the routes would avoid many wetlands. Impacts of operation of the project on wetlands would be negligible to minimal and long term (see Section 5.7.9).

Cumulative Effects of Project on Wetlands

There are four reasonably foreseeable projects in the route width of one or more of the alternative routes. Two of those projects are the resurfacing projects on MN 9 and MN 210, which are not anticipated to have any effects on wetlands. The other two projects are the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects, which would have beneficial impacts on wetlands through the restoration of habitat. The cumulative effects of the project on wetlands would be short term and minimal.

10.1.5.10 Wildlife and their Habitats

Potential Effects of Project on Wildlife and their Habitats

Construction of the project would have short-term and negligible to minimal impacts on most wildlife species. The species most likely to be directly impacted by construction are those that are small with limited mobility or visibility, such as small mammals, amphibians, and invertebrates. Burrows, dens, and other types of low or subsurface habitats might be removed, crushed, or damaged by construction. Impacts on ground nesting birds could occur as part of clearing and trenching activities. Larger and more mobile wildlife using existing habitats within the route width are expected to be temporarily displaced during construction due to increased human activity. Potential long-term impacts on terrestrial and aquatic species are anticipated to be minimal along all route alternatives. Operational impacts are expected from continued maintenance of the ROW (see Section 5.7.10).

Cumulative Effects of Project on Wildlife and their Habitats

There are four projects in the route width of one or more of the alternative routes. Two of those projects are the resurfacing projects on MN 9 and MN 210, which are not anticipated to have any effects on wildlife and their habitats. The other two projects are the Doran Creek Stream and Ecological Restoration and the Aquatic Ecosystem Restoration: Section 1135, Lower Otter Tail River projects. These stream restoration projects would temporarily displace individuals of larger wildlife species, and they would also impact smaller species, particularly those such as amphibians and invertebrates that are endemic to aquatic ecosystems, because work on the stream and ecosystem restoration projects would be focused on aquatic ecosystems. The cumulative impacts of the project on wildlife and their habitats are anticipated to be short term and minor.

1 Minn. R. 4410.0200, subp. 11a

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[4] U.S. Army Corps of Engineers St Paul District Website, https://www.mvp.usace.army.mil/Home/Projects/Article/940859/aquatic-ecosystem-restoration-section-1135-lower-otter-tail-river-wilkin-county/. Accessed January 2024.

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[6] Bois de Sioux Watershed District, http://www.bdswd.com/Projects_Template.html. Accessed January 2024.

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Chapter 11 Application of Route Selection Criteria

The analysis that follows applies the information and data available in the routing permit application, the scoping EAW, and this EIS to the criteria the Commission must consider when making a decision concerning a pipeline routing permit.

The Commission must locate proposed pipelines in an orderly manner that minimizes adverse human and environmental impacts, while ensuring that pipeline routing permit needs are met and fulfilled in an orderly and timely manner.[1] The Commission cannot set safety standards for pipeline construction.[2] Minnesota Rule 7852.1900, subpart 3, identifies the following 10 criteria the Commission must consider when making a permit decision for routing a pipeline:

A. human settlement, existence and density of populated areas, existing and planned future land use, and management plans;
B. the natural environment, public and designated lands, including but not limited to natural areas, wildlife habitat, water, and recreational lands;
C. lands of historical, archaeological, and cultural significance;
D. economies within the route, including agricultural, commercial or industrial, forestry, recreational, and mining operations;
E. pipeline cost and accessibility;
F. use of existing rights-of-way and right-of-way sharing or paralleling;
G. natural resources and features;
H. the extent to which human or environmental effects are subject to mitigation by regulatory control and by application of the permit conditions contained in part 7852.3400 for pipeline right-of-way preparation, construction, cleanup, and restoration practices;
I. cumulative potential effects of related or anticipated future pipeline construction; and
J. the relevant applicable policies, rules, and regulations of other state and federal agencies, and local government land use laws including ordinances adopted under Minnesota Statutes, section 299J.05, relating to the location, design, construction, or operation of the proposed pipeline and associated facilities.

The following sections analyze the three route alternatives (RA-North, RA-Hybrid, and RA-South) in comparison to these route selection criteria and summarize mitigation measures currently recommended by EERA staff should the Commission ultimately decide to issue a pipeline routing permit for the project.

11.1 Route Selection Criteria Summary

This section lists the route selection criteria and compares potential impacts of the three route alternatives.

Table 11-1 lists the route selection criteria outlined in Minnesota Rule 7852.1900, subpart 3, and compares potential impacts of the three route alternatives. Further discussion of each criterion is provided in Section 11.2.

Table 11-1 Summary of Potential Impacts of Route Alternatives by Route Selection Criterion

Criterion Considered by Commission	RA-North	RA-Hybrid	RA-South
A. Human settlement, existence and density of populated areas, existing and planned future land use, and management plans	Impacts on human settlement would be generally short-term and negligible to minimal, including impacts on cultural resources, environmental justice populations, public services and infrastructure, populated areas, socioeconomics, Tribal treaty rights, future land use, zoning, and management plans. Aesthetic impacts would be minimal to moderate during construction. Would have slightly more residents with a view of the construction workspace. Impacts from project operation would be negligible to minimal. Would have more noise sensitive receptors (NSR) close to the construction workspace but fewer NSRs within 0.5 mile of a horizontal directional drill (HDD) entry.	Impacts on human settlement would be similar to RA-North. Would have slightly fewer residents than RA-North with at least a partial view of the construction workspace. Would have the fewest NSRs affected by construction noise. The applicant has obtained landowner agreement along a portion of RA-Hybrid.	Impacts on human settlement would be similar to RA-North. Would have slightly fewer residents than RA-Hybrid with at least a partial view of the construction workspace. Would have fewer NSRs close to the construction workspace than RA-North but more NSRs within 0.5 mile of an HDD entry. The applicant has obtained landowner agreement along RA-South.

Criterion Considered by Commission	RA-North	RA-Hybrid	RA-South
B. The natural environment, public and designated lands, including but not limited to natural areas, wildlife habitat, water, and recreational lands	Would cross one Waterfowl Production Area (WPA). Impacts on public and designated lands would be short-term and negligible. Would cross the Pelican and Red Rivers by HDD. Impacts on water would be short-term and minimal. Would not cross the Otter Tail River or the Fergus Falls Fish & Game Club Orwell property, and likely would have fewer impacts on recreation than the other two route alternatives. Most impacts on wildlife and wildlife habitat would be highly localized, short-term, and negligible to minimal.	Would cross the same WPA as RA-North. Impacts on public and designated lands would be the same as RA-North. Would cross the Pelican, Otter Tail, and Bois de Sioux Rivers by HDD. Impacts on water would be similar to RA-North. Would not cross the Fergus Falls Fish & Game Club Orwell property. Recreation impacts are anticipated to be short-term and minimal to moderate. Impacts on wildlife and wildlife habitat would be similar to RA-North.	Would cross the same WPA as RA-North. Route width would partially overlap two other WPAs; however, the WPAs would be outside of the construction workspace. Impacts on public and designated lands would be the same as RA-North. Would cross the Pelican, Otter Tail, and Bois de Sioux Rivers by HDD. Impacts on water would be similar to RA-North. Would cross the Fergus Falls Fish & Game Club Orwell property. Recreation impacts are anticipated to be short-term and minimal to moderate. Impacts on wildlife and wildlife habitat would be similar to RA-North.
C. Lands of historical, archaeological, and cultural significance	Low potential for archaeological resources based on the route's proximity to waterbodies and the number of previously identified archaeological resources within the project area (area within 1 mile of the route width).	Higher potential for archaeological resources than RA-North based on the route's proximity to waterbodies and the number of previously identified archaeological resources within the project area (area within 1 mile of the route width).	Low potential for archaeological resources based on survey results. None of the archaeological sites identified have been determined to be eligible for or listed in the National Register of Historic Places.
D. Economies within the route, including agricultural, commercial or industrial, forestry, recreational, and mining operations	Minimal agricultural impacts; crop losses during construction would be mitigated by compensation from the applicant. Negligible impacts on commercial, industrial, and recreational economies. No impacts on forestry or mining operations.	Similar to RA-North.	Similar to RA-North.

Criterion Considered by Commission	RA-North	RA-Hybrid	RA-South
E. Pipeline cost and accessibility [b]	$40.0 million +/- 15%	$40.4 million +/- 15%	$37.0 million +/- 15%
F. Use of existing rights-of-way and right-of-way sharing or paralleling	96.0% of length parallels road right-of-way.	76.5% of length parallels road right-of-way.	46.1% of length parallels road right-of-way.
G. Natural resources and features	See Criterion B.	See Criterion B.	See Criterion B.
H. The extent to which human or environmental effects are subject to mitigation by regulatory control and by application of the permit conditions contained in part 7852.3400 for pipeline right-of-way preparation, construction, cleanup, and restoration practices	Most effects of the project could be mitigated by regulatory control and application of permit conditions.	Similar to RA-North. No difference in the extent to which effects would be subject to mitigation.	Similar to RA-North. No difference in the extent to which effects would be subject to mitigation.
I. Cumulative potential effects of related or anticipated future pipeline construction	No related or anticipated future pipeline construction was identified for Otter Tail or Wilkins County. Overall negligible to minimal short-term cumulative effects with the MCE Project in Richland County, North Dakota, if constructed at the same time.	Similar to RA-North.	Similar to RA-North.

Criterion Considered by Commission	RA-North	RA-Hybrid	RA-South
J. The relevant applicable policies, rules, and regulations of other state and federal agencies, and local government land use laws including ordinances adopted under Minnesota Statutes, section 299J.05, relating to the location, design, construction, or operation of the proposed pipeline and associated facilities	Applicant would obtain all applicable permits and comply with permit conditions, regulations, and ordinances.	Similar to RA-North. No difference in the permits needed or regulations and ordinances that would be applicable.	Similar to RA-North. No difference in the permits needed or regulations and ordinances that would be applicable.

[a] Costs are for the pipeline portion of the project only. The cost of the capture facility is the same for all route alternatives and is estimated at $29.75 million +/- 15%.

11.2 Discussion

This section discusses each of the 10 route selection criteria and compares each criterion for the three route alternatives.

11.2.1 Criterion A

Human settlement, existence and density of populated areas, existing and planned future land use, and management plans

The construction and operation of the capture facility and one of the three pipeline route alternatives would each have minimal to moderate short-term impacts on aesthetic resources. RA-North would have several more residents with at least a partial view of the construction workspace compared to RA-Hybrid. RA-South would have several fewer residents with at least a partial view of the construction workspace compared to RA-Hybrid. The capture facility would blend with the existing ethanol plant. Once constructed, the pipeline would be below ground. Aboveground pipeline facilities would have minimal visual impacts. Aesthetic impacts from project operation would be negligible to minimal, with no noticeable difference among the route alternatives.

Potential impacts on cultural resources would be subjective. Agricultural operations, which can have contemporary cultural value, would be impacted along each of the alternative routes, but the project would not remove cultivated land from production. The project could temporarily impact hunting activities and the habitats of plants and wildlife of Tribal cultural interest during construction and until restoration of disturbed areas is complete. Overall, potential impacts to cultural resources during construction and operation of the project are anticipated to be minimal and would be similar for all route alternatives.

An EJ assessment identifies disadvantaged communities that have been historically marginalized and overburdened by pollution and evaluates if a project would disproportionally affect these communities. Census Tract 9609, which is crossed by all three alternatives, was identified by the MPCA screening tool as an EJ area of concern. Potential impacts along each of the route alternatives are expected to be minimal for EJ communities during construction. Local roadways would experience a short-term minimal increase in traffic during construction activities. Construction would use HDD and boring techniques at road crossings to limit impacts on local traffic. Residents within Census Tract 9609 and the other census tracts crossed by the project might experience intermittent, short-term noise from construction equipment for up to 30 days. Operation of the capture facility and pipeline facilities would not generate noticeable noise. The project would not result in significant impacts on air quality during construction or operation. Overall, EJ impacts from construction and operation of the project would not result in disproportionate adverse impacts for EJ areas of concern.

Land use in the route width, and in the area of the project generally, is predominantly agriculture. Land use impacts would be the same across the three route alternatives. Project construction would have a short-term minimal to moderate impact on land use within the construction workspace. Operation of the pipeline would have a long-term, minimal impact on land use. An operational ROW would be created, but agriculture (the most prevalent land use) could continue. Landowners could not plant trees or build structures within the operational pipeline ROW. The project would be compatible with local and regional land use plans. Overall, impacts on land use and zoning are anticipated to be minimal.

Heavy equipment needed to construct the pipeline would have an intermittent and short-term impact on noise levels in the vicinity of the project. Except for HDDs and some hydrostatic testing activities, construction would be limited to daytime hours. Construction equipment noise would be expected to decrease to levels below state daytime standards within 500 to 1,600 feet. The project is expected to conform to state noise standards. Compared to the other route alternatives, RA-South would have fewer NSRs close to the construction workspace but more NSRs within 0.5 mile of an HDD entry. Noise from the operation of the capture facility is not expected to result in a perceptible increase in the sound levels experienced at NSRs near the capture facility and would not be distinguishable from the noise already produced at the ethanol plant. Operation of the pipeline facilities would not have a noticeable impact on ambient sound levels. Because the project is expected to conform to state noise standards and the applicant would use barrier walls as needed for mitigating noise from HDDs, potential impacts would be minimal for all route alternatives.

Populated areas are defined for this analysis as incorporated areas or legal entities, and census-designated places, which are statistical entities and the equivalent of incorporated places. There would be no impacts on populated areas because no populated areas are within 1,600 feet of the route width for any of the three route alternatives.

Specific changes to a property's value are difficult to predict but are expected to be minimal. Potential impacts on property values would be similar for all three route alternatives. Construction-specific impacts on property values would be temporary (less than 6 months) and the applicant would be responsible for any construction-related damages. The project would not be expected to affect the value of residential properties during operation. Overall, impacts on property values are anticipated to be minimal and dissipate quickly with distance from the pipeline. However, impacts on specific properties could vary widely.

Construction of the project would have negligible impacts on public health and safety. The presence of construction personnel and equipment could temporarily increase demand for local public services. As with any major construction project, worker health and safety concerns exist. Operational impacts to health and safety would be a concern primarily in the event of an accidental release of CO_2, when public health and safety impacts are expected to be minimal to significant (depending on the extent and where a release occurs). Normal operations of the project would not impact public health. Potential impacts on public health and safety are expected to be similar for all three route alternatives.

Public services and infrastructure include emergency services, hospitals, school districts, and public utilities that serve residents and business. Public services and infrastructure impacts are anticipated to be short-term, negligible to minimal, and similar across the three route alternatives. The presence of additional construction personnel could affect law enforcement agencies, fire protection services, and health care facilities in the communities adjacent to the project for all route alternatives. Local emergency services would be able to manage these minor increases during the 6 months of construction. There are no anticipated impacts on schools, public transit, or railroads. Impacts on roads would be minimal and primarily from increased construction traffic. A temporary increase of water use, sewage, and solid waste is anticipated due to the influx of construction workers and materials. The existing utilities would be sufficient to handle the temporary increase. During operation, electrical service would be supplied to the capture facility through existing service lines, and the project is not anticipated to require additional power generation capacity.

Socioeconomics assesses overall social and economic character of an area and the project's effects on the well-being of current and future residents of the affected community. Socioeconomic impacts are anticipated to be minimal, short-term to long-term, and similar across the three route alternatives. Most impacts would be beneficial. Construction would result in a temporary increase in local population associated with the workers and associated spending from lodging, transportation, and food. The nearby cities have adequate housing and infrastructure to support the additional workers for all three route alternatives. Local labor would also be used, increasing employment in the surrounding area. The applicant estimates its total direct capital cost or investment would be $69.75 million for RA-North, $70.12 million for RA-Hybrid, and $66.75 million for RA-South with a construction payroll of $30,910,000. The project would increase tax revenues, benefiting the counties and state. The applicant estimates that the project would generate property tax revenues of $894,000 in Otter Tail County and $972,000 in Wilkin County during the first year of operations.

Lands in the local vicinity of the project were ceded to the United States government in two 1851 treaties, and neither treaty that ceded lands within the project area established government-recognized usufructuary hunting or gathering rights within the ceded lands. Therefore, potential impacts on Tribal treaty rights along each of the route alternatives during construction and operation of the project are expected to be negligible.

11.2.2 Criterion B

The natural environment, public and designated lands, including but not limited to natural areas, wildlife habitat, water, and recreational lands

Air quality and GHG emission impacts from the project could contribute to increased levels of air pollution in Minnesota. However, by capturing and sequestering CO_2 underground, the project would provide a net benefit to GHG emissions because the CO_2 sequestered from ongoing annual operations at the ethanol plant would outweigh construction and operation emissions. Construction impacts would include emissions from construction equipment and vehicles as well as temporary changes in land use along the pipeline ROW. Operational impacts would include emissions from operation of the pipeline and the CO_2 capture facility, including equipment leaks. Construction emissions for the route alternatives would be directly proportional to their lengths. In other words, RA-North would have somewhat lower construction emissions and RA-Hybrid would have somewhat higher emissions compared to RA-South. Emissions from project operation would be the same regardless of the pipeline route.

Climate change is expected to result in increasing temperatures and a greater frequency and intensity of extreme weather events. In Minnesota, climate models have identified the potential for increased rainfall, heat, localized flooding, and persisting drought conditions. The project would have a net beneficial effect on climate change as it would capture and store CO_2 emissions from the ethanol plant. Because the pipeline would be underground, flooding would not impact operation of the project. Any MLVs located in floodplains would be constructed in accordance with floodplain permitting requirements. Drought conditions might require contingency water sources. All route alternatives would face similar impacts regarding climate change.

The topography in the project area is relatively flat with localized areas of steeper slopes occurring adjacent to waterbodies. Bedrock is generally deeper than 50 feet. No mineral resources are within the construction workspaces for any of the three route alternatives. The risk to the project facilities from geologic hazards such as earthquakes and landslides is low. Impacts on geology and topography would be short-term and minimal. Impacts would not vary among the route alternatives.

The only direct impact on public and designated lands would be at one WPA, which would be crossed by all three route alternatives. Impacts to the wetland associated with this WPA are not expected. The route width of RA-South would partially overlap with two other WPAs; however, the WPAs would be outside of the construction workspace. Potential project impacts on public and designated lands for all three route alternatives would be short-term and negligible.

Most vegetation cover occurring along all route alternatives does not provide suitable habitat for rare and unique species. Potential impacts for all three route alternatives would be unique to individual listed species, could vary widely, and would be highly localized and limited to specific habitats. No federally listed species are expected to be directly taken. Indirect impacts on federally listed species would be negligible and could be avoided by following USFWS guidance. No bald or golden eagle nests would be removed or disturbed. There would be no direct take of adult state-listed birds. There is a possibility of take of eggs or young state-listed birds through inadvertent destruction of ground nests during construction. Overall, for each of the three route alternatives, impacts on rare and unique species would be localized, negligible to minimal, and short-term.

Soils in the project area consist mainly of well to poorly drained loams and clays. The route alternatives generally share similar soil characteristics. During construction, vegetation clearing, topsoil removal, and trenching would expose soils and increase the potential for erosion, compaction, and mixing of topsoil with subsoil. The applicant would minimize these impacts by complying with required permits and implementing the applicant's Minnesota ECP and Minnesota APP. With these measures, impacts on soils during construction would be minimal and temporary. Impacts on soils during operation would be negligible.

Vegetation in the construction workspace for the three route alternatives is dominated by cultivated crops. Vegetation associated with developed areas is also prevalent along all three route alternatives. Impacts to agricultural vegetation during construction and operation are lowest for RA-North due to its length. Agricultural impacts along RA-South and RA-Hybrid are about equal. Otherwise, the relative percent of cover and distribution of non-agricultural vegetation types is similar among all three route alternatives. Impacts on vegetation would result almost entirely from removal and crushing during construction. Indirect impacts include possible introduction of invasive species. Overall, construction impacts on vegetation are expected to be short-term and minimal for all route alternatives. Removal of woody vegetation in forested areas would be long term due to longer regeneration time for woody cover. Forested areas comprise less than 1 acre total for each of the route alternatives. Operational impacts on vegetation would be long-term and minimal.

None of the three route alternatives would cross lakes, or waters with federal or state designations related to high resource value. The route alternatives would cross a similar number of drainage ditches. RA-North would cross fewer rivers and streams than RA-Hybrid and RA-South. While there are wells within 1 mile of the route width for all three route alternatives, the majority are outside of the construction workspaces of RA-North and RA-South, and no wells are within the construction workspace of RA-Hybrid. Potential impacts on surface waters would occur during construction and would be short-term and minimal for all route alternatives. Construction activities would have temporary, minimal, and localized impacts on groundwater. Floodplain impacts would be short-term and negligible during construction for all route alternatives. Water supply appropriations would be regulated by DNR-issued permits that would have conditions to minimize impacts on groundwater resources. DNR would review permit applications and would not issue a permit if the amount of water to be withdrawn would adversely affect the aquifer or other users. Therefore, no long-term impacts on water resources are expected during project operation.

Wetlands listed in the National Wetlands Inventory were compared for the three route alternatives. Primarily emergent wetlands were identified, with lesser amounts of forested and riverine wetlands. Direct wetland impacts would occur during pipeline construction. Wetland impacts are comparable among the three route alternatives. Impacts on forested wetlands would be slightly higher for RA-Hybrid relative to RA-North and RA-South. Wetland impacts would be minimal and short-term in emergent wetlands, and minimal to moderate and longer-term in forested wetlands. Indirect impacts on wetlands would be comparable among all three route alternatives and would be negligible to minimal and long-term during operation of the project. Wetland impacts would be minimized through implementation of standard best management practices and conditions required under the state and federal permits for work in wetlands.

For all three route alternatives, the majority of wildlife species present are common generalist species well-adapted to disturbed habitats and human activities. Wildlife species range from larger mammals to smaller reptiles, amphibians and invertebrates. Fish, aquatic amphibians, and aquatic invertebrates could be present in intermittent and perennial streams crossed by the route alternatives. Larger, more mobile wildlife species would likely avoid portions of the ROI during construction. Smaller, less mobile wildlife species and/or species in burrows could be inadvertently injured or killed by construction equipment. Habitat loss or degradation would be minimal, as most of the route width for all three route alternatives is agricultural land. Potential impacts on wildlife would be comparable across all three route alternatives. Most impacts on wildlife would be highly localized, short-term and negligible. Operation of the project would have minimal impact on wildlife and their habitats.

Recreational facilities could be affected by construction-related impacts on aesthetics, noise, and air quality. Recreation impacts are anticipated to be short-term, minimal to moderate. All three route alternatives would cross the King of Trails Scenic Byway (US Highway 75). RA-Hybrid and RA-South would cross the Otter Tail River, a state-designated water trail. The project could temporarily impact these recreational resources during construction due to the presence of equipment in the viewshed, generation of dust, removal of vegetation in the viewshed, and increased noise. RA-South would pass through the Fergus Falls Fish & Game Club's Orwell property. The applicant would continue to communicate with the club to minimize visual and noise impacts during construction. RA-North would not cross the Otter Tail River or the Orwell property, and would be anticipated to have fewer impacts on recreation than the other two route alternatives. Operation of the project would not cause visual or noise impacts on recreational resources.

11.2.3 Criterion C

Lands of historical, archaeological, and cultural significance

Archaeological resources were identified within the route widths for all alternative routes. While RA-North has not been extensively surveyed for archaeological sites, its lack of archaeological potential compared to RA-Hybrid and RA-South indicates RA-North could likely have the least impact on archaeological resources of the three alternative routes.

None of the archaeological sites within the route widths for the alternative routes have been determined to be Eligible for or Listed in the NRHP. Construction of the project would result in negligible impacts on the previously identified Not Eligible historic architectural resources within the ROI.

Archaeological resources or unrecorded historic cemeteries identified within the project area, but outside the route width, are not expected to be impacted by the project. Known archaeological resources were identified within the route widths for all route alternatives—none have been determined to be Eligible for or Listed in the NRHP.

Archaeological potential is based on proximity to waterbodies and the number of previously identified archaeological resources within the ROI. While RA-North has not been extensively surveyed for archaeological resources, it lacks archaeological potential compared to RA-Hybrid and RA-South. RA-Hybrid has more potential for unknown archaeological resources to exist than RA-North, but less than RA-South. Of the three route alternatives, RA-South crosses or is near the most waterbodies, increasing its overall archaeological potential, which is evidenced by the number of sites identified by the applicant's survey.

If previously identified archaeological sites within the route widths that have not been evaluated for the NRHP are determined to be Eligible for listing in the NRHP, construction of the project could result in moderate, permanent adverse impacts from direct construction activities. If previously identified archaeological resources are determined Not Eligible for listing in the NRHP, construction of the project could result in negligible impacts from direct construction activities.

Historic architectural resources identified within the project area of the route alternatives, but outside the route width, are not expected to be impacted by the project. Historic architectural resources were identified within the route widths for all alternatives—none have been determined to be Eligible for or Listed in the NRHP. Construction of the project would result in negligible impacts on the previously identified Not Eligible historic architectural resources within the ROI.

11.2.4 Criterion D

Economies within the route, including agricultural, commercial or industrial, forestry, recreational, and mining operations

Impacts on commercial, industrial, forestry and mining economies would be negligible for all route alternatives.

Short-term agricultural impacts would be minimal across the three route alternatives. Long-term agricultural impacts would also be minimal. During construction, lands would not be available for agricultural production. Easement agreements can compensate landowners for lost crops due to construction. Following construction of the pipeline, agricultural land would be restored, and agricultural activities could resume. Crop production could be reduced in areas that were disturbed by construction, typically for 2 to 3 years but potentially up to 5 years, depending on impacts on soils from construction disturbance.

An ethanol plant is located at the east end of the three route alternatives. No other industrial facilities exist within the route width of the three alternatives. Impacts would be short-term and negligible across the three route alternatives. Construction of the pipeline and capture facility might result in temporary localized traffic delays for workers and delivery of raw materials and products to and from the ethanol plant. Impacts during operation of the pipeline and capture facility are not anticipated.

Otter Tail and Wilkin Counties offer a variety of recreational opportunities as their primary tourist attraction, such as nature preserves, hiking trails, biking trails, fishing, hunting, snowmobiling, boating, canoeing, kayaking, and swimming. Impacts on recreation would be short-term and minimal. Tourism opportunities are similar for the three route alternatives. Construction would result in temporary and minimal noise, dust, and visual impacts within the local vicinity that could be experienced by tourists in the area. The pipeline facilities would be almost entirely underground during operation and create minimal visual impacts on surrounding areas. The carbon capture facility would be adjacent to the ethanol plant and compatible with its surrounding viewshed. Once construction is finished and the project is in operation, it is not expected to cause any noise or dust impacts on adjacent tourism areas. The project's impacts on tourism economies would be negligible during operation.

11.2.5 Criterion E

Pipeline cost and accessibility

The primary difference in costs among the three route alternatives is the route length. The project would connect to a larger CO_2 system called the MCE Project. RA-North would not connect to the applicant's proposed MCE Project route in North Dakota; however, the connection point remains undefined because the applicant has not obtained a permit for the pipeline in North Dakota. The estimated cost for RA-North is $40.0 million. RA-Hybrid would cost $40.4 million, and RA-South would cost $37.0 million.

11.2.6 Criterion F

Use of existing rights-of-way and rights-of-way sharing or paralleling

All three route alternatives parallel existing rights-of-way for a portion of their length. RA-North parallels existing road rights-of-way for 22.1 miles, or 96 percent of its length. RA-Hybrid parallels existing road rights-of-way for 22.3 miles, or 76.5 percent of its length. RA-South parallels existing road rights-of-way for 13.0 miles, or 46.1 percent of its length.

11.2.7 Criterion G

Natural resources and features

Natural resources and features are described above under Criterion B, Natural Environment.

11.2.8 Criterion H

The extent to which human or environmental effects are subject to mitigation by regulatory control and by application of the permit conditions contained in [Minnesota Rule] 7852.3400 for pipeline right-of-way preparation, construction, cleanup, and restoration practices

EERA staff has not identified significant differences among the three route alternatives regarding the extent to which effects are subject to mitigation measures. Most effects of the project could be mitigated along all route alternatives.

11.2.9 Criterion I

Cumulative potential effects of related or anticipated future pipeline construction

Cumulative impacts of the project are described in Chapter 10. No related or reasonably foreseeably future pipeline construction has been identified in Otter Tail or Wilkins County. The pipeline described in this EIS would continue into North Dakota. This portion of the MCE Project in Richland County, North Dakota, is discussed in Chapter 10.

11.2.10 Criterion J

The relevant applicable policies, rules, and regulations of other state and federal agencies, and local government land use laws including ordinances adopted under Minnesota Statutes, section 299J.05, relating to the location, design, construction, or operation of the proposed pipeline and associated facilities

It is assumed that all route alternatives are equal such that all are subject to, and must comply with, the relevant applicable policies, rules, and regulations of other state and federal agencies, and local government land use laws.

11.3 EERA Staff Recommended Mitigation

This section summarizes mitigation measures currently recommended by EERA staff should the Commission ultimately decide to issue a pipeline routing permit for the project. These recommendations are above and beyond mitigation in the sample routing permit issued for the project. In addition to the mitigation measures summarized below, the Commission could require that an independent environmental inspector, who reports directly to EERA staff, monitor construction and restoration of the project. The applicant could be required to pay for the costs of the environmental inspector.

11.3.1 Noise

EERA staff recommends the applicant provide documentation of coordination with residents located within 1,320 feet of HDD entries. The submittal should document locations of sound dampening barrier walls and include a plan for monitoring noise levels at these locations during HDD operations. The information should be provided 30 days prior to submittal of the Plan and Profile. In its review of a preliminary version of the draft EIS, the Minnesota Department of Health concurred with this mitigation measure.

11.3.2 Public Health and Safety

EERA staff does not recommend any mitigation for Public Health and Safety related to the construction and normal operations of the project. With respect to a potential accidental release of CO_2, EERA staff believes the following mitigations are reasonable:

- Applicant-provided indoor CO_2 detectors for residences within 1,000 feet of the project. This distance was chosen based on the most impactful scenario as described in **Appendix G**.
- A special permit condition requiring the applicant to file its Emergency Response Plan that is filed with PHMSA with the Commission.
- A special permit condition requiring the applicant to provide an accidental release plan, developed in coordination with local emergency responders, for Commission review 30 days prior to submittal of the Plan and Profile. The accidental release plan could include the specific equipment, training, and reimbursement that could be provided to emergency managers. The plan could also list the names of the emergency responders and a provision to update contact information as needed. The plan could discuss the feasibility of a "reverse 911" notice that goes out to landowners' telephones in the event of an emergency shutdown or rupture. The release plan could identify how the applicant would pay for costs of any repair to public infrastructure or private property (including crops and livestock) that might occur during an accidental release.
- A special permit condition requiring the applicant to identify locations of fracture arrestors and any locations of thicker-walled pipe on the Plan and Profile filed with the Commission.
- A special permit condition requiring the applicant to provide its public education plan for Commission review 30 days prior to submittal of the Plan and Profile. The public education plan could include specific safety information for neighboring landowners, including what to do in case of a rupture.

11.3.3 Recreation

Should the Commission elect to issue a pipeline routing permit along RA-South, EERA staff recommends the applicant provide documentation of coordination with the Fergus Falls Fish & Game Club.

11.3.4 Archaeological and Historic Resources

Should the Commission issue a pipeline routing permit, appropriate surveys for archaeological resources should occur regardless of which route alternative is selected. If archaeological resources are found, treatment plans should be prepared in consultation with Tribes and SHPO as appropriate.

11.3.5 Rare and Unique Resources

The applicant should use only "bio-netting" or "natural netting" types and mulch products without synthetic (plastic) fiber additives.

11.3.6 Water Resources

The applicant should provide to the Commission results of geotechnical evaluations of groundwater conditions for any beach ridge areas in which sheet piling would be used for pipeline construction. The evaluations should be provided 30 days prior to the Plan and Profile submittal and the applicant should document coordination with DNR staff. The submittal could include DNR staff concurrence regarding use of sheet piling.

11.3.7 Wildlife and their Habitats

The applicant should use only “bio-netting” or “natural netting” types and mulch products without synthetic (plastic) fiber additives.

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[1] Minn. R. 7852.0200, subp. 4.

[2] Minn. R. 7852.0100, subp. 28.

Chapter 12 List of Preparers

Chapter 12 provides information on titles of staff who prepared this EIS. Throughout the EIS process, multiple individuals have contributed to varying degrees related to their areas of expertise. Individual involvement has included a range of tasks, including developing text in the EIS, researching specific applicable topics, analyzing data, preparing graphics and summary tables, and reviewing and finalizing text in the document.

12.1 Minnesota Department of Commerce, Energy Environmental Review and Analysis Unit

The Commerce EERA unit is preparing the EIS on behalf of the Commission. The Commission is the Responsible Government Unit for the EIS.

List of Preparers for the Department of Commerce EERA
Name: Andrew Levi **Title:** Environmental Review Manager
Name: Jessica Thiel **Title:** Environmental Review Planner
Name: Jenna Ness **Title**: Environmental Review Manager
Name: Ray Kirsch **Title**: Unit Supervisor

12.2 Environmental Impact Statement Preparation Team

EERA staff was supported by HDR, Inc.; Allied Solutions, Inc.; and System Insight Engineering, LLC. The table below includes the list of preparers from HDR.

List of Preparers for HDR, Inc.
Name: Joe Sedarski, PE, JD **Title:** Senior Environmental Project Manager/Senior Technical Advisor
Name: Catherine Storey **Title:** Senior Environmental Scientist
Name: Patricia Terhaar, PG **Title:** Senior Environmental Scientist/Project Manager
Name: Leandra Cleveland **Title:** Industrial ES&P Leader
Name: Michael Mayer, JD **Title:** Principal Environmental Project Manager
Name: Jennifer Bring **Title:** Environmental Science and Planning Section Manager

List of Preparers for HDR, Inc.
Name: Megan Mueller **Title:** Cultural Resource Specialist
Name: Daniel W. Jones **Title:** Senior Environmental Engineer
Name: Emily Ramos **Title:** Environmental Planner
Name: Benjamin Copenhaver **Title:** Acoustician
Name: Mauli Sand **Title:** Environmental Scientist
Name: Bonnie Wolgamot **Title:** Environmental Scientist
Name: Chelsea Huck **Title:** Environmental Planner
Name: Victoria Hsu **Title:** Senior Air Quality Specialist
Name: Megan McCabe **Title:** Air Quality Specialist
Name: Merin Swenson **Title:** Senior Environmental Planner
Name: William Neds, PE **Title:** Sustainability Analyst
Name: Danlyn Brennan, EIT **Title:** Water Resources EIT
Name: Christine Justiniano **Title:** GIS Technician
Name: Kimberly Gust **Title:** Senior Technical Editor
Name: Matthew Hodgson **Title:** Copy Editor

The table below includes the list of preparers from Allied Solutions, Inc.

List of Preparers for Allied Solutions, Inc.
Name: Dan Prascher **Title:** PHMSA Compliance and Pipeline Integrity Principal

The table below includes the list of preparers from System Insight Engineering, LLC.

List of Preparers for System Insight Engineering, LLC
Name: Arlen Ward, PE **Title:** Principal and CEO

12.3 Contributing Tribes and Minnesota State Agencies

The Commission requested "that EERA coordinate with the Minnesota Office of Pipeline Safety along with other state agencies and tribal governments to ensure their expertise is reflected in the EIS." EERA staff provided draft sections of the EIS for review. Draft sections were not complete, and not all sections were provided because of timing constraints. The table below lists Tribes and state agencies that provided comment.

List of Contributing Tribes and State Agencies
Tribe: Mille Lacs Band of Ojibwe
State Agency: Office of Pipeline Safety
State Agency: Department of Transportation
State Agency: Department of Health
State Agency: Department of Natural Resources

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