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1 Introduction

This environmental assessment (EA) has been prepared for the Duluth Loop Reliability Project (Project), which includes construction of new 115 kilovolt (kV) transmission lines, extension of an existing 230kV transmission line, and upgrades to several substations. This EA evaluates the potential human and environmental impacts of the proposed project and possible mitigation measures including project alternatives.

This EA is not a decision-making document, but rather serves as a guide for decision makers. The EA is intended to facilitate informed decisions by state agencies.

On October 21, 2021, Minnesota Power (Applicant) submitted a Certificate of Need (CN) Application and a high voltage transmission line (HVTL) Route Permit Application (RPA) to the Minnesota Public Utilities Commission (Commission).[1] The RPA was submitted under the alternative review process (Minnesota Statute 216E.04; Minnesota Rule 7850.2800-3900).

1.1 Project

In the RPA the stated purpose for the Duluth Loop Reliability Project is to replace the system support once provided by coalfired baseload generators located along Minnesota's North Shore by addressing severe voltage stability concerns, relieving transmission line overloads, and enhancing the reliability of Duluth-area transmission sources.[2]

The RPA continues, noting that the transmission system in the Duluth area has historically been supported by several coal-fired baseload generators located along Minnesota's North Shore, which have for decades contributed to the reliability of the transmission system by delivering power to the local area and providing system support. The applicant indicates that the transition away from reliance on coal to increasingly lower carbon sources of energy, has led to an increased reliance on the transmission system to deliver replacement power and system support to the Duluth area and along the North Shore.[3]

Minnesota Power believes in order to maintain a continuous supply of safe and reliable electricity while replacing the support once provided by these local coal-fired generators, the Duluth area transmission system must be upgraded. To accomplish this, Minnesota Power is proposing that the transmission system in the area be reconstructed, reconfigured, and improved to enhance system stability and reliability.[4]

[1] Minnesota Power Duluth Loop Combined Application (hereafter RPA), p. 1-1. October 21, 2021. eDocket No. 202110-179004.
[2] Ibid at pp. 1-1 to 1-3.
[3] Ibid.
[4] RPA, pp. at 1-1 to 1-3.

The Duluth Loop Reliability Project includes: (1) construction of about 14 miles of new 115 kV transmission line between the Ridgeview, Haines Road, and Hilltop Substations; (2) construction of a new approximately one-mile extension connecting an existing 230 kV transmission line to the Arrowhead Substation; (3) upgrades to the Ridgeview, Hilltop, Haines Road, and Arrowhead substations; and (4) reconfiguration, rebuild, and upgrade to existing transmission lines and communications infrastructure in the Project area.[5]

Minnesota Power anticipates starting construction in 2023, and the project is scheduled to be in-service in 2025.[6]

1.2 State of Minnesota's Role

In order to build the Project, Minnesota Power must obtain two approvals from the Commission —a Certificate of Need (CN), and a High Voltage Transmission Line (HVTL) Route Permit for the transmission lines.[7] In addition to these approvals from the Commission, the Project also requires approvals (permits, licenses) from other state agencies and federal agencies with permitting authority for specific resources. Commission route permits supersede and preempt all zoning, building, and land-use regulations promulgated by local units of government.[8]

To help the Commission with its decision-making and to ensure a fair and robust airing of the issues, the state of Minnesota has set out a process for the Commission to follow in making its decisions. This process requires[9]:

- the development of an environmental review document, and
- public hearings before an administrative law judge (ALJ).

The goal of the EA is to describe the potential human and environmental impacts of the project (the facts); the goal of the hearings is to advocate, question, and debate what the Commission should decide about the Project (what the facts mean). The entire record developed in this process—the EA and the report from the ALJ, including all public input and testimony—is considered by the Commission when it makes its decisions on the Applicant's CN and HVTL route permit applications.

1.3 Organization of Environmental Assessment

[5] RPA, pp. at 1-1 to 1-3.
[6] Ibid.
[7] Minnesota Rules 7850.
[8] Minnesota Statutes 216E.10
[9] Minnesota Statutes 216B and 216E

This EA is based on Minnesota Power's CN and HVTL route permit applications, public comments received during the scoping comment period for this EA, and input from the Commission. This EA addresses the matters identified in the *Scoping Decision* for this project (**Appendix A**) and is organized as outlined as follows:

Chapter 1	Introduction	Provides an overview of the Project, the state of Minnesota's role, and the organization of the document.
Chapter 2	Regulatory Framework	Describes the regulatory framework associated with the project, including the state of Minnesota's certificate of need and site and route permitting processes, the environmental review process, and the permits and approvals that would be required for the project.
Chapter 3	Overview Proposed HVTLs	Describes the engineering, design, and construction of the proposed HVTLs.
Chapter 4	Alternatives to the HVTL Project	Describes the alternatives for satisfying the energy demand or transmission needs to the proposed Project.
Chapter 5	Affected Environment, Potential Impacts, and Mitigation Measures	Discusses the resources in the Project area and the potential human and environmental impacts of the project and identifies measures that could be implemented to avoid or mitigate potential adverse impacts.
Chapter 6	Application of Routing Factors (Factors Considered)	Discusses the proposed Project and the merits relative to the *Factors Considered*.

1.4 Sources of Information

The primary sources of information for this EA are the applications for the CN, and the HVTL route permit submitted by Applicant. Additional sources of information are identified in the footnotes throughout the document. New and additional data has been included from the Applicant and from state agencies. Information was also gathered by visits to the Project area.

A number of spatial data sources, which describe the resources in the Project area, were used in preparing this EA. Spatial data from these sources can be imported into geographic information system (GIS) software, where the data can be analyzed and potential impacts of the project quantified, (acres of wetland within the anticipated right-of-way).

2 Regulatory Framework

The Project requires two approvals from the Commission – a certificate of need, and a HVTL route permit. The Project will also require approvals from other state and federal agencies with permitting authority for actions related to the project.

2.1 Certificate of Need

A CN is required for all "large energy facilities,"[10] unless the facility falls within a statutory exemption from the CN requirements. Through the CN proceedings the applicant must demonstrate using a number of factors prescribed in the rules that the proposed facility is in the best interest of the state's citizens. The applicant must also demonstrate there is not a more prudent and reasonable way than the proposed project to address the stated goals.

The Duluth Loop Project's transmission lines each meet the definition of a large energy facility and are without an exemption, thus, the granting of a CN is required prior to issuance of a HVTL Route Permit.

A portion of the combined application filed by Minnesota Power on October 21, 2021, is intended to satisfy the informational requirements contained in Minnesota Rule 7849.0220 in the consideration of a CN for the Duluth Loop Reliability Project.[11]

Application and Acceptance

The Commission must determine if an application for a CN is complete; the Commission must notify the applicant within 30 days of the receipt of an application if the application is not substantially complete. On notification, the applicant may correct any deficiency and may resubmit the application. If the revised application is substantially complete, the date of its submission is considered the application date.[12] In addition to deciding if the application is complete, the Commission will typically determine the type of hearing (contested case or informal) to be used. Once the application is determined to be complete, the Minnesota Department of Commerce (Department) will initiate the environmental review process.

Environmental Review

CN applications are subject to environmental review; in such a proceeding EERA staff must prepare an environmental report (ER) for the project.[13] The report contains "*information on the human and environmental impacts of the* [*project*] *associated with the size, type, and timing of the project, system configurations, and voltage*."[14] The ER also contains information on alternatives to the project, as well as mitigation measures.

[10] Minn. Stat. 216B.243, subdivision. 2; Minn. Stat. 216B.2421, subdivision. 2 (1 and 2).
[11] Minnesota Power Duluth Loop Combined Application, Appendix A. October 21, 2021. eDocket No. 202110-179004.
[12] Minn. R. 7849.0200, subpart. 5.
[13] Minn. R. 7849.1200.
[14] Ibid.

If an applicant for a CN applies for a HVTL route permit concurrently, or prior to scoping, EERA may elect to prepare an Environmental Assessment (EA) in lieu of an ER. If so, the EA must include the content required by Minnesota Rule 7849.1500.

Public Hearing

If it is determined that a contested case is not warranted, then the Commission will initiate an informal process. This informal process will include at least one public hearing that may be overseen by an Administrative Law Judge (ALJ) from the Office of Administrative Hearings (OAH). At the conclusion of this informal process the ALJ will produce a report.

A contested case hearing is warranted if there are disputed issues of material fact; in such a case, the Commission must request an ALJ from the OAH. The duties of the ALJ during these proceedings are described in Minnesota Rule 1400.5500. Once the OAH assigns an ALJ for a contested case hearing the parties will first meet at a pre-hearing conference. At this prehearing conference, the parties will discuss procedural issues including an intervention deadline for requesting formal party status, discovery, locations of public and evidentiary hearings and a schedule for a hearing.

If the HVTL route permitting process and CN determination are proceeding concurrently, the Commission may order that a joint hearing be held to consider both routing and need.[15]

At the conclusion of the evidentiary hearing, public hearing, and comment period the ALJ produces a report.

Final Decision

The Commission has 12 months to approve or deny a CN from the date the application is filed.[16]

On December 14, 2021, the Commission issued an Order on the application of Minnesota Power for a CN for the Duluth Loop Reliability Project; the Commission determined that 1) the Applicant's petition was substantially complete and 2) the Commission will evaluate the petition using the Commission's comment (informal) process.

2.2 HVTL Route Permit

The Duluth Loop Reliability Project requires a HVTL route permit from the Commission;[17] the Project qualifies for review under the alternative permitting process authorized by Minnesota Statutes § 216E.04, subd. 2(3) and Minnesota Rules 7850.2800, Subp. 1(C) because the 115 kV portion of the Project is a high voltage transmission line between 100 and 200 kV and the 230 kV portion of the Project is less than five miles in length.

[15] Minn. Stat. 216B.243, subdivision. 4 (stating that unless a joint hearing is not feasible or more efficient, or otherwise not in the public interest, a joint hearing shall be held).
[16] Minn. Stat. 216B.243, subdivision. 5; Application at page 4 (the applicant anticipates the site permit decision to be made in summer 2020).
[17] Minn. Stat. 216E.03, subdivision. 1 and 2.

Applicants must provide the Commission with written notice of their intent to file an application under the alternative permitting process,[18] which was provided on March 22, 2021.[19]

Application and Acceptance

Route permit applications must provide specific information.[20] This includes, but is not limited to, information about the applicant, descriptions of the project and site, and discussion of potential human and environmental impacts and possible mitigation measures.[21] Under the alternative permitting process an applicant is not required to propose alternative sites or routes; however, if alternatives were evaluated and rejected, the application must describe these and the reasons for rejecting them.[22]

Upon receiving a HVTL route permit application, the Commission may accept it as complete, reject it and advise the applicant of its deficiencies, or accept it as complete but require the applicant submit additional information.[23]

Once the Commission determines an application is complete, the formal environmental review process can begin.

Public Advisor

Upon acceptance of an RPA the Commission must designate a public advisor.[24] The public advisor answers questions about the permitting process but cannot provide legal advice or act as an advocate for any person.

Advisory Task Force

The Commission may appoint an advisory task force to aid in the environmental review process.[25] An advisory task force assists EERA staff in identifying additional routes or particular impacts to evaluate in the EA prepared for the project.[26] If appointed, an advisory task force must include certain local government representatives.[27] The advisory task force expires upon completion of its charge or issuance of the scoping decision.[28]

Appointment of an advisory task force is not required at the time of *Application Acceptance*; in the event no advisory task force is appointed citizens may request one be created.[29] If such a

[18] Minn. R. 7850.2800, subpart. 2.
[19] Minnesota Power, Notice of Intent to File Site and Route Permits Under the Alternative Process, August 18, 2021. eDocket No. 20218-177245-01.
[20] Minn. Stat. 216E.04, subdivision. 3; Minn. R. 7850.3100.
[21] Ibid.
[22] Ibid.
[23] Minn. R. 7850.3200.
[24] Minn. R. 7850.3400.
[25] Minn. Stat. 216E.08, subdivision. 1; Minn. R. 7850.3600, subpart 1.
[26] Minn. R. 7850.2400, subpart 3.
[27] Minn. Stat. 216E.08, subdivision. 1.
[28] Minn. R. 7850.2400, subpart 4.
[29] Minn. R. 7850.2400, at subpart 2.

request is made, the commission must make this determination at its next scheduled agenda meeting.[30]

The decision whether to appoint an advisory task force, does not need to be made at the time of application acceptance; however, a decision should be made as soon as practicable to ensure an advisory task force could complete its charge prior to issuance of the scoping decision.

Environmental Review

Route permit applications are also subject to environmental review. The alternative permitting process requires completion of an EA, which is prepared by EERA staff.[31] An EA contains an overview of the resources affected by the project and discusses potential human and environmental impacts and mitigation measures.[32] Under the alternative permitting process an EA is the only required state environmental review document.[33]

EERA conducts necessary public scoping meetings in conjunction with a public comment period to inform the content of the EA (i.e., Scoping).[34] The Commissioner of the Department or a designee determines the scope of the EA,[35] and may include alternative routes suggested during the scoping process if they would aid the Commission in making a permit decision.[36]

Public Hearing

The alternative permitting process requires a public hearing be held in the project area upon completion of the EA[37] in accordance with the procedures outlined in Minnesota Rule 7850.3800, subpart 3.

The hearing is typically presided over by an ALJ from the OAH. The Commission may request that the ALJ provide solely a summary of public testimony. Alternately, the Commission may request that the ALJ provide a full report with findings of fact, conclusions of law, and recommendations regarding the project. (This hearing is not a contested case hearing and is not conducted under OAH Rule 1405).

Final Decision

The Commission is required to make a HVTL route permit decision within six months from the date an application is accepted.[38] This time limit may be extended up to three months for just cause or upon agreement of the applicant.[39]

[30] Minn. R. 7850.2400, at subpart 2.
[31] Minn. Stat. 216E.04, subdivision 5; Minn. R. 7850.3700, subpart 1.
[32] Minn. Stat. 216E.04, subdivision 5; Minn. R. 7850.3700, subpart 4.
[33] Minn. Stat. 216E.04, subdivision 5.
[34] Minn. R. 7850.3700, subpart 2.
[35] Ibid at subpart 3.
[36] Ibid at subpart 2.
[37] Minn. R. 7850.3800, subpart 1.
[38] Minn. R. 7850.3900, subpart 1.
[39] Ibid.

On December 14, 2021, the Commission issued an Order on the application of Minnesota Power for a HVTL Route Permit for the Duluth Loop Reliability Project; the following disposition was made: 1) Accepted the HVTL Route Permit Application for the Duluth Loop Reliability Project as substantially complete, 2) take no action on an advisory task force, and 3) request a full ALJ report with recommendations for the project's public hearing.

2.3 EA Scoping Process for the Duluth Loop Reliability Project

Under Minnesota Rule, 7850.3700, subpart 4, the Environmental Assessment must include the following:

A. A general description of the proposed project.
B. A list of any alternative sites or routes that are addressed.
C. A discussion of the potential impacts of the proposed project and each alternative site or route on the human and natural environment.
D. A discussion of mitigative measures that could reasonably be implemented to eliminate or minimize any adverse impacts identified for the proposed project and each alternative.
E. An analysis of the feasibility of each alternative site or route considered.
F. A list of permits required for the project; and
G. A discussion of other matters identified in the scoping process.

Scoping is the first step in the development of the EA for a project undergoing review. The scoping process has two primary purposes:

- gather public input as to the impacts, mitigation measures, and alternatives to study in the EA.
- focus the EA on those impacts, mitigation measures, and alternatives that will aid in the Commission's decisions on the certificate of need and route permit applications.[40]

On January 10, 2022, Commission and EERA staff sent notice of the place, date and time of the Public Information and Scoping meetings to local government units and those persons on the Project contact/general list.[41]

Commission staff and EERA staff jointly held a Public Information and EA Scoping meeting at the AAD Shrine Meeting and Event Center in Hermantown on January 26, 2022. A remote-access meeting (Webex) was held on January 27, 2022. The purpose of the meetings was to provide information to the public about the proposed Project, to answer questions, and to allow the public an opportunity to suggest alternatives and impacts (i.e., scope) that should be considered during preparation of the environmental review document. A court reporter was present at the meetings to document oral statements.

[40] "The scoping process must be used to reduce the scope and bulk of an environmental impact statement by identifying the potentially significant issues and alternatives requiring analysis and establishing the detail into which the issues will be analyzed." (Minnesota Rule 7850.2500, subpart. 4)
[41] Notice of Public Information/Scoping Meeting, January 10, 2022, eDocket no. 20221-181338-01.

EERA also used the services of MetroQuest,[42] an on-line survey service provider, to gather comments on the proposed Project.

Thirteen people attended the in-person public information and scoping meeting, while three people attended the remote meeting. The comment period closed on February 4, 2022. Four public comments were received, and one comment letter was received from state agencies.[43]

Comments received included statements of support for or opposition to the proposed HVTL project as well as to specific concerns or perceived impacts. In preparing the Scoping Decision recommendation, EERA staff considered all comments to the extent practicable. The court reporter record from the public meetings, as well as scanned images (pdf) of the original written comments received, were posted on the EERA webpage, and filed in the dockets.

The process for individuals to request that specific alternative routes, alternative route segments, and/or alignment modifications be included in the scope of the environmental review document was discussed at the EA scoping meetings.

One alternative route segment (Neitzel Alternative Route Segment) was submitted for consideration by Lisa Neitzel during the EA scoping comment period. Ms. Neitzel expressed concerns about the impact that the proposed line would have on her daughter's health (EMF) and on the abundant wildlife in the area.

The Neitzel residence is located on the south side of Mogie Lake and is approximately 500 feet north of the current Line 71 conductor; the proposed new line (Line 176) would be double circuited with the existing 71 Line on new structures within the existing 71 Line ROW.

The Neitzel Alternative Route Segment would move the existing Line 71 and the new proposed Line 176 south approximately 700 feet to run parallel along the north side of the existing Line 98.

Pursuant to Minn. Rule 7850.3700, subpart 2(B), applicants have the right to review proposed alternatives and submit reply comments. On February 23, 2022, Minnesota Power filed a reply to comments, questions, and the request for the EA to include the Neitzel Alternative Route Segment that were submitted during the scoping comment period.[44] Minnesota Power stated in their response comment that they had previously evaluated the Neitzel Alternative Route Segment during the route development process prior to filing its CN and RPA; that this route alternative was rejected due to the need for additional ROW and greater impacts to homes and buildings as compared to the proposed route.

On March 7, 2022, EERA filed a *Scoping Process Summary - Comments and Recommendation* with the Commission.[45] EERA staff did not recommend any alternative routes, alternative route segments, and/or alignment modifications be included in the *Scoping Decision*; as to the Neitzel Alternative Route Segment, EERA concurred with Minnesota Power's conclusions. In addition to Minnesota Power's analysis, given

[42] Home | MetroQuest.
[43] Public Scoping Comments through February 4, 2022, Close of Comment Period (Oral and Written Comments), eDocket No. 20222-182651-02.
[44] Minnesota Power Reply Comment EA Scoping, February 23, 2022, eDocket No. 20222-1831103-02.
[45] EERA Scoping Process Summary-Comments and Recommendation, March 7, 2022. eDocket No. 20223-183500-01.

the distance from the existing Line 71 (and therefore from the new, proposed double-circuit Line 71/176) to the Neitzel residence, potential impacts from EMF are expected to be negligible.

On April 7, 2022, the Commission met concerning the review of EERA's *EA Scoping Summary* for the Duluth Loop Reliability Project docket. The Commission elected to take no action on the EA Scope.[46]

On April 25, 2022, the Assistant Commissioner of the Department signed the EA Scoping Decision (**Appendix A**) for Minnesota Power's Duluth Loop Reliability Project in St. Louis County.[47]

2.4 Other Permits and Approvals

A HVTL route permit for the Duluth Loop Reliability Project from the Commission is the only state permit required for the routing of the transmission lines. Commission-issued route permits supersede local planning and zoning and bind state agencies;[48] thus, state agencies are required to participate in the Commission's permitting process to aid the Commission's decision-making and to indicate routes that are not permittable.

However, various federal, tribal, state, and local approvals may be required for activities related to the construction and operation of the project. All permits subsequent to the Commission's issuance of a route permit and necessary for the project (commonly referred to as "downstream permits") must be obtained by a permittee. The information in this EA may be used by downstream permitting agencies in their evaluation of impacts to resources. **Table 1** lists permits and approvals that could be required for the Project, depending on the final design.

2.4.1 Federal Approvals

The United States Army Corps of Engineers (USACE) regulates potential impacts to waters of the United States. Dredged or fill material, including material that moves from construction sites into these waters, could impact the quality of the waters. The USACE requires permits for projects that may cause such impacts. The USACE is also charged with coordinating with Native American tribes regarding potential impacts to traditional cultural properties.

The U.S. Fish and Wildlife Service (USFWS) requires permits for the taking of threatened or endangered species. The USFWS encourages consultation with project proposers to ascertain a project's potential to impact these species and to identify general mitigation measures for the project.

[46] Minutes, April 7, 2022, Commission Meeting, May 2, 2022. eDocket 20225-185444-01.
[47] Scoping Decision, March 25, 2022. eDocket No. 20224-185055-01.
[48] Minnesota Statutes, sections 216F.07 and 216E.10.

The Federal Aviation Administration (FAA) regulates civil aviation, including the airspace used for aviation. The FAA requires permits for tall structures, such as transmission line structures, which could adversely impact aviation.

Table 1. Potential Permits and Approvals Required for the Duluth Loop Reliability Project[49]

Permit	Jurisdiction
Local Approvals	
Road Crossing/ROW Permits	St. Louis County; cities of Duluth, Proctor, and Hermantown
Lands Permit or Easement	St. Louis County; cities of Duluth, Proctor, and Hermantown
Over-width Loads Permits	St. Louis County; cities of Duluth, Proctor, and Hermantown
Driveway/Access Permits	St. Louis County; cities of Duluth, Proctor, and Hermantown
Municipal Stormwater Permit	City of Duluth
Minnesota State Approvals	
Endangered Species Consultation	MnDNR – Ecological Services
Licenses to Cross Public Waters	MnDNR – Lands and Minerals
National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit	Minnesota Pollution Control Agency (MPCA)
Section 401 Clean Water Act Water Quality Certification	MPCA
Spill Prevention, Control and Countermeasure Plan update	MPCA
Wetland Conservation Act (WCA)	Board of Water and Soil Resources, Soil and Water Conservation District, County, City,
Minnesota State Historic Preservation Office (SHPO) Consultation	Office of State Archaeologist, and Minnesota Indian Affairs Council
Driveway/Access Permit	MnDOT
Utility Accommodation on Trunk Highway ROW	MnDOT
Oversize and/or Overweight Permit	MnDOT
Federal Approvals	
Section 404 Dredge and Fill Permit	United States Army Corps of Engineers (USACE)
Endangered Species Consultation	United States Fish and Wildlife Service (USFWS)
Part 7460 Airport Obstruction Evaluation	Federal Aviation Administration /MnDOT
Other Approvals	
Crossing Permits/Agreements/Approvals	Other utilities such as pipelines, railroads

[49] RPA, at p. 9-1, Table 9-1.

2.4.2 State of Minnesota Approvals

The Minnesota Department of Natural Resources (DNR) regulates potential impacts to Minnesota's public lands and waters. The DNR requires a license to cross public lands and waters; licenses may require mitigation measures. Additionally, a water use permit from the DNR is required for all users withdrawing more than 10,000 gallons of water per day or 1 million gallons per year. Similar to the USFWS, the DNR encourages consultation with project proposers to ascertain a project's potential to impact state-listed threatened and endangered species and possible mitigation measures.

A general national pollutant discharge elimination system/sanitary disposal system (NPDES/ SDS) construction stormwater permit from the Minnesota Pollution Control Agency (MPCA) is required for stormwater discharges from construction sites. A permit is required if a project disturbs 1 acre or more of land. To ensure that state water quality standards are not compromised, the general NPDES/SDS permit requires:

- use of best management practices,
- a stormwater pollution prevention plan, and
- adequate stormwater treatment capacity once the project is constructed.

The Minnesota State Historic Preservation Office (SHPO) is charged with preserving and protecting the state's historic resources. Project proposers and state agencies consult with SHPO to identify historic resources (through surveys) and to avoid and minimize impacts to these resources.

The Minnesota Department of Agriculture (MDA) ensures the integrity of Minnesota's food supply while protecting the health of its environment and the resources required for food production. MDA assists in the development of *Agricultural Impact Mitigation Plans* (AIMP) to avoid and mitigate impacts to agricultural lands.

A permit from the Minnesota Department of Transportation (MnDOT) is required for transmission lines that are adjacent to or cross over Minnesota trunk highway rights-of-way (ROW). MnDOT's utility accommodation policy generally allows utilities to occupy portions of highway ROW where such occupation does not put the safety of the traveling public or highway workers at risk or unduly impair the public's investment in the transportation system.

The Minnesota Board of Water and Soil Resources (BWSR) oversees implementation of Minnesota's Wetland Conservation Act (WCA). The WCA is implemented by local units of government (LGUs). For linear projects that cross multiple LGUs, BWSR typically coordinates the review of potential wetland impacts among the affected LGUs. The WCA requires anyone proposing to impact a wetland to:

- try to avoid the impact,

- try to minimize any unavoidable impacts, and
- replace any lost wetland functions.

2.4.3 Local Approvals

Commission HVTL route permits preempt local zoning, building, and land use rules, regulations, or ordinances promulgated by regional, county, local, and special purpose government; however, coordination with local governments may be required for the issues listed below:

- Access/Driveway. Coordination may be required to construct access roads or driveways from county or township roads.
- Public Lands. Coordination would be required to occupy county or township lands such as forest lands, park lands, watershed districts, and other properties owned by these entities.
- Over-width Load. Coordination may be required to move over-width or heavy loads on county or township roads.
- Road Crossing and Right-of-Way. Coordination may be required to cross or occupy county or township road rights-of-way.

2.4.4 Conservation Programs

Conservation easements involve the acquisition of limited rights in land for conservation purposes. Landowners who offer the state a conservation easement receive a payment to stop cropping and/or grazing the land, and in turn the landowners establish conservation practices such as native grass and forbs, trees or wetland restorations. The easement is recorded on the land title with the county recorder and transfers with the land when the parcel is sold.[50] There may be lands within a proposed HVTL route or ROW that are part of various conservation programs including Reinvest in Minnesota (RIM) and the Conservation Reserve Enhancement Program (CREP).

The CREP is an offshoot of the Conservation Reserve Program (CRP) which is a land conservation program established by the U.S. Department of Agriculture and administered by the Farm Service Agency that pays farmers a yearly rental fee for agreeing to take environmentally sensitive land out of agricultural production in an effort to improve environmental health and quality. Minnesota implemented the CREP to target state-identified, high-priority conservation resources by offering payments to farmers and agricultural landowners to retire environmentally sensitive land using the Reinvest in Minnesota (RIM) Reserve Program.[51]

[50] Board of Water and Soil Resources, http://bwsr.state.mn.us/what-are-conservation-easements.
[51] Ibid.

The Board of Water and Soil Resources (BWSR) may alter, release, or terminate a conservation easement after consultation with the commissioners of agriculture and natural resources. BWSR may alter, release, or terminate an easement only if they determine that the public interests and general welfare are better served by the alteration, release, or termination.

2.4.5 National Electric Safety and Reliability Code

The Project must meet the requirements of the National Electrical Safety Code (NESC). Permittees must comply with the most recent edition of the NESC, as published by the Institute of Electrical and Electronics Engineers, Inc., and approved by the American National Standards Institute, when constructing new facilities or upgrading existing facilities.[52]

The NESC is designed to protect human health and the environment. It also ensures that the collection system, the transmission lines, and all associated structures are built from high-quality materials that will withstand the operational stresses placed upon them over the expected lifespan of the equipment, provided that routine maintenance is performed.

Permittees must also comply with North American Electric Reliability Corporation (NERC) standards. NERC standards define the reliability requirements for planning and operating the electrical transmission grid in North America.

[52] Minnesota Statute 326B.35.

3 Overview of the Proposed HVTL Project

The Duluth Loop Project includes: (1) construction of about 14 miles of new 115 kV transmission line between the Ridgeview, Haines Road, and Hilltop Substations; (2) construction of a new approximate one-mile extension connecting an existing 230 kV transmission line to the Arrowhead Substation; (3) upgrades to the Ridgeview, Hilltop, Haines Road, and Arrowhead substations; and (4) reconfiguration, rebuild, and upgrade to existing transmission lines and communications infrastructure in the Project area (**Figure 1**).

3.1 Proposed 115 kV HVTL

The Proposed 115 kV Route between the Ridgeview, Haines Road, and Hilltop Substations follows existing transmission lines for the majority of its length (**Figure 2**).

Detailed aerial maps of the proposed route are contained in **Appendix B**.

Following from north to south, the Proposed 115 kV Route beginning at the existing Ridgeview Substation and follows the existing 19 Line and 56 Line, within an east-west corridor, going west for about 1.2 miles from the Ridgeview Substation. Within this corridor, the proposed 115 kV transmission line will be located between the existing 19 and 56 Lines. This new line will become designated as the 19 Line and the existing 19 Line in this corridor will be reconstructed and be redesignated as part of the new 52 Line. At the point where the existing 56 Line turns north and the existing 19 Line turns southwest, the Proposed 115 kV Route will follow the existing 19 Line corridor. The centerline of the new construction shifts to the south side of the existing 19 Line and existing 52 Line to continue south and west for approximately 2.7 miles to enter the Haines Road Substation on the west side of Miller Trunk Highway.[53]

The following is a detailed description of the upgrades to existing infrastructure required for this portion of the Proposed 115 kV Route:

- Ridgeview Substation to the 56/19 Line split (**Appendix B, plates 1 and 2**) – The proposed 115 kV transmission line would be placed between the existing 19 and 56 Lines as it runs west from the Ridgeview Substation within existing Minnesota Power right-of-way (ROW) for about 1.2 miles. The existing transmission lines would be reconfigured as they enter the Ridgeview Substation to accommodate the new transmission line. Minnesota Power would replace the conductor and structures as needed on the existing 19 Line. H-Frame structures are planned for the new line and the rebuilt 19 Line.[54]

[53] RPA, at p. 2-1.
[54] RPA, at p. 2-2.

- The 56/19 split to the Swan Lake Road Substation (**Appendix B, plates 2 to 4**) – The proposed 115 kV transmission line would be placed to the east and south of the existing 19 Line for approximately 1.5 miles on an expanded ROW, crossing Rice Lake Road, to the Swan Lake Road Substation. Minnesota Power would replace the conductor and structures as needed on the existing 19 Line. H-Frame structures are planned for the new line and the rebuilt 19 transmission Line.[55]

- Swan Lake Road Substation to the Haines Road Substation (**Appendix B, plates 4 to 6**) – The proposed 115 kV transmission line would be placed to the east and southeast of the existing 52 Line for approximately 1.2 miles on an expanded ROW, crossing West Arrowhead Road, Sundby Road, and Miller Trunk Highway before entering the Haines Road Substation. An existing distribution line that runs south from the Swan Lake Road Substation to Arrowhead Road would be moved to the east of the existing 52 Line (new 57 Line) and new 52 Line on a new ROW. Minnesota Power would replace the conductor and structures as needed on the existing 52 Line (new 57 Line). Wood H-Frame and steel monopole structures are planned for the new line and the rebuilt 52 Line from the Swan Lake Road Substation to the Haines Road Substation.[56]

From the Haines Road Substation, the Proposed 115 kV Route continues west generally along the existing 58 Line corridor. This corridor contains the currently energized 58 Line and a parallel deenergized line, known as 58D, which is currently supporting fiber optic communications. Both existing 58 Line and 58D will be rebuilt with new conductor and structures as necessary for approximately 3.5 miles to a point about 0.3 miles east of the intersection of the existing 58 and 57 Lines. At this point, the Proposed 115 kV Route turns south in a new alignment for about 1.5 miles crossing Maple Grove Road and Hermantown Road to the existing 57 Line corridor located south of the Midway River. The Proposed 115 kV Route continues south following the existing 57 Line corridor for about 1.4 miles to the existing 71 Line. The conductor and structures will be replaced as needed on the existing 57 Line. Next, from the intersection with the existing 71 Line, 71 Line and the new 115 kV line (176 Line) will be reconstructed as a 115/115 kV double circuit line, going south for about 0.1 miles then east for 1.5 miles on the existing 71 Line corridor. At a point about 0.25 miles east of Lavaque Road, the proposed 71 Line/176 Line 115/115 kV double circuit line would turn south for about 0.1 mile, then east for about 0.75 miles, then south for approximately 0.75 miles, and west for about 0.25 miles to enter the Hilltop Substation. Several segments of the existing 98 Line will be shifted and rebuilt at the end of this alignment to facilitate the changes.[57]

The following is a detailed description of the upgrades to existing infrastructure would be required for this portion of the Proposed 115 kV Route:

[55] RPA, at p. 2-2.
[56] Ibid.
[57] RPA, at p. 2-3.

- Haines Road Substation to the 57 Line (**Appendix B, plates 6 to 12**) – The proposed 115 kV transmission line would exit the Haines Road Substation to the west and be placed on the existing 58D that is located north of the existing 58 Line. Immediately west of the Haines Road Substation to the west of Westburg Road, the proposed 115 kV transmission line and the existing 58 Line would be moved and rebuilt to the south to address right-of-way encroachments and provide more clearance from the commercial buildings along the north side of Market Street (**Appendix B, plate 6**) and from the commercial buildings along the south side of Lighting Drive (**Appendix B, plate 7**). The proposed 115 kV transmission line would continue on the existing 58D for about three miles to a point 0.3 miles east of the intersection of the existing 58 and 57 Lines. The existing 58 Line would be rebuilt from the Haines Road Substation to the intersection of the existing 58 and 57 Lines to accommodate the placement of the new line directly to the north. A new ROW would be needed in some sections.[58]

- Both the new line and rebuilt 58 Line would be reconfigured on Minnesota Power's property north of the Hermantown City Hall (**Appendix B, plate 9**).[59]

- The existing 58 Line that runs northwest to the existing 57 Line intersection would be reconfigured so that the two transmission lines do not cross. The existing 58 Line would be removed for a distance of about 0.3 miles (**Appendix B, plate 9**). A fiber optic connection to the 57 Line would need to be re-established, therefore a new underground fiber optic connection would be installed for about 0.75 miles along the existing 58 Line corridor (**Appendix B, plates 10, 11, and 12**).[60]

- Monopole structures are planned for the new line and the rebuilt 58 transmission Line from a point east of Sundby Road to the Haines Road Substation and from the Haines Road Substation to Minnesota Power's property north of the Hermantown City Hall (**Appendix B, plates 5 to 9**). H-Frame structures would be used from Minnesota Power's property north of the Hermantown City Hall to the intersection of the existing 58 and 57 Lines (**Appendix B, plates 9 and 10**).[61]

- 57 Line south to 71 Line (**Appendix B, plates 10 and 13 to 17**) – The proposed 115 kV transmission line and the 57 Line would turn south and share a new 160- foot-wide ROW for approximately 1.6 miles before rejoining the existing 57 Line ROW. The existing 57 Line from this point back to the existing 58 Line intersection north of Maple Grove Road would be removed (approximately 1.8 miles). The existing 57 Line parallels the Midway River and would be rerouted to reduce the length of impact on the Midway River. The proposed 115 kV transmission line

[58] RPA, at p. 2-3.
[59] Ibid.
[60] Ibid.
[61] RPA, at p. 2-3.

would parallel the proposed 57 Line ROW on west side for 1.4 mile to the intersection with the existing 71 Line. H-Frame structures would be used for the new line and rebuilt 57 Line with short section of monopole structures east of the Hermantown Cemetery.

- 71 Line Double-Circuit (**Appendix B, plates 17 to 21**) – The proposed 115 kV transmission line would be double-circuited with the existing 71 Line on new structures going south then east for about 1.5 miles on the existing 71 Line ROW.[62]

3.2 Proposed 230 kV HVTL

The Proposed 230 kV Route for the 230 kV line begins at the Arrowhead Substation and goes north for about 0.1 miles, then northeast for approximately 0.1 miles, then north for about 0.1 miles, then east for about 0.1 miles, then north and east for about 0.3 miles to a connection with the existing 98 Line (**Figure 3, and Appendix B, plates 22 and 23**), which would then be redesignated 108 Line. The Proposed 230 kV Route is located mostly on Minnesota Power property except for the northernmost 0.15 miles that spans the Canadian National Railroad and private property. The segment is parallel to existing 115 kV transmission lines. Approximately 0.5 miles of the existing 98 Line would be removed from the corner of the existing 90 Line and 98 Line to the new 108 Line tie-in, including the span over the Canadian National Railroad (**Appendix B, plate 22**).[63]

3.3 Route Width, Right-of-Way, and Anticipated Alignment

When the Commission issues a route permit, it approves a route, a route width, and an anticipated alignment within that route width.

- **Route**: The path the transmission line will follow between the solar farm's Collector Substation to the grid interconnect substation (Sherburne County Substation). Under Minnesota Statute 216E, subd. 8, the route may have a variable width of up to 1.25 miles.
- **Right-of-Way (ROW)**: The ROW is the physical land area within a route that is needed to construct and operate an energy facility; usually represented as the required easement.
- **Route Width**: The area along the route within which the actual ROW will be placed. The route width is typically larger than the ROW to provide flexibility to address engineering, human (landowner preferences) and environmental concerns that arise after the permit has been issued.
- **Anticipated Alignment**: A representation of the location of the poles and conductors within the ROW. In many cases, the poles would be placed in the center of the ROW, but in some areas,

[62] RPA, at p. 2-3.
[63] Ibid, at p. 2-4.

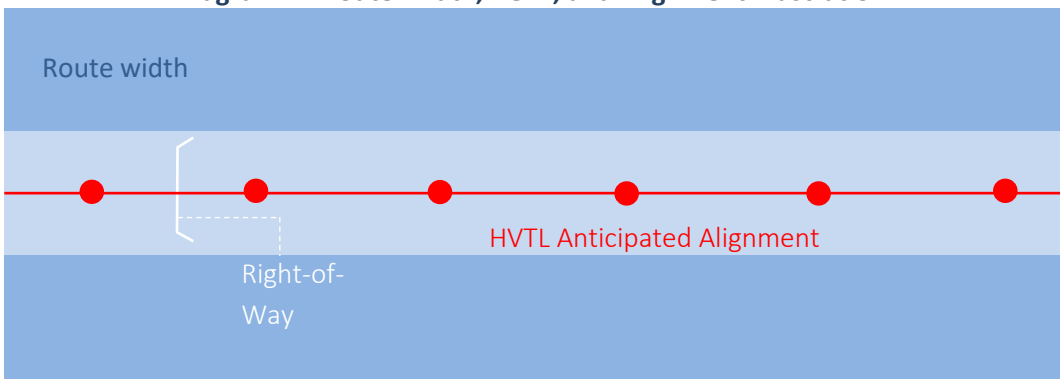
such as along certain roads, developers will propose to place the structures within, but near the edge of existing road ROW, outside of the travel lanes.

The Commission may include conditions in a route permit (see sample route permit in **Appendix C**). These conditions address the route width and anticipated alignment in a specific area of the project, for example, requiring the alignment of a specific portion of the route to be north rather than south of a road, or requiring that the route width be narrower than initially requested in certain areas.

Route Width

The route width is typically larger than the actual ROW needed for the transmission line (**Diagram 1**). This additional width provides flexibility in constructing the line yet is not of such extent that the placement of the line is undetermined. The route width allows permittees to work with landowners to address their concerns and to address engineering issues that may arise after a permit is issued. The route width, in combination with the anticipated alignment, is intended to balance flexibility and predictability.

Diagram 1. Route Width, ROW, and Alignment Illustration



When the Commission issues a HVTL route permit, a specific route and anticipated alignment are designated, and construction and maintenance conditions are specified. The HVTL route permit anticipates that the right-of-way will generally conform to the anticipated alignment as identified within the route permit unless changes are requested by individual landowners or unforeseen conditions are encountered. Any right-of-way modifications within the designated route shall be located so as to have comparable overall impacts relative to the factors in Minn. R. 7850.4100, as the alignment identified in the permit, and shall be specifically described and documented in and approved as part of the plan and profile post-permit compliance deliverable. Should such modification in the alignment require deviation outside of the designated route, the permittee shall follow the requirements of Minnesota Rule 7850.4900 (Amendment of Permit Conditions) to seek approval.

For the proposed 115 kV route, Minnesota Power is requesting approval for a route width that varies from about 500 feet wide to approximately 1,800-feet wide: 250 feet to 900 feet on either side of the centerline

for the transmission line (**Figure 2**). Minnesota Power has requested a wider route width in the following constrained areas:[64]

- 19- and 52-Lines route width between approximately 560 feet and 610 feet (**Appendix B, plates 1 to 7**)
- 57- and 176-Lines route width is about 560 feet (**Appendix B, plates 7 to 18**)
- 71 and 176 double-circuit Lines route width is about 500 feet (**Appendix B, plates 18 to 22**)
- Ridgeview Substation route width is about 810 feet (**Appendix B, plate 1**)
- Around the Haines Road Substation, Miller Creek, and Miller Trunk Highway span area has a route width of approximately 1,825 feet at the widest spot north to south(Appendix B, plates 6 to 7)
- Midway River area with the 57 and 176 Lines has a route width of approximately 1,710 feet at the widest spot east to west (Appendix B, plates 11 to 18)
- The Hermantown Cemetery with the 57 and 176 Lines has a route width of about1,550 feet (Appendix B, plate 17)
- Hilltop Substation has a route width of approximately 1,750 feet east to west (Appendix B, plate 22)

For the Proposed 230 kV Route, Minnesota Power is requesting approval of a 500-foot-wide route width (250 feet on either side of the centerline for the transmission line) with the exception of the area around Arrowhead Substation where additional route width is requested (**Appendix B, plate 24**).[65]

Right-of-Way

The right-of-way (ROW) is that specific area required for the safe construction and operation of the transmission line, where such safety is defined by the National Electric Safety Code (NESC) and the North American Electric Reliability Corporation (NERC) reliability standards. The ROW must be within the designated route and is the area for which the applicant obtains rights (easements) from private landowners to construct and operate the line.

Once a route permit is issued by the Commission, the Permittee will conduct detailed survey and engineering work, including, for example, soil borings. The Permittee would also contact landowners to gather information about their property and their concerns and discuss how the transmission line ROW might best proceed across their property. Use of a ROW for a transmission line across private property is typically obtained by an easement agreement between the permittee and landowner.

[64] RPA, at pp. 2-4 to 2-5.
[65] Ibid.

For new 115 kV transmission lines, Minnesota Power typically acquires a minimum ROW of up to 100 feet wide (50 feet on each side of the transmission line centerline). For the new 230 kV transmission lines, Minnesota Power typically acquires a minimum ROW of up to 130 feet wide (65 feet on each side of the transmission line centerline). It is sometimes necessary to secure extra permanent right-of-way at angles to accommodate guy anchors if used. Narrower ROW widths at specific and isolated routing constraint points may be possible and will need to be evaluated on a case-by-case basis.[66]

Anticipated Alignment

The anticipated alignment is the anticipated placement of the transmission line within the route and ROW, where the transmission line is anticipated to be built; usually represented as the "centerline".

After coordinating with landowners and completing detailed engineering plans, the permittee will establish the final alignment for the project and designate pole placements. These final plans, known as "*plans and profiles*," must be provided to the Commission so that the Commission can confirm that the Permittee's plans are consistent with the record the Commission has based its decision, the route permit, and all permit conditions prior to construction of the project.

3.4 Transmission Structure and Conductor Design

Transmission structures are one of the most visible elements of the electric transmission system. They support the conductors used to transport electric power from generation sources to customer load. Transmission lines carry electricity over long distances at high voltages, typically between 115 kV and 765 kV. There are various types of conductors which are used transmission line. The most common conductors used in HVTLs are Aluminum Alloy Conductors. The most common conductor in use for transmission today is aluminum conductor steel reinforced (ACSR). Aluminum conductor steel supported (ACSS) cable is also used for overhead transmission lines. ACSS is designed to operate continuously at higher temperatures up to 250°C without loss of strength, which allows for a significant increase in current carrying capacity over ACSR. From the outside, ACSS and ACSS/TW conductors look like traditional ACSR. All are manufactured with steel cores and aluminum outer strands. The key difference is that the ACSR aluminum is made from hard drawn aluminum, while ACSS uses soft aluminum. Aluminum is used because it has about half the weight and lower cost of a comparable resistance copper cable.

Transmission Structures

The proposed transmission structures for the Project are wood pole, H-frame structures and steel monopole structures. Structure heights and span lengths are a function of span properties, topography, wire, voltage, tension, route, and other factors. **Appendix D** illustrate typical height expected for most

[66] RPA, at p. 2-5.

tangent (straight line) type structures based on similar facilities. Actual span lengths and structure heights may vary depending on site specific characteristics.[67]

The new 115 kV wood H-frame structures will be approximately 50 to 80 feet tall with spans of approximately 500 to 1,000 feet. The new 115 kV steel monopole structures will be approximately 65 to 110 feet tall with spans of approximately 250 to 700 feet (**Table 2**).[68]

The new 230 kV steel monopole structures will be approximately 65 to 110 feet tall with spans of approximately 250 to 700 feet. In certain locations such as angles, along highways, constrained areas, or environmentally sensitive areas, other specialty structure types may be required. Less common structure configurations for dead ends, angles, crossings, and transpositions may also be necessary (**Table 2**).[69]

The proposed transmission line will be designed to meet or surpass relevant state codes including the National Electric Safety Code ("NESC") and Minnesota Power standards. **Table 2** summarizes the key specifications of the proposed transmission structures.

Table 2. Structure Design Summary[70]

Line Type	Structure Type	Structure Material	ROW Width (feet)	Structure Height (feet)	Foundation	Foundation Diameter (feet)	Span Between Structures (feet)
115 kV Single Circuit	H-frame	Wood	100	50-80	Direct Embed	n/a1	500- 1,000
115 kV Single Circuit	Monopole	Steel	100	65-100	Concrete Pier	4-6	250-700
115 kV Double Circuit	Monopole	Steel	100	65-110	Concrete Pier	4-6	250-500
230 kV Single Circuit	Monopole	Steel	130	65-110	Concrete Pier	4-6	250-700

Note: The values in the table above are typical values expected for most tangent structures based on similar facilities. Actual values may vary.

[67] RPA, at p. 2-5.
[68] RPA, at p. 2-5.
[69] Ibid.
[70] RPA, at p. 2-6, Table 2-1.

Conductor Design

The conductors for the 115 kV transmission line will consist primarily of 666 ACSS on new construction and reconstruction. A 636 ACSR conductor may be used for the 115 kV transmission line in some areas to match existing conductors. The conductors for the 230 kV transmission line will consist of 954 ACSR to match existing conductors. Typical transmission line construction with H-Frame structures have two shield wires. Shield wires are wires installed on all overhead transmission lines to protect them from lightning. Typical transmission line construction with monopole structures has a single shield wire but may have up to two. Typical transmission line construction has a single Optical Ground Wire (OPGW) in a shield wire position for communication purposes, although this varies, and lines may have no OPGW or two OPGW cables.[71]

3.5 Associated Facilities

The associated facilities are those facilities that are not a direct component of the HVTLs, but that would not be constructed or expanded if the project did not exist and on whose existence the viability of the project depends on such as reconductoring, upgrading, and reconfiguration of existing lines, substation modifications and expansions, and communication infrastructure alterations.

Transmission Line Upgrades

The following reconfiguration, rebuild, and upgrades are required to existing transmission lines in the Project area as part of the Duluth Loop Project (**Figure 4, and Appendix B**)[72]:

- Reconductor of 115 kV Haines Road – Swan Lake Road Line No. 52 (52 Line).
- Reconductor of 115 kV Swan Lake Road – Ridgeview Line No. 19 (19 Line).
- A segment of existing 115 kV Arrowhead – 15th Ave West Line No. 71 (71 Line) will be reconstructed as a double circuit line with the new 115 kV Hilltop – Haines Road Line No. 176 (176 Line).
- Existing 115 kV Arrowhead – Haines Road Line No. 58 (58 Line) will be uncrossedfrom existing 115 kV Arrowhead – Colbyville Line No. 57 (57 Line) to become 115kV Arrowhead – Colbyville 115 kV Line No. 58 (58 Line).
- Existing 115 kV Arrowhead – Colbyville Line No. 57 (57 Line) will be uncrossed from existing 115 kV Arrowhead – Haines Road Line No. 58 (58 Line) and connected to existing 115 kV Haines Road – Swan Lake Road Line No. 52 outsideof Haines Road Substation to become 115 kV Arrowhead – Swan Lake Road Line No. 57 (57 Line).
- Existing 230 kV Arrowhead – Iron Range Line No. 98/Tap to Hilltop (98 Line Tap)will be upgraded to a higher thermal rating; and
- Existing 98 Line Tap will be disconnected from existing 230 kV Arrowhead – Iron Range Line No. 98 and extended to the Arrowhead Substation to become the 230kV Arrowhead – Hilltop

[71] RPA, at p. 2-6.
[72] Ibid, at pp. 2-6 to 2-7.

Line No. 108 (108 Line).

Substation Modifications

The following upgrades are required to existing substations as part of the Duluth Loop Project

Hilltop Substation

The existing Hilltop Substation is in Duluth, Minnesota. The substation will be expanded by approximately 0.1 acres on existing Minnesota Power property to accommodate the construction of a new 115 kV transmission line entrance. This new 115 kV transmission line entrance will include a substation dead-end structure, circuit breaker, two switches, and bus work. The existing 230/115 kV transformer has a rating of 187 MVA and will be replaced with a 230/115 kV transformer with a rating of 373 MVA. The 115 kV circuit breaker, two switches, and some substation conductors on the low side of the 230/115 kV transformer will be replaced with higher ampacity equipment. A 230 kV circuit breaker will be added between the 230/115 kV transformer position and the 230 kV transmission line position. The three existing 115 kV transmission line circuit breakers will also be replaced as an additional asset renewal component of the project (**Figure 5**).[73]

Ridgeview Substation

The existing Ridgeview Substation is in Duluth, Minnesota. The Ridgeview Substation will be expanded by about 3.6 acres on existing Minnesota Power property to accommodate a new 115 kV transmission line entrance, a future 115 kV transmission line entrance, and a future capacitor bank in a ring bus configuration. The existing substation bus will be reconfigured and expanded to a six position 115 kV ring bus with three 115 kV transmission line positions, two 115/14 kV transformer positions, and a future 115 kV transmission line position. An aging 115/14 kV transformer will be replaced and relocated to a shared ring bus position with the future capacitor bank (**Figure 6**).[74]

Haines Road Substation

The existing Haines Road Substation is in Hermantown, Minnesota. Within the existing substation, a 115 kV circuit breaker will be added to an existing transmission line entrance. Some existing substation conductors will be replaced with high ampacity conductors.[75]

Arrowhead Substation

The existing Arrowhead Substation is in Hermantown, Minnesota. Within the existing substation, a 230 kV transmission line entrance will be added to accommodate the proposed 230 kV reconfiguration

[73] RPA, at p. 2-7.
[74] Ibid, at p. 2-7.
[75] Ibid, at p. 2-8.

establishing the Arrowhead – Hilltop 230 kV Line (108 Line). This new 230 kV transmission line entrance will include a substation dead-end structure, circuit breaker, two switches, and bus work.[76]

Communication Infrastructure Modifications

Modifications to communications infrastructure along the Project will be completed as part of the Duluth Loop Reliability work to improve overall communication capabilities of the transmission system. To accommodate reconfigurations, some sections of existing Optical Ground Wire (OPGW) to an adjacent splice box will be replaced due to age and condition. OPGW is placed in the secure topmost position of the transmission line where its "shields" the all-important conductors from lightning while providing a telecommunications path for internal as well as third party communications. These modifications to communication infrastructure would not independently require a Certificate of Need or Route Permit from the Commission.

Communications infrastructure modifications are anticipated to occur in the following areas (**Figure 7**):[77]

- Replace aging OPGW on existing 230 kV tap to Hilltop (98 Line Tap) and continue this communications path on new 108 Line into the Arrowhead Substation.
- Replace aging OPGW on existing 115 kV Hilltop – Hibbard Line No. 7 (7 Line) and route this communications path into the Hilltop Substation.
- Replace aging OPGW on existing 71 Line near the Hilltop Substation and route this communications path into the Hilltop Substation.
- Replace aging OPGW on 19, 52, 57, and 58 Lines; and
- Construct an underground fiber communications path in the existing transmission corridor between reconfigured 57 Line and 58 Line.

3.6 ROW Acquisition, Construction, Restoration, and Maintenance

Following the issuing of a HVTL Route Permit to the Applicants for the Duluth Loop Reliability Project, the permittee will perform a physical evaluation of each parcel along the permitted route. This work would include mobilization of various survey crews to conduct preliminary assessments (soil characterization, foundation design, wetland/biological reviews, property surveys, etc.). A geotechnical company will take soil borings to assess the soil characteristics and determine appropriate foundation design specifications; other consulting engineers will perform surveys to minimize potential impacts of the project and identify right-of-way corridors, natural features, man-made features, and associated ground elevations that will be considered in the detailed engineering necessary to construct the HVTL Project.

[76] RPA, at p. p. 2-8.
[77] RPA, at p. p. 2-8.

For new 115 kV transmission lines, Minnesota Power typically acquires a minimum ROW of up to 100 feet wide (50 feet on each side of the transmission line centerline). For new 230 kV transmission lines, Minnesota Power typically acquires a minimum right- of-way of up to 130 feet wide (65 feet on each side of the transmission line centerline). It is sometimes necessary to secure extra permanent right-of-way at angles to accommodate guy anchors if used. Narrower right-of-way widths at specific and isolated routing constraint points may or may not be possible and would be evaluated on a case-by-case basis.[78]

The workforce required for construction of the Project's facilities is estimated to be about 25 to 75 construction workers, depending on the construction sequencing and time of the year. This includes vegetation maintenance crews, transmission line and substation construction workers, safety supervisors, environmental support, and other on- and off- site support staff. Minnesota Power will work with local governments in the Project area to meet any specific local employment obligations.[79]

The construction activities will provide a seasonal influx of additional dollars into the communities during the construction phase, with construction materials purchased from local vendors where feasible.

ROW Acquisition

One of the first steps in the construction process is to acquire an easement from each of the landowners along the permitted transmission line route. Prior to contacting these landowners, the applicants would conduct a title search to identify all persons and entities that have a recorded interest in the affected real estate. Once ownership has been determined, a ROW agent would contact each landowner to discuss where the structure(s) would be located on the property, as well as the boundaries of the easement. The location of the proposed transmission line could be staked with the permission of the landowner.

As a result of largely following existing transmission lines, Minnesota Power has existing easements for the existing lines (**Figures 1**, **2**, and **3**). To accommodate the new construction and proposed rebuilds and reconfigurations, Minnesota Power intends to either secure new easements, as needed, or to amend existing easements.[80]

In locations where new easements are needed, Minnesota Power will work with landowners to negotiate the terms of an easement that will be acceptable to both parties. Most right-of-way discussions will begin during the detailed design phase of the project, after a final route has been selected by the Commission; however, some discussions may begin earlier. The land evaluation and acquisition process will include a title search, contact with the landowner, survey, real estate document preparation, negotiation, and completion of an easement agreement.[81]

[78] RPA, at p. 6-1.
[79] RPA, at p. 6-6.
[80] RPA, at p. 6-1.
[81] Ibid.

The ROW agent would collect area land value data to determine the amount of just compensation to be paid for the rights to construct, operate, and maintain the transmission line in the easement. Based on this data, a fair market value offer would be developed, necessary documents to acquire the easement would be prepared, and an offer made to the landowner.

If a negotiated settlement could not be reached with a landowner, the applicants may acquire an easement through the exercise of the power of eminent domain pursuant to Minnesota Statutes, Chapter 117. The process of exercising the power of eminent domain is called condemnation.

Before commencing condemnation, the applicants would provide the landowner with a copy of each appraisal it had obtained for the property interests to be acquired. To begin the formal condemnation process, the applicants would file a petition in the district court where the property is located and serve that petition on all owners of the property.

If the court grants the petition, the court will appoint a three-person condemnation commission that would determine the compensation for the easement. The condemnation commission would schedule a viewing of each parcel identified in the petition. Next, the condemnation commission would schedule a valuation hearing where the applicants and landowner present testimony and evidence about the just compensation for acquiring the easement. The commission would then make an award of just compensation and file it with the court. The applicant and the landowner would both be bound by the award. At any point in this process, the case could be dismissed if the parties reach a settlement.

There may be instances where a landowner elects to require the applicants to purchase their entire property rather than acquiring only an easement for the transmission facilities. The landowner is granted this right under Minnesota Statutes section 216E.12, subdivision 4. This statute, sometimes referred to as the "Buy-the-Farm" statute, applies only to transmission lines with a voltage of 200 kV or more and to properties that meet certain other criteria; thus, the Buy-the-Farm Statute may apply to parcels crossed by the proposed 230 kV transmission line.

Once a ROW is acquired, and prior to construction, the ROW agent would contact each landowner to discuss the construction schedule and requirements. To ensure safe construction, special considerations may be needed for fences, crops, or livestock. Fences or livestock, for example, may need to be moved or temporary or permanent gates may need to be installed. In each case, the ROW agent would coordinate with the landowner, who would be compensated for any project-related construction damages.

Substations

The existing Hilltop Substation will be expanded on property currently owned by Minnesota Power. The existing Ridgeview Substation will also be expanded on property currently owned by Minnesota Power. The modifications necessary at the existing Haines Road Substation are not anticipated to require a

physical expansion of the fenced substation. All system accommodations necessary at the Arrowhead Substation are anticipated to be completed within the existing fenced boundary of the substation. No new substations will be constructed as part of the Project.[82]

Communication Infrastructure

Modifications to communications infrastructure in the Project area will be completed as part of the Duluth Loop Project to improve overall communication capabilities of the transmission system. To accommodate reconfigurations, some sections of existing OPGW to an adjacent splice box will be replaced due to age and condition.[83] Communications infrastructure modifications are anticipated to occur in the areas shown on **Figure 7**.

Construction

Construction of the project would not begin until all necessary federal, state, and local approvals have been obtained, easements have been acquired for rights-of-way, and final plans and profiles have been approved by the Commission. The precise timing and order of ROW clearing and construction along the line would depend on the receipt of all necessary approvals for each segment of the line being constructed, system loading issues, when existing transmission lines can be taken out of service for construction to proceed, and available workforce.

The first phase of construction activities would involve survey staking of the transmission line centerline and/or pole locations, then removal of trees and other vegetation from the full width of the right-of-way. As a general practice, low-growing brush will be allowed to reestablish at the outer limits of the easement area. Tree species that endanger safe and reliable operation of the transmission facility will be removed.[84]

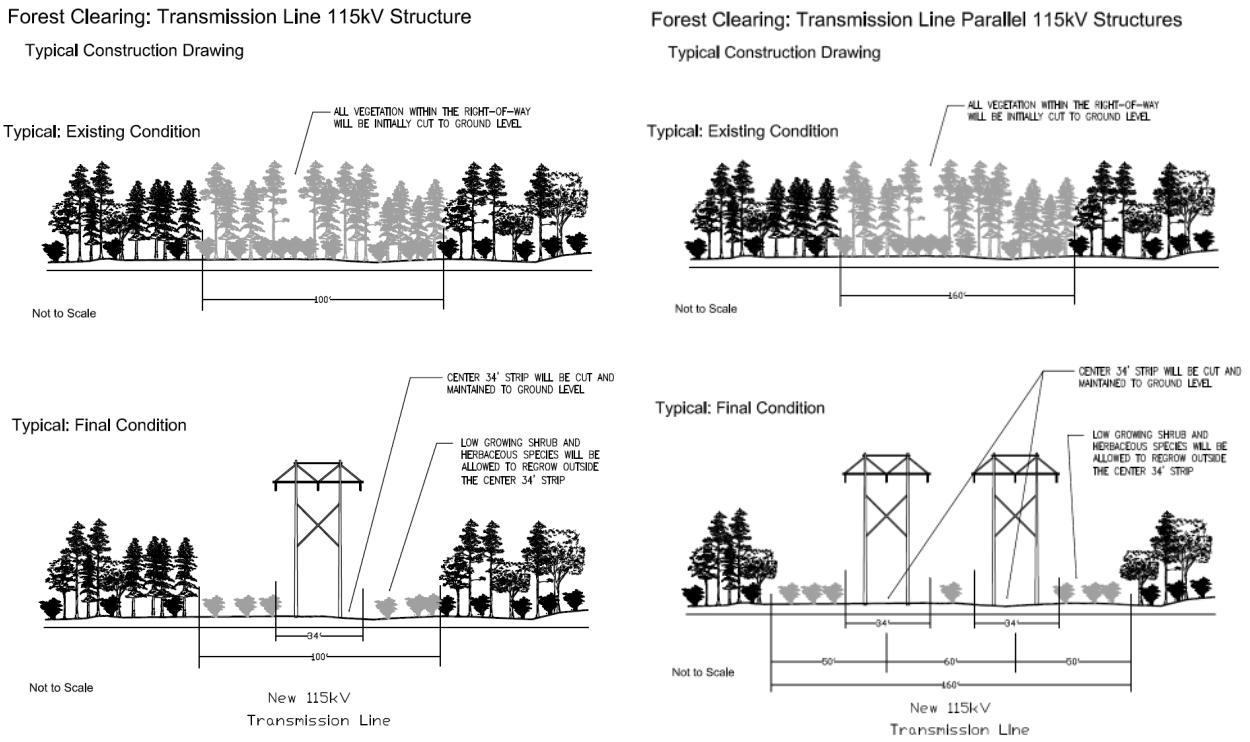
The NESC states that "vegetation that may damage ungrounded supply conductors should be pruned or removed." Trees beyond the easement area that are in danger of falling into the energized transmission line (danger trees) will be removed or trimmed to eliminate the hazard as shown in **Diagram 2**, as allowed by the terms in the given acquired easement. Danger trees generally are those that are dead, weak, or leaning towards the energized conductors.[85]

All material resulting from the clearing operations will be either chipped on site and spread on the right-of-way, stacked in the right-of-way for use by the property owner, or removed and disposed of otherwise as agreed to with the property owner during easement negotiations.[86]

[82] RPA, at p. 6-2.
[83] RPA, at p. 6-2.
[84] Ibid, at p. 6-3.
[85] Ibid.
[86] Ibid.

The final survey staking of pole locations may occur after the vegetation has been removed and prior to the structure installation.

Diagram 2. Standard Vegetation Management Practices[87]



The second phase of construction would involve structure installation and stringing of conductor wire. During this phase, underground utilities are identified through the required One Call process to minimize conflicts with the existing utilities along the routes.[88]

If temporary removal or relocation of fences is necessary, installation of temporary or permanent gates will be coordinated with the landowner. The right-of-way agent may work with the property owner for early harvest of crops, where possible, with compensation to be paid for any actual crop losses. During the construction process, it may be necessary for the property owner to remove or relocate equipment and livestock from the right-of-way.[89]

Transmission line structures are typically designed for installation at existing grades. Therefore, structure sites will not be graded or leveled unless it is necessary to provide a reasonably level area for construction

[87] RPA, at p. 6-4.
[88] Ibid.
[89] Ibid.

access and activities. For instance, if vehicle installation equipment cannot safely access or perform construction operations properly near the structure, minor grading of the immediate terrain may be necessary.[90]

Minnesota Power will employ standard construction practices that were developed from experiences with past projects in addition to industry-specific Best Management Practices (BMPs). BMPs address right-of-way clearance, erecting transmission line structures, and stringing transmission lines. BMPs for the Project will be based on the specific construction design, prohibitions, maintenance guidelines, inspection procedures, and other activities involved in constructing the line. In some instances, these activities, such as schedules, are modified to incorporate a BMP for construction that will assist with minimizing impacts on sensitive environments. For example, in areas where construction occurs within a wetland, BMPs such as matting, or winter construction may be used to minimize impacts.[91]

Line construction will be staged in phases to effectively execute the work while maintaining service.

The existing transmission lines that will be removed as part of this Project are identified in **Figure 1** and **Appendix B, plates 7, 8, 10, and 11 to 17**.

New wood pole structures will be installed directly into the ground (referred to as "direct embed"), by augering or excavating a hole typically 8 to 14 feet deep and 3 to 4 feet in diameter for each pole. Any excess soil from the excavation will be spread and leveled near the structure or removed from the site, if requested by the property owner or regulatory agency. The new wood poles will then be set and the augered holes backfilled with the excavated material, native soil, or crushed rock. In poor soil conditions, a galvanized steel culvert is sometimes installed vertically with the structure set inside, or in some case a wood framed 'bog shoe' is used to help support the poles.[92]

Steel pole structures are expected to be foundation supported with the drilled concrete pier foundations being the predominate foundation type (**Diagram 3**). Concrete pier foundations are expected to vary from 4 feet to 6 feet in diameter (**Diagram 4**).[93]

After a number of structures have been erected, Minnesota Power will begin to install the wiring by establishing stringing setup areas. These stringing setup areas are usually located every two miles along a project route, or as needed, and occupy approximately 100-foot by 500-foot area. Conductor stringing operations require brief access to each structure to secure the conductor wire to the insulators and to install shield wire clamps once final sag is established. Temporary guard or clearance structures are

[90] RPA, at p. 6-4.
[91] Ibid, at pp. 6-4 to 6-5.
[92] Ibid.
[93] Ibid.

installed, as needed, over existing distribution or communication lines, streets, roads, highways, railways or other obstructions after any necessary notifications are made or permits obtained. This ensures that conductors will not obstruct traffic or contact existing energized conductors or other cables; this also protects the conductors from damage.[94]

Diagram 3. Drilling a Hole for a Structure Foundation

The diameter and depth of the hole depend on structure design and soil conditions.

Some soil conditions and environmentally sensitive areas may require unique construction techniques. The most effective way to minimize impacts to these areas is to avoid placing structures in these areas by spanning the transmission line over wetlands, streams, and rivers. When spanning sensitive areas is not feasible, one or more of the following practices may be required by the Commission's route permit to minimize impacts:

- Constructing during frozen ground conditions.
- Using construction mats when winter construction is not possible and wetlands and other sensitive areas could be impacted.
- Avoiding equipment fueling and maintenance activities in or near environmentally sensitive areas.
- Implementing the best management practices in the project's Stormwater Pollution Prevention Plan (SWPPP), which may include use of silt fences, bio logs, erosion-control blankets embedded with seeds, and other measures.

[94] RPA. at p. 6-5.

Diagram 4. Finished Structure Foundation

Structure foundations are typically 4 to 6 feet in diameter.

Wherever large construction projects require the clearing of existing vegetation, the potential for unwanted plant species to invade and establish themselves is a general concern. The Minnesota Noxious Weed Law defines a noxious weed as an annual, biennial, or perennial plant that the Commissioner of the Minnesota Department of Agriculture (MDA) designates to be injurious to the public health, the environment, public roads, crops, livestock, or other property. The application of BMPs will limit the spread of noxious and invasive weeds by cleaning construction equipment before it enters the construction work area and by using only invasive-free mulches, topsoil, and seed mixes.

Substations

Substation construction will be performed in compliance with the applicable NESC, Occupational Safety and Health Act, and state and local regulations. Designs will be completed by Minnesota licensed professional engineers, as required by Minnesota Statutes and Rules. Contractors will be committed to safe working practices. The final design of the substations will consider the local conditions of the substation sites and comply with all applicable safety codes and Minnesota Power standards.[95]

The substation modifications will be designed to allow future maintenance to be done with the minimum impact on substation operation and the necessary clearance from energized equipment to ensure safety.[96]

[95] RPA, at p. 6-6.
[96] RPA, at p. 6-6.

Standard construction and mitigation practices developed from experience with past projects in addition to industry specific BMPs will be employed. BMPs for the Project will be based on the specific construction design, prohibitions, maintenance guidelines, inspection procedures, and other activities involved in constructing the substations. As with the transmission lines, in some cases these activities will be modified to incorporate a BMP for construction that will assist with minimizing impacts on sensitive environments.[97]

Restoration

The Applicants indicate that construction crews will attempt to minimize ground disturbance during construction, consistent with BMPs required as part of the SWPPP and other permits and approvals. Nonetheless, parts of the project area (especially associated with structure sites) will be disturbed during the normal course of construction.

Commonly used BMPs to control soil erosion and assist in reestablishing vegetation that may be used include, but are not limited to:

- Erosion control blankets with embedded seeds
- Silt fences
- Hay bales
- Hydro seeding
- Planting individual seeds or seedlings of non-invasive native species

In accordance with Minnesota Pollution Control Agency (MPCA) construction permit requirements, temporary restoration before the completion of construction in some areas along the ROW could be required.

Once construction is complete and restoration activities have commenced, a Permittee's representative will contact the landowner to discuss any damage that has occurred as a result of project construction. If fences, drain tile, or other property have been damaged, the Permittee (or a contractor) will repair damages or provide the landowner reimbursement for repairs, consistent with the conditions in the easement agreement. Commission HVTL route permits require permittees to compensate landowners for damage to crops and drain tile, if applicable.

Once construction of the transmission project is complete, temporary road approaches, access roads, and staging areas will be removed, revegetated, and restored to their original condition to the extent practicable, and as negotiated with each landowner or responsible agency/official.

[97] RPA, at p. 6-6.

Areas where vegetation is disturbed or removed during construction will be allowed to naturally reestablish to pre-disturbance conditions. Resilient species of common grasses and shrubs typically reestablish with few problems after disturbance. Areas with significant soil compaction and disturbance from construction activities may require assistance to reestablish vegetation and control soil erosion. Commonly used methods to accomplish this include, but are not limited to, prompt reseeding of disturbed areas, erosion control blankets, silt fences, and weekly inspection of construction sites for compliance. Reseeding of non-cropped areas disturbed during construction will be done with a seed mix free of noxious weeds, similar to that which was removed. Vegetation that is consistent with NESC-prescribed clearances would be allowed to reestablish.

Maintenance

Transmission lines are designed to operate for decades and require only moderate maintenance, particularly in the first few years of operation. Nationwide, the electric transmission system is very reliable. The average annual availability of transmission infrastructure is in excess of 99%. Protective relaying equipment automatically take a transmission line out of service when a fault is sensed on the system. Both system faults and scheduled maintenance are infrequent.

The Permittee is responsible for the operation, maintenance, and, when necessary, repair of the transmission project. The Permittee, or its agents, will periodically access to the ROW to perform inspections, conduct maintenance, and repair damage over the life of the Project. The principal operating and maintenance cost for transmission facilities is the cost of inspections, which will be performed monthly by either truck or by air. Inspections will be conducted to ensure that the transmission line is fully functional, and that no vegetation has encroached so as to violate NESC prescribed clearances.

Once constructed, the operation and maintenance costs for Duluth Loop Project will be minimal for several years since the transmission line will be new and vegetation maintenance on the route corridor will occur prior to construction. Minnesota Power's vegetation management costs for all its transmission lines (100 kV and above) on its system was approximately $660 per line mile in 2020. In addition to vegetation management, Minnesota Power also performs other general maintenance on its transmission facilities such as repairing aged or worn equipment or facilities. Minnesota Power's maintenance costs, excluding vegetation management, for its transmission lines (100 kV and above) was approximately $520 per mile in 2020. The O&M costs provided are the average O&M costs for Minnesota Power's transmission facilities. The specific O&M costs for an individual transmission line vary based on the location of the line, the number of trees located along the right-of-way, the age and condition of the line, the voltage of the line, and other factors.[98]

[98] RPA, at p. 2-9.

Generally, vegetation within the ROW that has the potential to interfere with the operation of the Project will be removed. Native shrubs that will not interfere with the safe operation of the transmission line will be allowed to reestablish in the ROW. Clearing needs are determined from annual ROW inspection. When necessary, problem vegetation will be cleared through a combination of mechanical and hand clearing, along with herbicide application, where allowed, to remove or control vegetation growth.

Typically, utilities will use commercial pesticide applicators licensed by the MDA to apply herbicides approved by the U.S. Environmental Protection Agency (EPA) and the MDA. If during post-construction monitoring of the restored ROW a higher density and cover of noxious weeds on the ROW is noted when compared to adjacent off-ROW areas, the utility will obtain landowner permission and work to mitigate noxious weed concerns.

Substations also require a degree of maintenance to keep them functioning in accordance with accepted operating parameters and NESC requirements. Transformers, circuit breakers, batteries, protective relays and other equipment need to be serviced periodically in accordance with the manufacturer's recommendation. The site itself must also be kept free of vegetation, and drainage maintained.

3.7 Project Costs

The Applicants estimate the total cost for the Project is between $50 million and $709 million (based on 2021 dollars).[99] This estimate is an engineering estimate and expected to reflect actual costs within 20 percent (**Table 3**). Final costs are dependent on a variety of factors, including the approved route, timing of construction, cost of materials, and labor.

3.8 Project Schedule

The anticipated permitting and construction schedule for the Project is provided in **Table 4**. It is anticipated that construction of the Project will being in the fall 2023.

3.9 Future Expansion

The proposed 115 kV and 230 kV transmission lines are designed to meet the current and projected load serving needs in the Project area. The new ACSS conductor on the proposed 115 kV transmission line was selected to accommodate some future load growth in the area. New transmission structures will not be capable of supporting an additional transmission circuit in the future.[100]

[99] RPA, at p. 2-9.
[100] RPA, at pp. 2-8 to 2-9.

Table 3. Project Cost Estimates[101]

Project Component	Low End (2021$) ($Millions)	High End (2021$) ($Millions)
115 kV Transmission Lines	$28.2	$42.6
230 kV Transmission Lines	$5.5	$8.3
Ridgeview Substation	$9.1	$10.6
Hilltop Substation	$5.6	$6.6
Arrowhead Substation	$1.2	$1.4
Haines Road Substation	$0.4	$0.5
Project Cost Totals	**$50.0**	**$70.0**

Table 4. Project Schedule Estimates[102]

Activity	Anticipated Date
Certificate of Need and Route Permit Application Filed	Fall 2021
Certificate of Need and Route Permit Issued	Spring 2023
Land Acquisition Begins	Spring 2023
Right-of-Way Clearing Begins	Winter 2023
Project Construction Begins	Fall 2023
Project In-Service	December 2025

The proposed substation modifications are designed to provide for interconnection with existing, proposed, and potential future transmission facilities. A future consideration that is enabled by the Project as proposed would involve relocating the termination of the existing Big Rock – Colbyville 115 kV Line from the Colbyville Substation to the Ridgeview Substation. The future 115 kV transmission line position at the Ridgeview Substation is being developed to accommodate this future consideration.[103]

As discussed in the 2019 Minnesota Biennial Report, a potential Duluth 230 kV project (MPUC Tracking Number 2007-NE-N1) remains a future consideration that is preserved by the Duluth Loop Reliability Project as proposed. The Duluth 230 kV project involves adding a second 230/115 kV transformer at the Hilltop Substation and upgrading an existing line from 115 kV to 230 kV between the Arrowhead and Hilltop substations.[104] The Duluth Loop Reliability Project as proposed increases the reliability and capacity of the Hilltop 230/115 kV transformer, allowing the Duluth 230 kV project to be delayed.[105]

[101] RPA, at p. 2-9, Table 2-2.
[102] RPA, at p. 2-11, Table 2-4.
[103] Ibid.
[104] 19-0205-Biennial-Transmission-Projects-Report-103119-MTO.pdf (minnelectrans.com).
[105] RPA, at p. 2-8.

4 Alternatives to the Proposed Project

The Duluth Loop Reliability Project is one possible solution to replace the system support once provided by coalfired baseload generators located along Minnesota's North Shore. This chapter evaluates the alternatives to the Project that may also address this problem (meet the stated need and purpose). As described in Chapter 2, the Commission must determine whether the proposed project is needed or if another project would be more appropriate for Minnesota. For example, a project of a different type or size, or a project that connects to different endpoints (substations).

The alternatives discussed here include the following:

Generation and Non-Wire Alternatives

- Peaking Generation
- Distributed Generation
- Renewable Generation
- Energy Storage
- Demand Side Management and Conservation
- Reactive Power Additions

Alternative Voltages

- Lower Voltage Alternatives
- Higher Voltage Alternatives

Upgrade of Existing Facilities

Alternative 115 kV Endpoints

- Colbyville Substation
- Swan Lake Road Substation
- Arrowhead 230/115 kV Substation
- 15th Avenue West Substation

Double Circuiting

Alternative Number, Size, and Type of Conductor

Direct Current Alternative

Underground Alternative

No-Build Alternative/Consequence of Delay

These alternatives are commonly referred to as system alternatives. This chapter discusses whether these system alternatives are feasible (whether they can be engineered, designed, and constructed) and available (whether the alternative is readily obtainable and at the appropriate scale) and, if so, whether they can meet the need for the Project.

4.1 Generation and Non-Wire Alternatives

Minnesota Power evaluated various generation and non-wire solutions, including new peaking generation, distributed generation, renewable generation, battery energy storage, demand side management, and reactive resources as alternatives to the proposed Project. To be a viable alternative to the Project, a generation or non-wire alternative (or combination of alternatives) must address the three primary needs for the Project by:[106]

1) resolving severe voltage stability concerns,
2) relieving transmission line overloads, and
3) enhancing the reliability of Duluth-area transmission sources.

To adequately resolve the severe voltage stability issues that are resolved by the Project, the operational characteristics of any generation or non-wire alternative must enable it to effectively offset a significant amount of load in the Duluth Loop during an outage of either the Arrowhead – Colbyville 115 kV Line (Line 57) or the Arrowhead – Haines Road 115 kV Line (Line 58). This generation would be utilized to proactively reduce the amount of load effectively seen by the transmission system in order to remain within the Duluth Loop voltage stability threshold until the outage is restored. Therefore, the generation or non-wire alternative must be located at or near the Duluth Loop substations and must be available at the necessary time, with the necessary response, and for the necessary duration to address the Duluth Loop voltage stability issues. This generation must be available for dispatch, able to ramp up quickly, capable of matching the system load, and operate for the appropriate duration based on the restoration time of the transmission line outage.[107]

As determined by Minnesota Power, the Duluth Loop voltage stability threshold with none of the North Shore Loop generators online is 54 MW, increasing to 65.7 MW if the peaking units at the Laskin Energy Center are online. Therefore, a minimum generation or non-wire solution must be able to produce enough power to offset any Duluth Loop load above this threshold during peak-hour loading. The historical peak load for the area in the 2019 data set was 139.7 MW. Based solely on the historical peak load, therefore, a generation or non-wire alternative must be able to offset a minimum of 74 MW of Duluth Loop load.[108]

A more appropriate minimum generation or non-wire alternative would include some margin for load growth or unforeseen system conditions, likely pushing the actual need well above 100 MW.[109]

[106] RPA, at p. 4-2.
[107] Ibid.
[108] Ibid.
[109] Ibid.

4.1.1 Peaking Generation

Peaking generation, in this context, means dispatchable generation that is interconnected to the transmission system and can run continuously when called upon, most likely using natural gas as the fuel source. Minnesota Power considered two general configurations for peaking generation. One peaking generation option is to install a bank of several relatively small natural gas reciprocating internal combustion engine (RICE) generators. Given the 74 MW minimum generation requirement for resolving the voltage stability issues, a RICE solution would likely require between 8-12 individual units. The second peaking generation option is to install a relatively large natural gas combustion turbine in the Duluth area. For either of these solutions, the optimal point of interconnection for resolving voltage stability and transmission line loading concerns is at or near the Colbyville Substation.[110]

In addition to concerns with siting a new fossil-fueled (natural gas) generation station in a primarily residential area of Duluth, there are concerns about the cost-effectiveness of such a solution; for these reasons Minnesota Power does not believe these options are a more reasonable and prudent alternative to the Project.

4.1.2 Distributed Generation

Minnesota Power considered distributed generation in the Duluth Loop as an alternative to the Project. Distributed generation, in this context, means dispatchable generation that is connected to the local distribution system and can run continuously when called upon, most likely on natural gas.[111]

While Minnesota Power considered various configurations of distributed generation and dynamic reactive support for the Duluth Loop and the North Shore, fossil-fueled distributed generation has the same fundamental concerns as transmission-connected peaking generation – and likely at a greater cost if consisting of a number of smaller generators in diverse locations. Therefore, Minnesota Power does not believe new fossil-fueled distributed generators are a more reasonable and prudent alternative to the Project.

4.1.3 Renewable Generation

Minnesota Power considered renewable generation as an alternative to the Project. Renewable generation, in this context, means either solar or wind generation. The renewable generation may be interconnected at a single location on the transmission system or at multiple locations on the transmission or distribution system. In adequately address voltage stability concerns in the Duluth Loop, a system solution is needed that will provide a significant amount of reliable power (a minimum of 74 MW, but

[110] RPA, at p. 4-3.
[111] Ibid.

potentially over 100 MW) to the Duluth Loop and North Shore during an outage of either Arrowhead – Colbyville 115 kV or Arrowhead – Haines Road 115 kV.[112]

These generation options would need to be available when called upon in the amount required to mitigate the risk of a voltage collapse. Because renewable generation is dependent on natural events, such as sunlight or wind speed, and cannot be dispatched if those conditions are not met, neither wind generation nor solar generation alone are viable alternatives to the Project. Energy from these resources is not necessarily available at the times when it would be most necessary to support reliability in the Duluth Loop. For example, evaluating 2019 historical data, the Winter peak for the Duluth Loop area occurred on January 29, 2019, at 6:00 P.M., when a minimum of 74 MW of generation would be needed to mitigate the risk of voltage collapse. As the sunsets at around 5 P.M. in January, solar energy output at 6 P.M. is generally non-existent. Wind energy output is unpredictable, sometimes decreasing during the evening hours of the day. Therefore, the addition of new renewable generation, by itself, is not a more reasonable and prudent alternative to the Project.[113]

The combination of renewable generation with energy storage is discussed below.

4.1.4 Energy Storage

Minnesota Power considered energy storage, both by itself and combined with new renewable generation, as an alternative to the Project. Energy storage, in this context, means a battery or some other energy storage technology capable of being charged and discharged when called upon to do so if there is sufficient energy available.[114]

To adequately address voltage stability concerns in the Duluth Loop, a system solution is needed that will provide a significant amount of power (a minimum of 74 MW on peak, but potentially over 100 MW) to the Duluth Loop and North Shore for an extended duration during an outage of either Arrowhead – Colbyville 115 kV or Arrowhead – Haines Road 115 kV.[115]

Given the nature of the transmission reliability concerns, Minnesota Power believes the generation needs to be able to run continuously for at least 7 days to allow adequate time for restoration in the event of a catastrophic transmission failure. During these periods (7 days) there may be little or no opportunity to recharge an energy storage solution from the transmission system due to high Duluth Loop area load levels relative to the Duluth Loop voltage stability threshold. Actual transmission line restoration times can vary significantly by severity, location and other factors. Many unplanned transmission outages and failures can be corrected in less than 7 days; however, several restorations of Minnesota Power's

[112] RPA, at pp. 4-3 to 4-4.
[113] Ibid.
[114] Ibid, at pp. 4-4 to 4-5.
[115] Ibid.

transmission facilities resulting from severe weather within the last two years have exceeded this 7-day duration by a factor of 2 or more.[116]

The maximum daily average over 7 days for Duluth Loop load was 1238.3 MWh above the stability threshold (2019 historical load data) and occurred between January 25, 2019, and February 1, 2019. During this 7-day period, the minimum load level was 96.9 MW, which is well above the 65.7 MW stability threshold with Laskin generation online. Therefore, an energy storage solution would have had to discharge continuously from a minimum of 31.2 MW to a maximum of 74 MW during this 7-day duration and would not have been able to recharge from the transmission system. For an energy storage solution by itself, a minimum rating of 8,668 MWh would be necessary to support the transmission system adequately and reliably during a 7-day transmission outage of both Arrowhead – Colbyville 115 kV and Arrowhead – Haines Road 115 kV. An energy storage solution of this magnitude would be over 5 times larger than the largest in the world, for this reason, Minnesota Power does not believe this would be a reasonable alternative to the Project.[117]

Given that there is no or limited opportunity to recharge an energy storage solution from the transmission system, Minnesota Power also examined pairing the energy storage solution with new solar generation. If solar could produce the needed generation during daylight hours, energy storage could supply the needed generation outside of daylight hours. Evaluating 2019 historical data, a 24-hour peak of 1370.7 MWh of energy was needed above the stability threshold in the Duluth Loop area. This occurred beginning at sunrise on January 29, 2019, the day when peak loading occurred in the Duluth Loop, and there was approximately 9.5 hours of possible daylight between sunrise and sunset.[118]

In the most idealized and optimistic scenario, 144.3 MW of solar generation paired with an 852.4 MWh rated energy storage solution would be the minimum alternative to mitigate the risk of voltage collapse in the Duluth Loop. The solar generation would support the daytime battery charging load of 89.7 MW. This also assumes that peaking generation at the Laskin Energy Center is running throughout the 7-day outage. If Laskin was not running or became unavailable, then the Duluth Loop voltage stability threshold would diminish, and additional solar and storage capacity would be required. The numbers above also do not provide any room for load growth above the historical 2019 peak, or for periods of reduced solar output due to weather.[119]

Minnesota Power utilized the MISO MTEP21 Transmission Cost Estimation Guide to estimate the cost of the 852.4 MWh energy storage solution. Excluding the cost of the 144.3 MW solar generation facility, the estimated cost of an energy storage solution with a rated instantaneous charge/discharge of 89.7 MW

[116] RPA, at pp. 4-4 to 4-5.
[117] Ibid.
[118] Ibid.
[119] Ibid.

and an energy rating of 852.4 MWh is $276.4 million based on the MISO assumptions for lithium-ion energy storage "grid supporting devices."[120]

Any combination of energy storage and solar generation meeting the minimum requirements for resolving the voltage stability concerns in the Duluth Loop would be very substantial in both size and cost. In addition to the economics of such a solution, siting, operational complexity, and the long-term effectiveness for the solution would all be significant concerns. Therefore, Minnesota Power does not believe the addition of new energy storage in the Duluth Loop, whether by itself or in combination with new renewable generation, is a reasonable and prudent alternative to the Project.[121]

4.1.5 Demand Side Management and Conservation

Minnesota Power considered demand side management and conservation as alternatives to the Project. In this context, demand side management and conservation are assumed to encompass all forms of peak shaving programs, such as interruptible loads and dual fuel programs, as well as more general energy conservation programs, such as energy-efficiency rebates. As noted in the previous section on energy storage, total Duluth Loop area load during the most demanding 7-day period in 2019 would have needed to be reduced by 31.2 – 74 MW to mitigate the risk of voltage collapse following unplanned outages during that period. This represents approximately 22 – 53 percent of the 139.7 MW historical peak demand for the Project area. Although conservation programs will continue to be implemented in the Project area to encourage efficient use of electricity, these programs are insufficient to reach these significant levels of load reduction in the Duluth Loop.[122]

Minnesota Power has stated that these solutions, involving demand side management and conservation, are not a viable alternative to the Project.[123]

4.1.6 Reactive Power Additions

Minnesota Power considered implementing additional reactive power additions to support the area and prevent voltage collapse. Reactive power additions, in this context, mean transmission technology capable of providing reactive power and voltage support to the system using traditional electromechanical devices such as switched capacitor banks and reactors, flexible AC transmission system devices such as static VAR compensators or static synchronous compensators, or synchronous condensers. Unlike generation or energy storage solutions, reactive power additions do not produce any active power (MWs) for consumption by end-use customers, meaning this alternative is not capable of directly offsetting

[120] RPA, at pp. 4-4 to 4-5.
[121] Ibid.
[122] Ibid, at p. 4-6.
[123] Ibid.

Duluth Loop load as discussed for previous generation and non-wire alternatives. While a reactive power addition alone may contribute to resolving or reducing the severity of the Duluth Loop voltage stability issues, reactive power additions alone cannot satisfy any of the needs of the Project. Reactive power additions would not reduce overloads on the Hilltop 230/115 kV transformer or increase the ratings of transmission lines in the Duluth Loop or the North Shore Loop, meaning that the existing system upgrades would be necessary.[124]

Minnesota Power does not believe that solutions involving only reactive power additions are a viable alternative to the Project.[125]

4.2 Alternative Voltages

Transmission Lines carry electricity over long distances, from the generating facility to areas of demand. The electricity in transmission lines is transported at voltages of over 200 kV to maximize efficiency. Voltages of 230 kV to 500 kV are typical. Currently in Minnesota, the high-voltage system is generally comprised of 230-kiloVolt and 345-kV systems. There are also two direct current (DC) lines, one of 400-kV and one at 500-kV. Structures are generally steel lattice towers, wooden H-Frames, or single-pole steel.

Sub-transmission Lines carry electricity at voltages less than 200 kV: typically, 161 kV or 115 kV. The 161-kV and 115-kV systems are responsible for transmitting power from the larger transmission system throughout the entire state through distribution substations.

From distribution substations, electricity is transferred to distribution lines. These lines cover much shorter distances, and are typically energized at 16 kV, 12 kV, or 4 kV. Lower-voltage distribution lines carry electricity to neighborhoods on shorter wooden poles or underground. Transformers located on distribution poles further step down the voltage before it is ultimately delivered to homes and businesses.

4.2.1 Lower Voltage Alternatives

Minnesota Power considered lower voltage solutions involving improvements to the local 14 kV or 34 kV distribution system as an alternative to the Project. Minnesota Power does not have any existing 69 kV assets in the area; therefore 69 kV was not considered as an alternative to the Project.[126]

As previously stated, a minimum of 74 MW of load would be needed in the Project area to mitigate the risk of voltage collapse during peak hours. In the case of lower-voltage alternatives involving the local

[124] RPA, at pp. 4-6.
[125] Ibid.
[126] RPA, at pp. 4-6 to 4-7.

distribution system, this means that 74 MW of load would need to be shifted out of the Duluth Loop onto distribution substations served from other parts of the transmission system.[127]

The Haines Road, Swan Lake Road, Ridgeview, and Colbyville substations in the Duluth Loop have distribution tie points that are generally designed to shift load from one Duluth Loop substation to another. A relatively small amount of load can be shifted onto some substations outside of the Duluth Loop, including onto the 15th Ave West Substation and the Four Corners Substation. A typical full-capacity distribution system tie point in the Duluth Area will have a capacity of between 15-30 MW. It is likely that several new 14 kV or 34 kV ties would be required to shift 74 MW of load out of the Duluth Loop onto adjacent distribution substations. This would involve new distribution feeders, significant distribution feeder and substation upgrades, and potentially new substations as substation capacity outside the Duluth Loop may not be sufficient. Shifting load out of the Duluth Loop onto other nearby Duluth-area substations also does nothing to improve the reliability or capacity of the existing Duluth Area 230/115 kV transformers, which is one of the three main need drivers for the Project.[128]

For these reasons, Minnesota Power has concluded that lower-voltage solutions are not a more reasonable and prudent alternative to the Project.[129]

4.2.2 Higher Voltage Alternatives

Minnesota Power considered higher voltage solutions involving new 230 kV transmission as an alternative to the Project. Existing 230 kV transmission at the Arrowhead and Hilltop substations is the only higher voltage available in the Duluth area which is common to Minnesota Power's transmission system. Adding a different higher voltage would require new transformers. Any new 230 kV transmission line would have to connect to the Duluth Loop via a new 230/115 kV transformer. Space constraints at existing 115 kV substations in the Duluth Loop would likely require a new substation to be built to accommodate a new 230 kV Duluth Loop transmission connection. A new 230/115 kV Rice Lake Substation sited near the end of the common corridor located west of the Colbyville Substation would allow the two existing Duluth Loop 115 kV transmission paths to be connected to the new 230 kV line.[130]

While Minnesota Power believes the Arrowhead – Rice Lake 230 kV alternative provides a reasonable technical alternative to the proposed Duluth Loop Project, in the end Minnesota Power rejected the concept due to significant human and environmental impacts of constructing a new 230/115 kV substation

[127] RPA, at pp. 4-6 to 4-7.
[128] Ibid.
[129] Ibid.
[130] RPA, at pp. 4-6 to 4-8.

on a greenfield site in the Rice Lake area, and the associated requirement of approximately 12 miles of new 230 kV transmission right-of-way located adjacent to existing Duluth Loop 115 kV lines.[131]

4.2.3 Upgrading of Existing Facilities

To resolve the Duluth Loop voltage stability issues and thermal overloads in the Duluth Loop and North Shore Loop utilizing existing facilities, significant improvements would be needed on existing transmission lines in the Duluth Loop and North Shore Loop.

Starting at the north end of the North Shore Loop, 61.2 miles of existing double circuit transmission line on lattice towers between the Mesaba Junction Switching Station and the Taconite Harbor Substation would need to be completely rebuilt with a significantly larger conductor to achieve sufficient capacity to support load in the Duluth Loop and the North Shore Loop under contingency conditions. In addition, another 30 miles of existing transmission line between the North Shore Switching Station and the Big Rock Substation would also have to be rebuilt with a larger conductor for the same reason.[132]

In the Duluth Loop, Arrowhead – Colbyville 115 kV (19.2 miles), Arrowhead – Haines Road 115 kV (7.4 miles), Haines Road – Swan Lake Road 115 kV (1.3 miles), and Swan Lake Road – Ridgeview 115 kV (2.9 miles) would also need to be rebuilt with larger conductor. Completing a total rebuild and installation of a larger conductor on 183.2 total circuit miles of transmission lines could provide transmission line capacity necessary for serving the Duluth Loop and the North Shore Loop while also significantly reducing the impedance of the long distance from the Duluth Loop to the Hoyt Lakes area. The reduced system impedance would also improve the voltage stability threshold for serving the Duluth Loop under the contingencies. If larger conductor alone is not sufficient, a series compensation station or dynamic reactive support may be needed in the Duluth Loop and/or North Shore Loop to fully mitigate the risk of voltage collapse.[133]

Minnesota Power has stated that rebuilding over 183 miles of existing lines and adding series compensation or dynamic reactive support in the North Shore Loop would be significantly more expensive than the Duluth Loop Project as proposed, would require significant outage durations during which time customers in the Duluth Loop and the North Shore Loop would be fed radially from either the Duluth area or from the Hoyt Lakes area. In addition, completing these upgrades would do nothing to improve the capacity or reliability of existing 230/115 kV transformers in the Duluth area, and therefore the proposed upgrades at the Hilltop and Arrowhead substations would also still be required.[134]

[131] RPA, at pp. 4-6 to 4-8.
[132] Ibid, at p. 4-9.
[133] Ibid.
[134] RPA, at p. 4-9.

For these reasons, Minnesota Power believes that upgrading the existing system is not a reasonable alternative to the Project.

4.2.4 Alternative Endpoints

Minnesota Power has stated that the endpoints of the proposed Project were selected because they efficiently address many existing system needs in the Duluth Loop and North Shore Loop effectively and simultaneously, including replacing electric service reliability formerly provided to the Duluth Loop and North Shore Loop by retired or idled coal-fired baseload generators located along the North Shore.[135]

However, Minnesota Power also considered alternative 115 kV endpoints, including:

- Colbyville Substation
- Swan Lake Road Substation
- Arrowhead 230/115 kV Substation
- 15th Avenue West Substation

These alternative endpoints were deemed inferior to the endpoints selected for the 115 kV portion of the proposed Project for a variety of reasons ranging from functionality, upgrading costs, to corridor constraints.[136]

4.2.5 Double-Circuiting

Double circuiting is the construction of two separate transmission circuits (three phases per circuit) on the same structures. Placing two transmission circuits on common structures generally reduces right-of-way requirements, which potentially reduces human and environmental impacts. Double circuit construction typically comes with a higher cost compared to single circuit and, in some cases, may result in reduced reliability or operational flexibility.

Minnesota Power stated that they considered double circuiting the new 115 kV line with existing transmission lines.

A primary need for establishing a third transmission path into the Duluth Loop is to ensure the Duluth Loop always remains connected to either the Arrowhead Substation or Hilltop Substation. Without local baseload generation online in the North Shore Loop, the Duluth Loop cannot be served radially from Silver Bay under most conditions without causing a voltage collapse.[137]

[135] RPA, at pp. 4-9 to 4-12.
[136] Ibid.
[137] RPA, at pp. 4-12 to 4-13.

The Project transmission lines serve a common purpose of completing the connection from the Arrowhead or Hilltop 230/115 kV transmission sources to the Duluth Loop and the North Shore Loop. Double circuiting any two of these Duluth Loop transmission paths would not meet the need for the Project due to reliability concerns. However, double circuiting a Duluth Loop transmission line with other transmission lines not associated with the Duluth Loop would be consistent with the stated need. Minnesota Power has proposed that the new 115 kV transmission line exiting the Hilltop Substation to be double circuited with the existing Arrowhead – 15th Avenue West 115 kV Line for approximately 3.5 miles, that represents about 25 percent of the proposed 115 kV Project line length.[138]

4.2.6 Alternative Number, Size, and Type of Conductor

All lines on the Minnesota Power transmission system for circuits at 230 kV and below utilizes one wire per phase. The use of an increased number of conductors or bundled conductor systems has some benefits in terms of corona performance and cost effectiveness, particularly at extra high voltages of 345 kV and above. There is no significant technical benefit for the Project to utilize a bundled conductor system on 115 kV or 230 kV lines. Minnesota Power has determined that with the added cost and complexity of bundled systems applied to lines at 115 kV or 230 kV, there is no justification to pursue an increased number of conductors (bundled conductors) on this Project.[139]

The benefits to using larger wire size are reduced transmission losses; however, this long-term savings must exceed the initial cost increase to be considered as a viable alternative. Beyond the wire cost alone, larger wires translate to increased structural loading which results in higher structure costs. For longer transmission lines and extra high voltage lines, it is often worthwhile to perform a conductor optimization study to evaluate the economics of selecting different conductor sizes and configurations in view of long-term losses and initial capital costs. However, Minnesota Power believes in cases of shorter 115 kV or 230 kV lines, localized transmission capacity needs and consistency with adjacent facilities of the same voltage class are more significant considerations than negligible economic savings from reduced losses. As such, Minnesota Power has determined there would not be a benefit to using significantly larger conductors beyond those selected for the Project.[140]

ACSR is the most common conductor type used on transmission lines. The existing 115 kV lines in the Duluth Loop are currently using 636 kcmil ACSR (kcmil is 1000 circular mils which is a measure of cross-sectional area) conductors and the 230 kV Line uses 954 kcmil ACSR. Minnesota Power also uses Aluminum Conductor Steel Supported (ACSS) wire on some facilities. ACSS is referred to as a high temperature conductor as it is capable of higher thermal operation at reduced sag compared to ACSR.

[138] RPA, at pp. 4-12 to 4-13.
[139] Ibid, at p. 4-13.
[140] RPA, at pp. 4-13 to 4-14.

ACSS generally has a higher initial installation cost compared to a similarly sized ACSR wire; however, this cost can sometimes be justified based on loading needs and operational costs.[141]

Additional high temperature conductor types and other alternate wires exist such as special alloy or composite core conductors; however, these conductor types are best suited for special loading and operational considerations and have much higher initial costs beyond that of ACSR or ACSS.

Beyond initial costs, another important consideration of wire selection is consistency with existing lines and standards. The addition of a new conductor type or system outside of Minnesota Power's current standards would require new installation training and new inventory to be carried for maintenance and critical spares resulting in increased costs and/or a reduction in inventory levels of other items, which then results in diminished maintenance and emergency restoration responsiveness and effectiveness.

Minnesota Power selected 954 kcmil ACSR for the new 230 kV lines, and 666 kcmil ACSS for most of the new and reconstructed 115 kV lines for the Duluth Loop Project. In some cases (for instance where connections are made to some existing lines) 636 kcmil ACSR will be used. These conductor selections are consistent with Minnesota Power standards and are anticipated to meet the needs of the Duluth Area and the North Shore Loop for the foreseeable future.

The selection of 666 ACSS over 636 ACSR for the new and reconstructed 115 kV lines is due to an existing standard conductor in Minnesota Power's system and during normal anticipated line loading, its losses would be like 636 ACSR. The increased cost for the 666 ACSS is justified due to its higher thermal capacity which will allow for infrequent post contingent loading beyond that of 636 ACSR and consistent with the 1200 Amp rating of much of the existing substation equipment in the Duluth Loop. The 954 ACSR was selected for the 230 kV line because it is within Minnesota Power's standard and is consistent with the existing line.[142]

4.2.7 Direct Current Alternatives

High voltage direct current (HVDC) lines are typically proposed for transmitting large amounts of electricity over long distances because line losses are significantly less over long distances on a HVDC line than an AC line. Minnesota Power has determined that a HVDC line would not be a reasonable alternative to the proposed Project; the Project is being proposed for local transmission system reliability purposes and HVDC lines are typically proposed for large regional transmission projects that involve hundreds of miles of new transmission line.[143]

[141] RPA, at pp. 4-13 to 4-14.
[142] RPA, at pp. 4-13 to 4-14.
[143] Ibid.

Additionally, the Project must be readily tapped and tied in with the existing AC transmission system now and in the future to serve customers in the project area. HVDC lines require expensive conversion stations at each delivery point because the DC power must be converted to AC power before it can be used by customers; such conversion stations would add significantly to the cost of the Project.[144]

4.2.8 Underground Alternatives

Undergrounding is an alternative that is seldom used for high voltage transmission lines like those being proposed for the Project. One of the primary reasons underground high voltage transmission lines are seldom used is that they are significantly more expensive than overhead lines. The cost range depends on site specific factors, such as the design voltage, the type of underground cable required, the subsurface conditions, the thermal capability of the soil, and the number of river crossings.[145]

Minnesota Power reports that the construction cost of locating the entire length of the Project's proposed transmission underground is estimated to be as much as 8 to 10 times greater per mile than if it were to be constructed overhead as proposed. This cost does not include the large reactors that would likely be required at each substation to counteract the large line charging currents present on underground high voltage lines. In addition, there are increased line losses and additional maintenance expenses incurred throughout the useful life of an underground high voltage line that further increase the total additional cost of building an underground line instead of an overhead line.[146]

Minnesota Power continues that beyond the initial costs, another important consideration of undergrounding lines is consistency with existing lines and standards. Minnesota Power does not have any buried lines at voltages of 115 kV and above. The addition of underground transmission is outside of Minnesota Power's current standards and would require new installation training, tooling, equipment, and new inventory to be carried for maintenance and critical spares resulting in increased costs and/or a reduction in inventory levels of other items, which then results in diminished maintenance and emergency restoration responsiveness and effectiveness.[147]

While undergrounding of a transmission line may provide some benefits (aesthetics) in specific situations (urban), there are still human and environmental impacts both during and after construction of an underground transmission line. The predominant environmental impact from the construction, operation, and maintenance of underground transmission lines arises from the need to obtain and maintain a completely cleared rights-of-way above the underground transmission line. While construction activities for overhead transmission lines are typically concentrated around the line's

[144] RPA, at pp. 4-13 to 4-14.
[145] Ibid, at pp. 4-15 to 4-16.
[146] Ibid.
[147] RPA, at pp. 4-15 to 4-16.

structures, leaving areas between structures relatively undisturbed apart from some vegetation removal, construction of underground transmission lines requires the entire right-of-way to be cleared and utilized for construction activities. This results in increased impact to wetland areas due to the likely need to install an access road capable of supporting heavy construction equipment, trenching activities, and cable installation. After construction, the right-of-way needs to be maintained free of woody vegetation to reduce soil moisture loss, since high voltage underground conductors make use of soil moisture for conductor cooling. A permanent road must also be maintained along the right-of-way for maintenance and repair.[148]

Underground lines can also be more challenging to operate and maintain. While overhead lines are typically subject to more frequent outages than underground cables, service can usually be quickly restored. This is accomplished by automatic reclosing of circuit breakers, which results in only a momentary outage of the line. Since circuit breakers on underground lines are typically not reclosed until it can be verified that a fault has not occurred on the underground cable, the smaller number of outages is typically offset by their increased duration. A faulted underground line takes much longer to restore because of the difficulty in locating the fault and accessing the site to make repairs. If the fault is due to a failure in the cable, the segment of failed cable must typically be replaced. This usually involves completely replacing the failed cable between two man-hole splice points, which are ordinarily located every 1,500 to 2,000 feet along the line. To replace failed cable, it must be possible to bring heavy equipment, including cable reels weighing 30,000 to 40,000 pounds, into the right-of-way during all seasons of the year. If the fault occurs in a wetland area where all-season roads are not maintained, restoration can be delayed due to the need to install wetland matting to gain access to the manholes involved in replacing the failed cable.[149]

Due to the construction, maintenance, reliability, and cost drawbacks of high voltage underground transmission lines, Minnesota Power believes that undergrounding is not a viable alternative for any segment of the proposed Duluth Loop Project.

4.2.9 No-Build Alternative

The current operational guide, due to the idling and retirement of the North Shore generators, places load in the North Shore Loop on a radial feed from the Hoyt Lakes area and load in the Duluth Loop on a radial feed from the Arrowhead Substation during necessary maintenance and upgrades. Customers on either side of the open point are exposed to outages anywhere along radial transmission system.[150]

[148] RPA, at pp. 4-15 to 4-16.
[149] RPA, at pp. 4-15 to 4-16.
[150] RPA, at pp. 4-16 to 4-17.

In the case of the North Shore Loop, there is approximately 140 line-miles of outage exposure. While the total line-miles of exposure are much less in the Duluth Loop, the substations in the Duluth Loop serve some of the most densely populated urban areas on Minnesota Power's entire system. Due to the configuration of the system and the risk involved with taking outages to perform routine construction and maintenance, it is becoming more and more challenging to schedule necessary outages of sufficient duration in the Duluth Loop and North Shore Loop. With these constraints, only critical or emergency maintenance is likely to be performed, resulting in deferred routine maintenance. At some point, outages will become unavoidable due to component failures or imminent concerns about safety and reliability. At that time, there will be even greater risk of a high-impact unplanned outage affecting the Duluth area or the North Shore due to deferred maintenance. Depending on load growth, the load-serving capability could be even further degraded, increasing the likelihood of a voltage collapse even more.[151]

Minnesota Power has concluded that the long-term use of the current operational guide results in the minimization of routine construction and maintenance on the transmission system and represents an unacceptable long-term reliability risk for the Duluth area and the North Shore, and therefore, the Duluth Loop Project must be constructed as proposed.[152]

[151] RPA, at pp. 4-16 to 4-17.

[152] Ibid.

5 Duluth Loop Reliability Project - Affected Environment, Potential Impacts and Mitigation Measures

The construction and operation of the proposed Project has the potential to impact human and environmental resources in the Project area. Some impacts will be short term and similar to those of any large construction project (noise, dust, soil disturbance). However, they can be mitigated by measures common to most construction projects, for example, the timing of construction activities, application of wetting agents to suppress dust, and use of erosion control blankets and silt fencing.

Other impacts will exist for the life of the Project and may include aesthetic impacts, impacts to community development, and impacts to vegetation. These long-term impacts result from the design and location of the Project, not the manner in which it is constructed. Long term impacts can be mitigated through prudent selection of routes and design of the Project.

5.1 Chapter Summary

This section provides a general description of the environmental and human setting of the Project. Topics discussed in the following subsections include environmental setting, human settlement, land-based economies, archaeological and historic resources, hydrologic features, vegetation and wildlife, and rare and unique natural resources that are known to occur or may potentially occur within the project area.

5.2 Affected Environment

For purposes of the review, the analysis of the affected environment studies different areas, or regions of influence (ROI), depending upon the resource evaluated (**Table 5**). The following terms and distances are used in this analysis.

- **Right-of-Way (115 kV and 230 kV Routes)**. The 115 kV HVTL project will have a ROW of 100 feet (50 feet on either side of the alignment). The 230 kV HVTL project will have a ROW of 130 feet (65 feet on either side of the alignment). This distance is used as the ROI for analyzing potential displacement impacts and impacts to land-based economies (agriculture, forestry, and mining) and natural resources.
- **One thousand feet (115 kV and 230 kV Routes)**. A distance of 1,000 feet from each side of the HVTL alignments is used as the ROI for analyzing aesthetic and electronic interference impacts. Impacts may extend outside of this 1,000-foot distance but are anticipated to diminish relatively quickly with distance from the conductors such that potential impacts outside this distance would be negligible.

Table 5. Regions of Influence

Type of Resource	Specific Resource/Potential Impact to Resource	Impact Assessment Area
		HVTL Routes
Human Settlement	Displacement, Electric and Magnetic Fields, Noise	Right-of-Way[1]
	Aesthetics and Electronic Interference	1,000 feet[2]
	Public Health and Safety, Socioeconomics, Cultural Values, Recreation, Public Services, Zoning and Land Use Compatibility, Transportation, Air Quality	Project Study Area
Land-Based Economies	Agriculture, Forestry, Mining	Right-of-Way[1]
	Tourism	Project Study Area
Archaeological and Historic Resources	-	One Mile
Natural Environment	Geology and Groundwater Resources, Soils, Water Resources, Flora, Fauna	Right-of-Way[1]
Rare and Unique Species	-	One Mile

[1] The right-of-way is 100 feet wide (115 kV) and 130 feet (230 kV), centered on the Application Alignments.
[2] On each side of the anticipated alignment, for a total 2,000-foot area of analysis.

• **One mile (115 kV and 230 kV Routes)**. A distance of one mile from the proposed HVTL routes is used as the ROI for analyzing potential impacts to archaeological and historic resources, rare and unique species, and airports and airstrips.

• **Project Study Area (115 kV and 230 kV Routes)**. The Project Study Area is defined generally as the townships and/or county within which the Project is located and is used as the ROI for analyzing potential impacts to cultural values, socioeconomics, public services, zoning and land use, emergency services and public health and safety, transportation, air quality, tourism, and recreation. These are resources for which impacts may extend throughout the host communities.

5.2.1 Describing Potential Impacts and Mitigation

This EA analyzes potential impacts of the project on various resources. The discussion of the duration, size, intensity, and location of the impacts provides context. This context is used to determine an overall resource impact level. Impact levels are described using qualitative descriptors. These descriptors are not intended as value judgments, but rather as a means to both ensure a common understanding among readers and compare resource impacts among these three projects.

- **Negligible** - Negligible means the impacts are so small or unimportant as to be not worth considering; they are insignificant.
- **Minimal** - Minimal impacts do not considerably alter an existing resource condition or function. Depending upon the resource and the location, minimal impacts may be noticeable to an average observer. These impacts generally affect common resources over the short-term.
- **Moderate** - Moderate impacts alter an existing resource condition or function and are generally noticeable or predictable for the average observer. Effects may be spread out over a large area making them difficult to observe but can be estimated by modeling or other means. Moderate impacts may be long-term or permanent to common resources but are generally short- to long-term for rare and unique resources.
- **Significant** - Significant impacts alter an existing resource condition or function to the extent that the resource is severely impaired or cannot function. Significant impacts are likely noticeable or predictable for the average observer. Effects may 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 may affect common and rare and unique resources.

This EA also discusses ways to avoid, minimize, or mitigate specific impacts. These actions are collectively referred to as mitigation.

- **Avoid** - Avoiding an impact means the impact is eliminated altogether by moving or not undertaking parts or all of a project.
- **Minimize** - Minimizing an impact means to limit its intensity by reducing project size or moving a portion of the project from a given location.
- **Mitigate** - Impacts that cannot be avoided or minimized could be mitigated. Impacts can be mitigated by repairing, rehabilitating, or restoring the affected environment, or compensating for it by replacing or providing a substitute resource elsewhere.

5.3 Environmental Setting

The Project is in St. Louis County, within and surrounding the communities of Hermantown, Duluth, and Proctor (**Figure 1**). Route development was based on the defined Project endpoints of Ridgeview

Substation, Hilltop Substation, and Arrowhead Substation. Land use is a mixture of low density, rural-type residential neighborhoods scattered throughout the area, along with commercial properties and open, public lands. The environmental setting in Project area consists of open space, deciduous forest, and hydrologic features such as lakes, streams, rivers, and wetlands. The physiographic features of this area vary from flat to rolling hills with steep ravines along streams and rivers.

The DNR and the U.S. Forest Service have developed an Ecological Classification System (ECS) for ecological mapping and landscape classification in Minnesota.[153]

Ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. The ECS enables resource managers to consider ecological patterns for areas as large as North America or as small as a single timber stand and identify areas with similar management opportunities or constraints relative to that scale. There are eight levels of ECS units in the United States. Map units for six of these levels occur in Minnesota: Provinces, Sections, Subsections, Land Type Associations, Land Types, and Land Type Phases. **Diagram 5** represents the Ecological Subsections in Minnesota.

The proposed Project is in St. Louis County, Minnesota within the North Shore Highlands Subsection of the Laurentian Mixed Forest Province (Province) as defined by the Minnesota Department of Natural Resource Ecological Classification System. The North Shore Highlands Subsection parallels the shoreline of Lake Superior and follows the Highland Moraine along the lake. Topography is gently rolling to steep; bedrock outcroppings are common, and soils are generally shallow. Soils are formed in red and brown glacial till and are very rocky. Lake Superior dominates this region and moderates the climate throughout the year, acting as an air conditioner in summer and a heat sink in winter. Pre-settlement vegetation was forest, consisting of white pine, red pine, jack pine, balsam fir, white spruce, and aspen-birch. Present land uses include recreation, tourism, and forestry.[154]

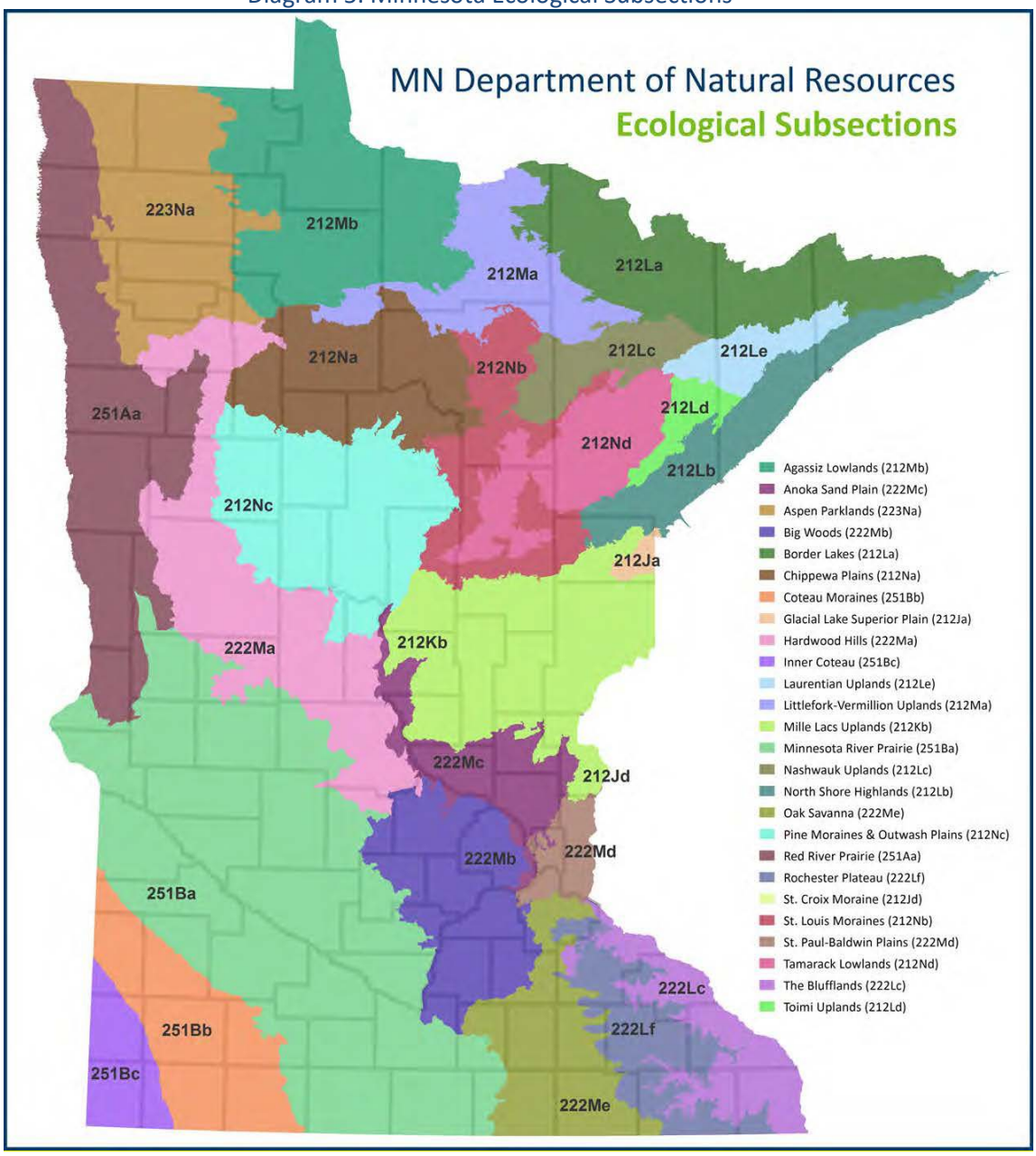
5.4 Human Settlements

High voltage transmission lines have the potential for effects, real or perceived on a local area, during construction and operation of a project. Potential public and health and safety issues during construction include injuries due to falls, equipment use, and electrocution. Potential health concerns related to operation of a HVTL may include health impacts from electric and magnetic fields (EMF), stray voltage, induced voltage, and electrocution. Transmission lines may also have the potential to displace homes or businesses, introduce new noise sources, affect the aesthetics, property values, and socioeconomics of

[153] DNR *Ecological Classification System*, http://www.dnr.state.mn.us/ecs/index.html
[154] Ibid.

the region in which the project would occur, be incompatible with local land use and zoning, interfere with electronic communications, and impact public services.

Diagram 5. Minnesota Ecological Subsections[155]



The proposed Project is in southeast corner of St. Louis County, Minnesota within the Arrowhead Region of the State (**Figure 1**). The proposed route crosses into the cities of Duluth and Hermantown, whereas

[155] DNR (1999) *Ecological Section of Minnesota*, Available from: https://gisdata.mn.gov/

the city of Proctor lies outside of the proposed route to the south. The thermal upgrades to the 98 Line would be located within the city of Proctor and Midway Township. Duluth is a port city on the west shore of Lake Superior. Hermantown is a suburb of Duluth and currently hosts a significant amount of the region's commercial and residential growth. Proctor is the smaller city of the three and is intersected by United States Highway 2.

The commercial properties are centered along Miller Trunk Highway and Highway 2.

The following subsections present an overview of the resources related to human settlement in the project area and how the HVTL may affect these resources and the measures available to mitigate these effects.

5.4.1 Aesthetics

Aesthetic, or visual resources, are generally defined as the natural and built features of a landscape that may be viewed by the public and contribute to the visual quality and character of an area. Aesthetic resources form the overall impression that an observer has of an area or its landscape character. Distinctive landforms, water bodies, vegetation, and human-made features that contribute to an area's aesthetic qualities are elements that contribute to an area's visual character. Visual quality is generally defined as the visual significance or appeal of a landscape based on cultural values and the landscape's intrinsic physical elements.

Visual sensitivity is a measure of viewer interest and concern for the visual quality of the landscape and potential changes to it, which is determined based on a combination of viewer sensitivity and viewer exposure. Viewer sensitivity varies for individuals and groups depending on the activities viewers are engaged in, their values and expectations related to the appearance and character of the landscape, and their potential level of concern for changes to the landscape. High viewer sensitivity is typically assigned to viewer groups engaged in recreational or leisure activities; traveling on scenic routes for pleasure or to and from recreational or scenic areas; experiencing or traveling to or from protected, natural, cultural, or historic areas; or experiencing views from resort areas or their residences. Low viewer sensitivity is typically assigned to viewer groups engaged in work activities or commuting to or from work.

Viewer exposure varies for any specific view location or travel route depending on the number of viewers and the frequency and duration of their views. Viewer exposure would typically be highest for views experienced by high numbers of people, frequently, and for long periods. Other factors, such as viewing angle and viewer position relative to a feature or area, can also be contributing factors to viewer exposure.

Most of the proposed route is located parallel to existing transmission lines. The current land use along the proposed route consists of low density and rural residential, open, and public lands, and commercial areas. Right-of-way tree clearing and construction activities will be visible throughout the proposed route.

The new transmission lines and substation expansions will be new features visible in the general area of the Project.

Both 115 kV and 230 kV structure types will be wood or steel pole H-frame structures or steel monopole structures. The proposed route will have different visual impacts from 115 kV transmission lines to 230 kV transmission lines due to structure height difference (**Appendix D**).

The proposed 115 kV structure height ranges from 50-110 feet. The new ROW and associated clearing will be visible where the approximately 1.5-mile-long segment of the new 115 kV transmission line proceeds south across Maple Grove Road and Hermantown Road through a densely wooded area, west of the Midway River (**Appendix B, plates 10 and 13 to 15**). Otherwise, approximately 88 percent of the 115 kV transmission line is proposed to be parallel or rebuilt with existing transmission lines.

The proposed 230 kV structure height ranges from 65-110 feet. Due to the increased height of these structures, these structures may be easier to see from the surrounding roadways, specifically where the approximately one-mile extension of an existing 230 kV transmission connects to the Arrowhead Substation (**Appendix B, plates 22 and 23**). The proposed 230 kV transmission line is parallel to existing transmission lines with existing ROWs.

The Ridgeview and Hilltop substation expansions will occur at existing substations and on property owned by Minnesota Power. The sight lines to both substation expansions would be obscured by existing stands of trees. There is already considerable utility infrastructure in the area (existing transmission and distribution lines are prevalent throughout the Project area). The Hilltop Substation expansion is shown on **Figure 5** and Ridgeview Substation expansion is shown on **Figure 6**.

Impacts and Mitigation

ROW clearing will be the most obvious visual impact in areas close to roads, residential areas, businesses, trails, and city-owned property such as cemeteries or parks.

The proposed 115 kV Route crosses the Hermantown Central Park (Fichtner Field) on the existing ROW for the 58 Line and 58D. Currently, there are two transmission lines (58 Line and 58D) that cross the park and these two crossings will remain and the change in the visual characteristics will be negligible (**Appendix B, plate 10**).

Many of the snowmobile trails in the Project area are located along or within the existing transmission line ROW; the Hermantown Night Riders snowmobile club has developed and maintains 59 miles of Grant-In-Aid trail connecting the Munger Trail in the South, North to Fish Lake and the North Shore trail. These trails run through Duluth, Proctor, Hermantown, Rice Lake, and Fredenberg, Minnesota.[156] The trail users

[156] Snowmobile Club - Hermantown Night Riders.

may notice a wider ROW but the anticipated difference in aesthetic quality while using the trail will be minimal. The ROW will be maintained for the existing 115 kV transmission lines, but additional tree clearing outside of the ROW may be necessary during construction for pull and tension sites. The existing transmission lines in the proposed route will limit the extent to which the new infrastructure is viewed as a disruption to the area's scenic integrity; given that the majority of the proposed route runs parallel with existing transmission lines or are rebuild segments, the visual impacts are expected to be minimal.

The Project proposes to reroute a portion of the existing 71 Line that currently crosses the Wild Rose Trail Subdivision. This reroute consolidates the transmission corridor (71 Line, proposed 176 Line and realigned 108 Line) and will result in a reduction of transmission line visual impacts to the front yards of residences within the Wild Rose Trail Subdivision (**Appendix B, plate 20**).

The reconstruction of the existing and proposed 115 kV transmission lines along Market Street will improve the visual characteristics of this segment by moving the lines closer to Market Street and having greater separation from the business, and the use of steel monopole structures will use less space in the parking lots than the current H-Frame structures (**Appendix B, plate 6**).

Relative to aesthetics the Duluth Loop Reliability project will have negligible to minimal potential impacts, along with some moderate benefits in those areas identified for rerouting and reconstruction of existing lines; no mitigation outside of the standard permit conditions is warranted.

5.4.2 Displacement

In the context of Chapter 216E-Electric Power Facility Permits (aka Minnesota Power Plant Siting Act) proceedings, displacement refers to the removal of a residence or building to facilitate the safe operation of a HVTL.

In the context of transmission line routing proceedings, displacement refers to the removal of a residence or building to facilitate the safe operation of a transmission line. The National Electric Safety Code (NESC) standards require certain minimum clearances between transmission lines and objects such as trees, buildings, or other structures to ensure that the transmission line can be operated safely. For electrical safety code and maintenance reasons, utilities generally do not allow residences or other buildings within the ROW of a transmission line. Any residences or other buildings located within a proposed ROW are generally removed, or "displaced." Displacements can be avoided through several means including transmission line structure placement, the use of specialty transmission line structures, and modifications of the ROW width.

Residences and business are located along most of the roads within the Project area. Residences are typically low density and rural residential with a house and non- residential structure. A non-residential structure is a structure in which one cannot reside (ex. garage, barn, shed, out-building, etc.). Minnesota

power has stated that avoidance of residences was a priority in selection of the proposed 230 kV and 115 kV routes.[157]

Based upon current GIS data and aerial photographs, the front deck of one residence appears to be located within the anticipated ROW for the proposed 115 kV transmission line; this structure appears to be currently within the ROW of the existing 71 Line (**Appendix B, plate 18**). The anticipated ROW for the proposed 115 kV transmission line contains three non- residential structures (**Table 6** and **Appendix B, plates 14, 17, and 19**). Two of the three non-residential structures have encroached on the existing ROW of the 71 Line (**Appendix B, plates 17 and 19**). One of the three non-residential structures would be located within new ROW of the proposed 57 Line and 176 Line (**Appendix B, plate 14**).

Based upon current GIS data and aerial photographs, an anticipated right-of-way for the proposed 115 kV transmission line may contain five businesses along Mall Drive, Market Street, and Lightning Drive (**Table 7** and **Appendix B, plates 6 and 7**). One of the five businesses, the bank building, located at the intersection of Mall Drive and Haines Road would be a new business building that may be within the expanded ROW for the proposed Project (**Appendix B, plate 6**). Four of the five businesses have encroached on the existing ROWs of the 58 Line and 58D and the 52 Line.

No residences or businesses are located within the anticipated ROW for the proposed 230 kV transmission line (**Table 6** and **Table 7** and **Appendix B, plates 22 and 23**).

Impacts and Mitigation

No residences or businesses are anticipated to be displaced by the proposed Project. The deck of the residence and two of the three non-residential structures have encroached on the existing 71 Line ROW (**Appendix B, plates 17, 18, and 19**). The proposed 115 kV transmission line (176 Line) would be double circuited with the existing 71 Line on new structures on the existing 71 Line ROW. The double-circuit segment will have a structure change to steel monopole from wood H-frame and therefore there may be an increase in the number of structures and structure heights.

Minnesota Power has stated that they propose to use the existing ROW and will work with the landowners regarding structure encroachment during construction and operations and maintenance.[158]

Minnesota Power proposes to reroute a portion of the existing 71 Line that currently crosses the Wild Rose Trail Subdivision (**Appendix B, plate 20**).[159] The reroute consolidates the transmission corridor (71

[157] RPA, at p. 7-2.
[158] RPA, at p. 7-4.
[159] RPA, at p. 7-4.

Table 6. Proximity of Residences to the Duluth Loop Project ROW[160]

Feature	Proposed 230 kV Transmission Line Right-of-Way		Proposed 115 kV Transmission Line Right-of-Way	
	Residences	Non-Residential Structures	Residences	Non-Residential Structures
Number within Project ROW	0	0	1[1]	3
Number within 0 to 75 feet from Project ROW*	0	1	11[2,3]	2
Number within 76 to 150 feet from Project ROW*	0	0	18	8
Number within 151 to 300 feetfrom Project ROW*	1	4	23	28
Number within 301 to 500 feetfrom Project ROW*	2	3	55[4]	56
Total Number within 500 feet ofProject ROW*	3	8	108	97

* Project Right-of-Way (ROW) is an approximate existing and proposed right-of-way.
Final right-of-way will be determined in final design.

1. This number includes a residence that is currently within the ROW of the existing 71 Line. The proposed 115 kV line will use the existing ROW of the 71 Line and will not increase the current ROW.
2. Deerfield Townhouses are located at Stebner Road and Tamarack Lane is a higher density rental townhouse complex with buildings within about 25 feet of the existing 58 Line right-of-way. This townhouse complex is counted as one residence.
3. This number does not include the residences within the Wild Rose Trail Subdivision where the existing 71 Line is proposed to be removed.
4. Miller Creek Townhouse are located at Sundby Road and Miller Creek Drive is higher density rental townhouse complex with a building about 380 feet from the existing 52 Line right-of-way. This townhouse complex is counted as one residence.

[160] RPA, at pp. 7-2 to 7-3; Table 7-1.

Table 7. Proximity of Businesses to the Duluth Loop Project ROW[161]

Feature	Proposed 230 kV Transmission Line Right-of-Way	Proposed 115 kV Transmission Line Right-of-Way
Number of Businesses within Project ROW	0	5
Number of Businesses 0 to 75 feet from Project ROW	0	4
Number of Businesses 76 to 150 feet from Project ROW	0	3
Number of Businesses 151 to 300 feet from Project ROW	0	15
Number of Businesses 301 to 500 feet from Project ROW	0	0
Total Number of Businesses within 500 feet of Project ROW	0	37

Line, proposed 176 Line and realigned 108 Line) and will result in a reduction of transmission line impacts to the yards of residences within the Wild Rose Trail Subdivision (**Appendix B, plate 20**). Also, Minnesota Power proposes several other areas of realignment, such as along Market Street and Lightning Drive, to address existing ROW encroachments and to accommodate recent developments. The proposed realignment along Market Street and Lightning Drive will move the existing 115 kV transmission line further south and north (respectively) to increase the separation of the proposed 115 kV transmission line from the businesses (**Appendix B, plates 6 and 7**). Minnesota Power will work with the bank building owner should the building be located within the expanded ROW. In addition, the proposed realignment along Lightning Drive would increase the separation from the Deerfield Townhouses located at Stebner Road and Tamarack Lane (**Appendix B, plate 7**).[162]

[161] RPA, at pp. 7-2 to 7-3; Table 7-2.
[162] Ibid.

As an effort to mitigate (minimize or avoid potential conflicts) potential conflicts, Minnesota Power will work with landowners to address alignment adjustments and structure placement during final design to the extent practical. The requested route widths afford Minnesota Power the flexibility to work with landowners around existing residences, other structures, and businesses, as appropriate.

5.4.3 Noise

High voltage transmission line projects have the potential to produce noise, both during construction and operation. During construction from operation of construction vehicles, equipment, and construction activities. During operation transmission lines may produce noise during rainy conditions due to the corona effect, a type of electrical conduction that occurs in the atmosphere near the conductor that may result in an audible hissing and cracking sound.

Potential human impacts due to noise include hearing loss, stress, annoyance, and sleep disturbance. This EA examines noise impacts from the construction and operation as required by Minnesota Rule 7849.1500, subpart 2.

Noise can be defined as any undesired sound.[163] It is measured in units of decibels on a logarithmic scale. A sound meter is used to measure loudness. The meter sums up the sound pressure levels for all frequencies of a sound and calculates a single loudness reading. This loudness reading is reported in decibels, with a suffix indicating the type of calculation used. The A-weighted decibel scale (dBA) is commonly used to measure the selective sensitivity of human hearing. This scales the physical sound levels that are measured as a pressure wave to match an equivalent "loudness" level across the audible spectrum that more closely resembles what a human ear would perceive. The A-weighted scale effectively puts more relative weight on the range of frequencies that the average human ear perceives clearly (e.g., mid-level frequencies) and less weight on those that humans do not perceive as well (e.g., very high and lower frequencies). Noise levels depend on the distance from the noise source and the attenuation of the surrounding environment. **Table 8** below provides an estimate of decibel levels of common noise sources.[164] A three dBa change in sound is barely detectable to average human hearing, whereas a five dBa change is clearly noticeable. A 10 dBa change is perceived as a sound doubling in loudness.

Minnesota's noise standards differ based on noise area classifications (NAC), which correspond to the location of the listener (or receptor) and the time of day (**Table 9**).[165] Although the NACs are based on the land use activity (residential, educational, and manufacturing) of the location where the noise is heard,

[163] MPCA (n.d.) *Noise Program*: https://www.pca.state.mn.us/air/noise-program.
[164] MPCA (November 2015) *A Guide to Noise Control in Minnesota*: https://www.pca.state.mn.us/sites/default/files/p-gen6-01.pdf.
[165] Minn. R, 7030.0050, https://www.revisor.leg.state.mn.us/rules/?id=7030.0050.

the NACs do not always reflect the zoning of the location. Noise standards are expressed as a range of permissible dBA over a one-hour time period.

Table 8. Common Noise Sources and Levels (A-weighted Decibels)[166]

Sound Pressure Level (dBA)	Common Indoor and Outdoor Noise Sources
100-110	Rock band (at 16.4 ft [5 m]) Jet flyover (at 984.3 ft [300 m])
90-100	Gas lawnmower (at 3.28 ft [1 m])
80-90	Food blender (at 3.28 ft [1 m])
70-80	Shouting (at 3.28 ft [1 m]) Vacuum cleaner (at 9.84 ft [3 m])
60-70	Normal speech (at 3.28 ft [1 m])
50-60	Large business office Dishwasher next room, quiet urban daytime
40-50	Library, quiet urban nighttime
30-40	Quiet suburban nighttime
20-30	Bedroom at night
10-20	Quiet rural nighttime Broadcast recording studio
0	Threshold of hearing

Table 9. MPCA Noise Standards - Hourly A-Weighted Decibels

Noise Area Classification	Daytime (7:00 a.m. – 10:00 p.m.)		Nighttime (10:00 p.m. – 7:00 a.m.)	
	L50	L10	L50	L10
1-Residential	60	65	50	55
2-Commerical	65	70	65	70
3-Industrial	75	80	75	80

In a residential setting, for example, noise restrictions are more stringent than in an industrial setting. Rural residential homes are considered NAC 1 (residential), while agricultural land and agricultural activities are classified as NAC 3 (industrial). The rules also distinguish between nighttime and daytime noise; less noise is permitted at night. Sound levels are not to be exceeded for 10 percent and 50 percent of the time in a one-hour survey (L_{10} and L_{50}) for each noise area classification.

[166] Minnesota Pollution Control Agency (MPCA). 2015. A Guide to Noise Control in Minnesota: Acoustical Properties, Measurement, Analysis and Regulation. pca.mn.us

Audible noise will occur as part of the construction and operation phases of the Project. Noise-sensitive land uses within the vicinity of the proposed Project route primarily include residential homes and neighborhoods, cross-country ski and walking trails, trout streams, Hermantown Cemetery, churches, office buildings, restaurants, retail/shopping stores, and city parks.

Construction noise is anticipated to occur primarily during daytime hours. The main source of noise will derive from heavy construction equipment operation and increased vehicle traffic due to construction personnel transporting materials to and from the site.

Transmission line conductors produce noise under certain conditions. The level of noise depends on conductor conditions, voltage level, and weather conditions. Operational noise levels produced by a 115 kV transmission line are generally less than outdoor background levels and are therefore not usually perceivable. Proper design and construction of the transmission line in accordance with industry standards will help to ensure that noise impacts are minimized.

Noise emissions from transmission line conductors generally occur during heavy rain and wet conductor conditions. In foggy, damp or rainy weather, transmission lines can create a crackling sound due to corona discharges – the small amount of electricity ionizing the moist air near the conductors. During heavy rain the background noise level of the rain is usually greater than the noise from the transmission line. As a result, people do not normally hear noise from a transmission line during heavy rain. During light rain, dense fog, snow and other times where there is moisture in the air, transmission lines will produce audible noise equal to approximately household background levels. During dry weather, audible noise from transmission lines is barely perceptible. Several other factors, including conductor voltage, shape and diameter, and surface irregularities such as scratches, nicks, dust, or water drops can affect a conductor's electrical surface gradient and therefore its corona and noise performance.

Impacts and Mitigation

During the construction of the transmission line projects, temporary, localized noise from heavy equipment and increased vehicle traffic is expected to occur along the ROW during daytime hours. Construction activity and crews would be present at a particular location during daytime hours for a few days at a time but on multiple occasions throughout the period between initial ROW clearing and final restoration. Construction equipment produces sound levels in the range of 74 to 85 dBA, measured at 50 feet from the source:

- Clearing and grading: grader (85 dBA), chainsaw (84 dBA), and tractor (85 dBA),
- Material delivery: flatbed truck (74 dBA) and crane (81 dBA),
- Auguring foundation holes: augur drill rig (84 dBA); and
- Setting structures: crane (81 dBA).

Construction noise could temporarily affect residences that are close to the ROW.

Several means to mitigate potential construction noise impacts include:

- Limiting heavy equipment use to the shortest possible time period.
- Minimizing construction equipment idling.
- Ensuring that proper mufflers are used on equipment.
- As practicable, locating stationary equipment (e.g., compressors, generators) away from receptors or behind barriers.

Noise from the operation of transmission lines is due to small electrical discharges along the conductors that ionize surrounding air molecules. This phenomenon is known as corona. The level of noise from these discharges depends on conductor conditions, voltage levels, and weather conditions. Noise emissions are greatest during heavy rains when conductors are consistently wet. However, during heavy rains, the background noise level is usually greater than the noise from the transmission line and few people are in close proximity to the transmission line in these conditions. As a result, audible noise is not generally noticeable during heavy rains.

In foggy, damp, or light rain conditions, transmission lines may produce audible noise higher than background levels. During dry weather, noise from transmission lines is a perceptible hum and sporadic crackling sound.

The applicant modeled and estimated noise levels for the transmission lines;[167] the predicted L50 audible noise levels associated with the various structure configurations of the Project are given in **Table 10** for the edge of right-of-way. Where the Project parallels existing transmission lines, the presence of another energized line nearby will impact the audible noise profile around the parallel lines. Therefore, the predicted audible noise associated with the various corridor scenarios where the Project's new 115 kV or 230 kV line parallels existing transmission lines are also given in **Table 10**.

Transmission line audible noise is primarily related to the electric field, and electric fields are particularly dependent on the voltage of the transmission line, the values in **Table 10** were calculated at the lines' maximum continuous operating voltage. Maximum continuous operating voltage is defined for the Project as the nominal voltage plus 10 percent, in this case either 126.5 kV (for nominally 115 kV lines) or 253 kV (for nominally 230 kV lines). Values were calculated assuming minimum conductor-to-ground clearance (that is, at mid-span) and a height of one meter above ground.[168]

As indicated in **Table 9**, the most stringent MPCA noise standard is the nighttime L50 limit for the land use category that includes residential areas (NAC-1). The NAC-1 nighttime limit is 50 dBA. The calculated L50 values at the edge of right-of-way for the Project presented in **Table 10** demonstrate that the audible

[167] RPA, at pp. 7-8 to 7-9.
[168] RPA, at pp. 7-8 to 7-9., Table 7-5.

noise associated with the Project will be within the most stringent MPCA limitations in all scenarios, and no mitigation is warranted.

Table 10. Noise Calculations for the Proposed project [169]

Corridor Configuration	Line Voltage	Edge of ROW L50 Noise (dBA)
Project: 115 kV H-Frame Existing: 115 kV H-Frame Existing 115 kV H-Frame	126.5 kV 126.5 kV 126.5 kV	24.09
Project: 115 kV H-Frame Existing: 115 kV H-Frame	126.5 kV 126.5 kV	22.66
Project: 115 kV Monopole Existing: 115 kV Monopole	126.5 kV 126.5 kV	22.86
Project + Existing: 115 kVDouble Circuit Monopole	126.5 kV 126.5 kV	20.37
Project + Existing: 115 kV Double Circuit Monopole Existing: 230 kV Monopole	126.5 kV 126.5 kV 253.0 kV	47.15
Project: 230 kV Monopole Existing: 115 kV H-FrameExisting: 115 kV H-Frame	253.0 kV 126.5 kV 126.5 kV	49.16
Project: 230 kV Monopole Existing: 115 kV H-Frame Existing: 115 kV H-Frame Existing: 115 kV Single Pole	253.0 kV 126.5 kV 126.5 kV 126.5 kV	49.16
Project: 230 kV Monopole Existing: 230 kV H-FrameExisting: 230 kV H-Frame	253.0 kV 253.0 kV 253.0 kV	49.37

5.4.4 Property Values

High voltage Transmission lines have the potential to impact property values. Because property values are influenced by a complex interaction between factors specific to each individual piece of real estate as well as local and national market conditions, the effect of one project on the value of one particular property is difficult to determine.

The placement of infrastructure near human settlements has the potential to impact property values. The impacts can be positive and negative. The type and extent of impacts depends on the relative location of the infrastructure and existing land uses in a given area. For example, a new highway may increase the

[169] RPA, at pp. 7-8 to 7-9., Table 7-5.

value of properties anticipated to be used for commercial purposes but decrease the value of nearby residential properties.

Potential impacts to property values due to large energy facilities are related to three main concerns:

- Potential aesthetic impacts of the facility,
- Concern over potential health effects from emissions (air emissions, wastewater discharges, electric and magnetic fields, etc.), and
- Potential interference with agriculture or other land uses.

Research on the relationship between property values and proximity to transmission lines has not identified a clear cause and effect relationship. Rather, the presence of a transmission line is one of many factors that affect the value of a specific property. The research has revealed trends which are generally applicable to properties near transmission lines:[170]

Impacts and Mitigation

When negative impacts on property values occur, the potential reduction in property values is in the range of 1 to 10 percent.

Impacts on property values decrease with distance from the line. Thus, impacts on the sale price of smaller properties are usually greater than impacts on the sale price of larger properties. Other amenities, such as proximity to schools or jobs, lot size, square footage of a house, and neighborhood characteristics, tend to have a much greater effect on sale price than the presence of a power line.

Negative impacts appear to diminish over time. The value of agricultural property is likely to decrease if the power line poles are placed in an area that inhibits farming operations.

A recent literature review examined 17 studies on the relationship between transmission lines and property values.[171] The reviewers concluded that the studies indicate small or no effects on the sale price of properties due to the presence of transmission lines.[172]

Impacts to property values could be mitigated by minimizing aesthetic impacts, perceived EMF health risks, and agricultural impacts. Selecting routes and alignments that maximize the use of existing ROW and that place the transmission line away from residences and out of agricultural fields could address

[170] Final Environmental Impact Statement, Arrowhead–Weston Electric Transmission Line Project, Volume I, Public Service Commission of Wisconsin Docket 05-CE-113, October 2000, p. 212-215.
[171] The Effects of Transmission Lines on Property Values: A Literature Review, Journal of Real Estate Literature, 2010, www.real-analytics.com/Transmission Lines Lit Review.pdf.
[172] Ibid.

these concerns, thus minimizing impacts to property values. Impacts can be mitigated through inclusion of specific conditions in individual easement agreements with landowners along the transmission line.

5.4.5 Socioeconomics/Demographics and Environmental Justice

Socioeconomics is an umbrella term used to describe aspects of a project that are either social or economic in nature, or a combination of the two. A socioeconomic analysis evaluates how elements of the human environment such as population/demographics, employment, housing, and public services might be affected by the proposed action and alternative(s).

Broadly defined, demography is the study of the characteristics of populations through statistical data. It provides a description of a population and how those characteristics change over time. Where there are foreseeable impacts, the incorporation of demographic data into environmental review may be useful in the evaluation of these potential impacts to the host community. These impacts may be beneficial or adverse. The discussion should address whether any social group is disproportionally impacted and identify possible mitigation measures to avoid or minimize any adverse impacts.

Environmental justice is the concept that seeks to achieve the fair and equitable distribution of environmental benefits and burdens associated with economic production, which includes the siting of large infrastructure projects. The original conception of environmental justice in the 1980s focused on harms to certain marginalized racial groups within rich countries such as the United States. The movement was later expanded to consider gender, international environmental discrimination, and inequalities more completely within disadvantaged groups. The ROI for environmental justice includes the census tract intersected by the Project.

Large infrastructure projects have the potential to impact the socioeconomic conditions of the areas in which they are sited, both positively and negatively. In the short term through an influx of non-local personnel, creation of construction jobs, construction material and other purchases from local businesses, and expenditures on temporary housing and support for non-local personnel. In the long term, large infrastructure projects may have socioeconomic impacts through changes in land use and local tax base, permanent job creation or relocation of project personnel to the area.

The Project site is located in Minnesota Economic Development Region 3 (**Diagram 6**); this region includes a total of seven counties (Aitkin, Carlton, Cook, Itasca, Koochiching, Lake, and St. Louis).

Table 11 presents population and economic information about Minnesota and the Project area. Data is provided at the county level to characterize the socioeconomic environment in the Project area and at the state level for the purpose of comparison.

Diagram 6. Economic Development Region 7W[173]

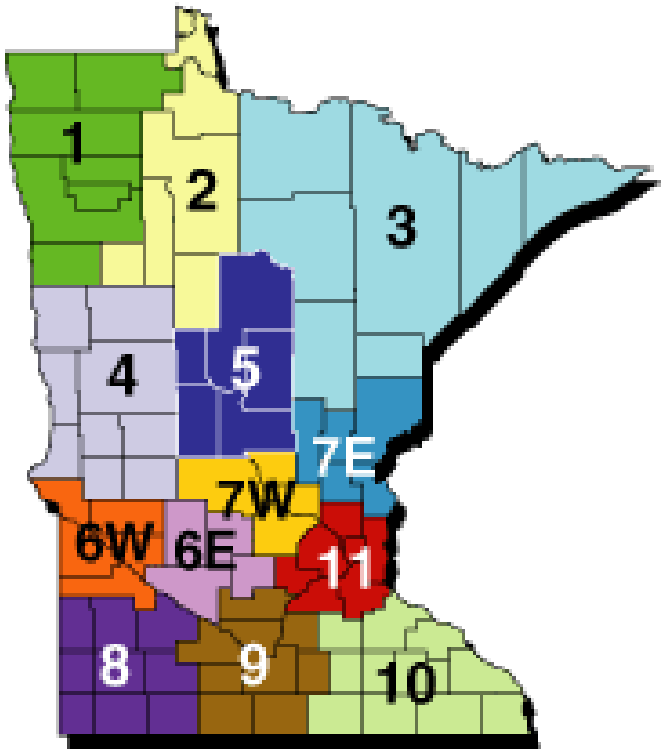


Table 11. Population and Socioeconomic Characteristics of Project Area[174]

Location	Population 2010	Population 2020	Change (%)	Median Household Income	Population below poverty level (%)
State of Minnesota	5,303,925	5,639,632	0.93 %	$74,593	9.0%
St. Louis County	200,226	199,070	-0.99%	$60,434	12.8%
City of Duluth	86,230	85,915	-0.99%	$52,463	18.2%
City of Hermantown	9,414	9,604	0.98%	$73,865	4.0%
City of Proctor	3,057	3,040	-0.99%	$57,794	5.1%

Impacts and Mitigation

If approved by the Commission, construction activities for the HVTLs will provide temporary increases in revenue to the area through increased demand for lodging, food services, fuel, transportation, and general supplies.

[173] https://apps.deed.state.mn.us/assets/lmi/areamap/edr.shtml.
[174] RPA, at pp. 7-10 to 7-11, Table 7-6.

During construction, the Project is expected to create new local job opportunities for various trade professionals that live and work in the area. Additional personal income will also be generated by circulation and recirculation of dollars paid out by the Project as business expenditures and state and local taxes. General skilled labor is anticipated to be available to serve the Project's basic infrastructure and site development needs, however, specialized labor may be required for certain aspects of the Project.

The availability of temporary or permanent housing is anticipated to be adequate. It is assumed that during construction, out-of-area workers will likely use lodging facilities nearby; sufficient temporary lodging and permanent housing is available within the Duluth metropolitan area, to accommodate construction workers and personnel.

The Applicants feel that the overall socioeconomic impacts associated with the Project will be positive; wages will be paid, and expenditures will be made to local businesses and landowners during the Project's construction and operation.[175] Additionally, the Applicant continues long-term societal benefits of the proposed Project include ensuring the continued reliable electric service to local customers into the future, which in turn, supports the local economy.

No additional permanent staff will be required for the operation and maintenance of the proposed transmission line; no permanent, long-term changes to population trends, economic indicators, or employment are anticipated. Since socioeconomic impacts are anticipated to be short-term and beneficial to the local communities, no mitigation is proposed.

A demographic review of the affected community to identify low-income and minority populations that might be present was conducted. U.S. Census data was used to identify low-income and minority populations. Low-income and minority populations are determined to be present in an area when the low-income percentage or minority group percentage exceeds 50 percent or is "meaningfully greater" than in the general population of the larger ROI. In this analysis, a difference of 10 percentage points or more was used as the threshold to distinguish whether a "meaningfully greater" low-income or minority population resides in the ROI. **Table 11** lists the percentage of individuals living below the poverty level and household income. None of the percentages for the Project intersected census tracts exceed 50 percent or the St. Louis County percentage by 10 percentage points or more, which is the defined threshold of significance for potential environmental justice impacts from the Project.

A meaningfully greater low-income or minority population does not reside in the area impacted by the Project; therefore, disproportionate, and adverse impacts to these populations are expected to be negligible. Mitigation is not proposed.

[175] RPA, at p. 7-10.

5.4.6 Zoning and Land Use Compatibility

High voltage transmission lines have the potential to adversely impact existing land uses and to be incompatible with existing land use patterns, local zoning requirements, and the future land use planning goals of local governmental units.

Large electric power facilities, like transmission lines, are subject to Minnesota's Power Plant Siting Act. Under this statute, a route permit issued for such facilities are "the sole site or route approval required to be obtained by the utility. Such permit shall supersede and preempt all zoning, building or land use rules, regulations or ordinances promulgated by regional, county, local and special purpose government."[176] Therefore, the applicant is not required to seek permits or variances from local governments to comply with applicable zoning codes. Nonetheless, impacts to local zoning are clearly impacts to human settlements, and the Commission considers impacts to human settlements as a factor in selecting sites and routes.

The proposed route is split between the City of Duluth and the City of Hermantown zoning ordinances. Most of the corridor is zoned as Low Density and Rural Residential with High Density Commercial zoning where the corridor crosses TH 194 at Hermantown Marketplace and small parcels of open space, public and industrial zoned areas (**Figure 8**). The Proposed 115 kV Route is within the Natural Environment and General Development Shoreland Overlay district per the Hermantown Zoning Code Chapter 5 Section 555.[177] The northeastern portion of the Proposed 115 kV Route overlaps the Duluth International Airport Overlay Zone C.[178] The proposed 115 kV route is located with the City of Duluth's Shoreland Management zones (overlay district) per Section 50-18.1 Natural Resources Overlay (NR-O).[179]

Current land use within the proposed route consists of mainly rural residential, open, and public lands and commercial areas. Commercial and retail spaces are primarily located at Hermantown Marketplace near the Haines Road substation. Hermantown Central Park and several recreational trails including snowmobile, cross-country skiing and walking trails intersect the proposed route.

The total acreage of each land cover type overlapped by the proposed route is provided in **Table 12** and shown on **Figure 9**. Land cover of the proposed new ROW is provided in **Table 13** for both the 115 kV and 230 kV transmission lines.

Impacts and Mitigation

The Duluth Loop Reliability project is compatible with the current applicable zoning requirements within St. Louis County and the cities of Duluth and Hermantown; no mitigation is warranted.

[176] Minnesota Statutes, Section 216E.10.
[177] ZONING CHAPTER 5 LAND USE REGULATIONS 2015-12-29.pdf (hermantownmn.com).
[178] UDC (duluthmn.gov).
[179] UDC (duluthmn.gov).

The Ridgeview and Hilltop substation parcels currently have approximately 2.3 acres in forested land cover, 0.13 acres in developed land use and approximately 1 acre in herbaceous/scrub shrub land cover (**Table 14; Appendix B Plates 1 and 2**). Since the Ridgeview and Hilltop substation expansions will alter the existing land cover, the expansion areas will be impacted. Land cover impacts from the proposed substation expansions are stated in **Table 14**. The construction footprints of the substation expansions are minor, and no mitigation is proposed.

Table 12. Land Cover Types Within the Proposed Route[180]

	Proposed Route		Proposed 230 kV Route		Proposed 115 kV Route	
Land Cover Type	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**
Cultivated Crops	0.21	0.01%	0	0%	0.2	0%
Deciduous Forest	699.46	42.51%	44.2	45%	655.2	42%
Developed, High Intensity	31.32	1.90%	7.7	8%	23.6	2%
Developed, Medium Intensity	46.79	2.84%	8.8	9%	37.9	2%
Developed, Low Intensity	36.36	2.21%	1.6	2%	34.7	2%
Developed, Open Space	72.79	4.42%	1.4	1%	71.4	5%
Emergent Herbaceous Wetlands	34.99	2.13%	4.5	5%	30.5	2%
Evergreen Forest	0.86	0.05%	0	0%	0.8	0%
Hay/Pasture	29.89	1.82%	1.5	2%	28.4	2%
Herbaceous	12.92	0.79%	3.5	4%	9.4	1%
Mixed Forest	55.04	3.35%	6.4	6%	48.6	3%
Open Water	0.31	0.02%	0	0%	0.3	0%
Shrub/Scrub	22.16	1.35%	6.4	6%	15.7	1%
Woody Wetlands	602.30	36.61%	13.1	13%	589.2	38%
Total	1645.40	100%	99.1	100%	1545.9	100%

The proposed route will overlap approximately 700 acres of forested land and 600 acres of woody wetlands, which are the two largest land use categories overlapped by the proposed ROW after developed land (**Table 12**). Impacts to forested land will be the most obvious impact to overall land cover within the proposed route (**Table 15**).

The 1.5-mile segment of new 115 kV transmission line west of the Midway River, traverses through a densely wooded area (**Appendix B, plates 10 to 15**). This stretch of transmission line will require new ROW which will convert the existing forested land to open, cleared space. Much of the proposed 115 kV

[180] RPA, at p. 7-29; Table 7-14.

route is planned to be parallel or double circuit to existing transmission lines, which will reduce the amount of new ROW needed and clearing.

Table 13. Land Cover Types Within the Proposed ROW[181]

	Proposed New 230 kV Right-of-Way		Proposed New 115 kV Right-of-Way	
Land Cover Type	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**
Cultivated Crops	0	0%	0	0%
Deciduous Forest	6.6	62%	46.5	59%
Developed, High Intensity	0	0%	<0.1	0%
Developed, Medium Intensity	0	0%	1.3	2%
Developed, Low Intensity	0	0%	1.9	2%
Developed, Open Space	0.2	2%	2.5	3%
Emergent Herbaceous Wetlands	1.3	12%	1.2	2%
Evergreen Forest	0	0%	0	0%
Hay/Pasture	0	0%	0.2	0%
Herbaceous	0.1	1%	0.5	1%
Mixed Forest	0.6	6%	4.0	5%
Open Water	0	0%	0	0%
Shrub/Scrub	0.1	1%	0.3	0%
Woody Wetlands	1.8	17%	20.3	26%
Total	**10.7**	**100%**	**78.8**	**100%**

Table 14. Land Cover Proposed Substation Expansions[182]

Land Cover Type	Acres	Percent of Total
Deciduous Forest	2.30	62.34%
Developed, Low Intensity	0.12	3.37%
Developed, Open Space	0.01	0.16%
Herbaceous	0.06	1.70%
Mixed Forest	0.43	11.73%
Shrub/Scrub	0.76	20.70%
Total	**3.68**	**100%**

[181] RPA, at p. 7-30; Table 7-15.
[182] RPA, at p. 7-30; Table 7-16.

Table 15. Land Cover Impacts from the Proposed 115 kV and 230 kV Routes[183]

	Proposed 230 kV Transmission Line		Proposed 115 kV Transmission Line	
Land Cover Type	**Temporary Direct Impacts[1]**	**Permanent Direct Impacts[2]**	**Temporary Direct Impacts[1]**	**Permanent Direct Impacts[2]**
Cultivated Crops (acres)	0	0	0	0
Deciduous Forest (acres)	7.3	2.9	74.9	23.0
Developed, High Intensity (acres)	0	0	1.7	<0.1
Developed, Low Intensity (acres)	0	0	4.1	<0.1
Developed, Medium Intensity (acres)	0.1	0	3.9	<0.1
Developed, Open Space (acres)	0.2	0	6.8	<0.1
Emergent Herbaceous Wetlands (acres)	0.9	<0.1	2.4	<0.1
Evergreen Forest (acres)	0	0	0	0
Hay/Pasture (acres)	0	0	0.7	<0.1
Herbaceous (acres)	0.1	0	0.4	<0.1
Mixed Forest (acres)	1.4	0.2	5.0	1.8
Open Water (acres)	0	0	0	0
Shrub/Scrub (acres)	0.3	0	1.3	<0.1
Woody Wetlands (acres)	1.5	1	38.4	9.9
Total	**11.8**	**4.1**	**139.6**	**34.7**

1 - Temporary fill impacts include access routes (30-foot-wide travel path along the proposed centerline of the project), structure work areas (100 foot by 100 foot per structure), and wire stringing areas (approximately 0.66 acres per location).
2 Permanent structure placement includes both H-Frame structure placement (56.5 sq. feet per structure) and Monopole Structure Placement (78.5 sq. feet per structure.

Relative to current land use in the Project area, potential impacts to land use are anticipated to be negligible to moderate; no mitigation beyond the standard permit conditions (**Appendix C**) is required.

5.4.7 Cultural Values

Cultural values are those community beliefs and attitudes which provide a framework for community unity and animate community actions. Cultural values are informed, in part, by history and heritage. The Project area has been home to a variety of persons and cultures. Transmission line projects have the

[183] RPA, at p. 7-31; Table 7-17.

potential to impact public perceptions of identity and may impact participation in community and regional events during construction or operation of large infrastructure projects. Historic demographics of St. Louis County include Bois Forte Band of Chippewa and Fond du Lac Band of Lake Superior Chippewa and German, Norwegian, Swedish, and Irish heritage.

St. Louis County is known for its abundant access to natural resources and recreational areas such as Lake Superior, the Boundary Waters Canoe Area, Voyagers National Park, and the Superior National Forest. Parts of the federally recognized Bois Forte Band of Chippewa and Fond du Lac Band of Lake Superior Chippewa reservations are located within St. Louis County.

Minnesota Power consulted with the Fond du Lac Band of the Lake Superior Chippewa Tribal Historic Preservation Officer (THPO, Jill Hoppe) regarding potential impacts from construction and operation of the Project; the THPO informed the Applicant of two concerns relative to cultural resources near to the route alternatives being considered. One area is Mogie Lake, a wild rice lake, that is about 400 feet north of the proposed route (**Appendix B, plates 18-19**). The second area is a historic trail called the *Rice Lake Trail* that led from Lake Superior, through Chief Buffalo's Tract, and northward to Wild Rice Lake (**Appendix B, plate 2**). The proposed route crosses this historic trail near the existing Line 19 and Line 56 intersect (**Appendix B, plate 2**).

The City of Duluth is the largest city within the county and the Port of Duluth is the farthest inland port accessible by oceangoing ships in the world.[184] Popular attractions and events in St. Louis County include Skyline Parkway, Grandmas Marathon, Duluth's Aerial Lift Bridge and Canal Park, the Duluth Air Show, the John Beargrease Sled Dog Marathon, the Bayfront Blues Festival, and the International Wolf Center. The major industries of St. Louis County include mining, wood and paper products, shipping, aviation, higher education, health care, and tourism.[185]

The present-day cultural values are centered around the celebration of national and local holidays and the appreciation of the natural features of the region instead of values based on heritage.

Impacts and Mitigation

No impacts to cultural values are anticipated as a result of the construction and operation of the Project and therefore no mitigation is deemed warranted. The Project will not adversely impact the work or recreation of residents in the vicinity of the transmission lines that underlie the area's cultural values, nor will it significantly impact geographical features that inform these values.

[184] Home - Port Authority (duluthport.com).
[185] About St. Louis County (stlouiscountymn.gov).

In consultation with the Fond du Lac Band of the Lake Superior Chippewa THPO, the Applicant reports that the THPO believes that the *Rice Lake Trail* is most likely no longer identifiable, however if construction identifies a historic trail in this area, then the Applicant is to notify the THPO.[186]

5.4.8 Electronic Interference (Radio, Television, Cellular Phone, and GPS Systems)

This chapter summarizes the potential impacts of the Project on electronic communications and communication devices, including radios, televisions, and microwave communications.

Electromagnetic noise from transmission lines may interfere with electronic communications when it is generated at the same frequencies as communication and media signals. This noise could interfere with the reception of these signals depending on the frequency and strength of the signal and distance from the electromagnetic noise source. Corona interference from transmission lines causes the greatest disturbance in a relatively narrow frequency spectrum, in the range of about 0.1 to 50 megahertz (MHz). Because many communication and media signals are transmitted at higher frequencies, impacts to communication signals are limited (**Diagram 7)**.

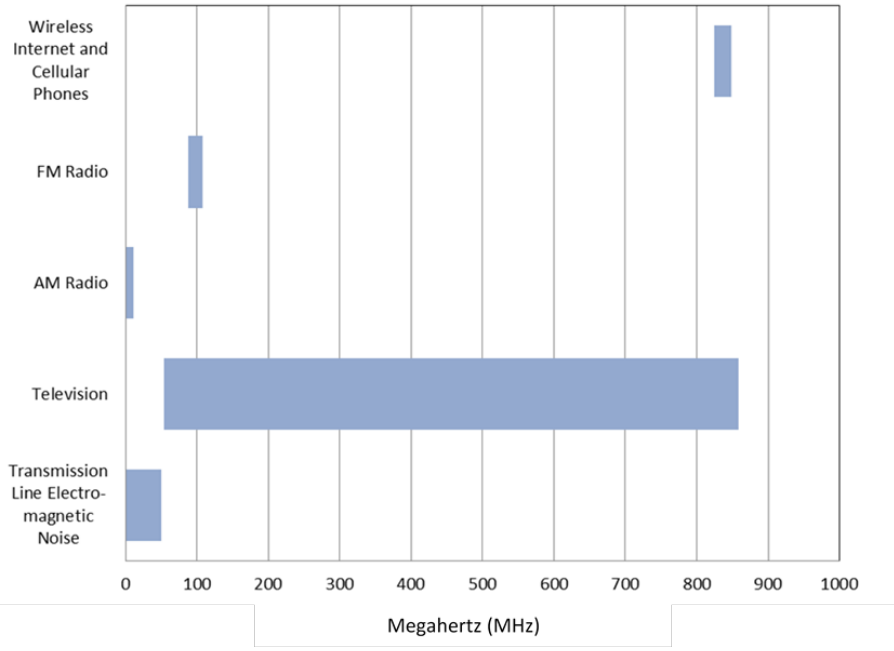
AM radio frequencies are most commonly affected by corona-generated noise. AM radio frequency interference typically occurs immediately under a transmission line and dissipates rapidly within the ROW to either side.

Television broadcast frequencies are typically high enough that they are not affected by corona-generated noise. In particular, digital and satellite television transmissions are not affected by corona-generated noise because they are dependent on packets of binary information or transmitted in the Ku band of radio frequencies (12,000-18,000 MHz). Digital and satellite transmissions are more likely to be affected by multi-path reflections (shadowing) generated by nearby towers. In addition, line-of-sight interference from transmission line structures can affect satellite television transmissions. The use of shielded coaxial cable for cable television transmittals generally makes them insusceptible to interference from electromagnetic noise.

Cellular phone signals use an ultra-high frequency, generally around 900 MHz, which is significantly higher than the range of electromagnetic noise generated by transmission line conductors. GPS signals operate at a higher frequency as well, within the range of 1,225 to 1,575 MHz.

[186] RPA, at Appendix M, page 40. Project Meeting Notes, April 9, 2021.

Diagram 7. Frequencies of Electronic Communication and Electromagnetic Noise[187]



Electromagnetic noise from transmission lines is not an issue for microwave communications. However, microwave communications can be physically blocked by taller transmission structures. Microwave beams are transmitted along aerial pathways between microwave communication towers. Microwave beam pathways can extend as close as 150 feet to the ground. Transmission line structures for this project would be 135 feet to 165 feet tall.

Impacts and Mitigation

No impacts to radio, cellular phones, or GPS units are expected from construction or operation of the Project. Because both cellular phone signals and GPS operate at frequencies outside the range of electromagnetic noise generated by transmission line conductors, the risk of interference is negligible.

EMI to digital and satellite television signals as a result of the Project is not anticipated. If EMI to these signals were to occur from multi-path reflections or line-of-sight interference, such interference can be mitigated by use of an outdoor antenna to improve digital signals or by moving the affected satellite antenna to a slightly different location. EMI from a spark discharge source due to imperfections on the conductor or associated equipment can be found and corrected.

Because no impacts on radio, television, cellular phones, or GPS units are anticipated from construction or operation of the Project, no mitigation measures are proposed.

[187] Marshall Brain "How the Radio Spectrum Works" 1 April 2000.HowStuffWorks.com. https://electronics.howstuffworks.com/radio-spectrum.htm.

The Applicant has stated that if television or radio interference is caused by or from the operation of the proposed facilities in those areas where good reception was available prior to construction of the Project, Minnesota Power will evaluate the circumstances contributing to the impacts and determine the necessary actions to restore reception to the present level, including the appropriate modification of receiving antenna systems if necessary.[188]

5.4.9 Transportation

Transmission line projects have the potential to impact local transportation networks such as roadways, railroads, airports, and airstrips. Heavy equipment used during construction has the potential to damage existing road surfaces and local roadways could experience temporary road and/or lane closures during construction. The inflow of construction contractors could increase traffic volumes on local roadways. Co-location of transmission lines with existing public roads could complicate future roadway expansion or realignments and could interfere with routine maintenance of roadways. In addition, if sited too close to an operating railroad, it could interfere with safe operation of the railroad.

The Federal Aviation Administration (FAA) and the MNDOT have both established guidelines for development of transmission lines near public airports. The FAA has developed height restrictions for development near public airports and has developed guidelines for placement of buildings and other structures near high frequency omni-directional range navigation systems. MNDOT has established zoning areas around public airports that restrict the area where buildings and other structures can be placed. Both the FAA and MNDOT guidelines apply only to public airports and are not applicable to private airstrips.

Existing interstate, state, county, and city owned ROW are located within the proposed route. Roadways include but are not limited to County Highway 48, County Road 284, County Highway 56, County Highway 6, County Road 898, United States Highway 53, Trunk Highway 194, County Highway 91, County Highway 32, County Highway 4, Rice Lake Road, West Arrowhead Road, Maple Grove Road, Lavaque Road, Morris Thomas Road, Ugstad Road, and Stebner Road (**Figure 1**).

Duluth International Airport is located approximately 1-mile northwest of Swan Lake Road Substation (**Figure 1**).

Impacts and Mitigation

Routing transmission lines along existing ROWs can minimize the proliferation of new utility ROW and the effects on private landowners. In order to share or occupy ROW, however, the applicant would have to acquire necessary approvals from the ROW owner (like the state, county, or township). Any occupation of state highway right-of-way requires a Utility Permit from the MNDOT, per Minn. R. Ch. 8810.3100-3600.

[188] RPA, at p. 8-18.

MNDOT's Accommodation Policy provides requirements and guidelines for the installation of utility facilities in and along MNDOT ROW, which the HVTL Project was developed to meet.[189]

Access to the work sites along the route may utilize existing roadways, with the limited possible exception of minor field access or driveway changes depending on final design. No changes to existing roadways will occur. During the construction phase, temporary impacts are anticipated on some public roads within and immediately adjacent to the route, primarily through additional traffic and slow-moving construction vehicles.

Minnesota Power will coordinate with the Department of Transportation to confirm that construction of the proposed route will not interfere with routine roadway maintenance.[190] Based on the location of other existing utilities and site improvements that are identified during survey activities, the transmission line will be designed to meet or exceed required clearances. Temporary localized traffic delays may occur when heavy equipment enters and exits roadway rights-of-ways along the transmission corridor and for stringing operations at roadway crossings.

After the completion of construction, the Permittee must ensure that township, city, and county roads used for purposes of access during construction are returned to pre-construction condition (**Appendix C**). The Applicant will meet with township road supervisors, city road personnel, or county highway departments to address any issues that arise during construction with roadways to ensure the roads are adequately restored, if necessary, after construction is complete.

After construction is complete, traffic impacts during the operations phase of the transmission lines will be negligible. A small maintenance crew driving through the area in pickup trucks on a regular basis will monitor and maintain the facilities as needed, but traffic function will not be impacted as a result.

Minnesota Power will coordinate with the Duluth International Airport and the Joint Airport Zoning Board on the status of their zoning ordinance revisions.[191] The Project is anticipated to be parallel to existing transmission lines and not closer to the airport than the existing transmission lines, however some transmission line structures might be taller than the existing transmission line structures. Minnesota Power will coordinate with the Duluth International Airport to avoid affects to the airport and therefore affects are not anticipated.

5.4.10 Public Utilities/Services

[189] Reasonable Accommodation - Policies - MnDOT (state.mn.us).
[190] RPA, at p. 7-14.
[191] RPA, at p. 7-14.

Transmission line projects have the potential to damage or interfere with the use of public utilities. The presence of a HVTL could also preclude construction and operation of new utility infrastructure. The proposed route is located in an area where usual public services are available such as waste and recycling services, electricity, city sewer and water systems, fire protection, police, and natural gas.

Existing distribution line ROWs are located within the proposed route as well as a natural gas pipeline owned by Northern Natural Gas Company that crosses the proposed route approximately 0.25 miles west of Ugstad Road and about 0.25 miles north of Morris Thomas Road (**Figure 1** and **Appendix B, plate 15**).

Impacts and Mitigation

With proper coordination, project construction and operation should not directly affect any of these public utilities. Construction of the solar farm will temporarily increase the population and workforce present within the vicinity of the Project. This increase in population may temporarily increase in individuals requesting the use of public services. However, this minimal increase in population should not create the need for more public services than already exist. Therefore, impacts to the public services system associated with a temporary increase in population are not anticipated.

The design and operating process of transmission lines require specific standards and mitigation outlined in NERC, Federal Energy Regulatory Commission (FERC) and NESC which aid in the compatibility of new construction with existing utilities. Existing transmission lines and substations will be temporarily taken out of service during construction of the transmission rebuilds and substation tie-ins. This construction work will be coordinated to avoid electric service outages.

The Applicant has stated that they will coordinate with Gopher State One Call before and during construction to fully understand infrastructure locations and safety concerns and to avoid possible structural conflicts. Underground utilities will be marked prior to construction start; if there is a need to cross an underground utility or other underground infrastructure with heavy equipment, the Permittee will employ BMPs to protect the infrastructure, such as construction matting.[192]

Since no impacts to public utilities or infrastructure are anticipated, no mitigation measures are proposed.

5.4.11 Safety Hazards and Emergency Services

As with any project involving heavy equipment, electrical components, and transmission lines, there are safety issues to consider during construction. Potential health and safety impacts from construction activities include injuries due to falls, equipment use, and electrocution.

[192] RPA, at p. 7-14.

Transmission line projects have the potential to impact the availability of emergency and public health and safety services of the local population during construction activities. The inflow of temporary construction personnel could increase demand for emergency and public health services. On the job injuries of construction workers requiring assistance due to slips, trips or falls, equipment use, or electrocution can create a demand for emergency, public health, or safety services that would not exist if the Project were not to be built. As road closures may be required during construction, such closures could impede police, fire, and other rescue vehicles access to the site of an emergency.

Emergency response services in the Project area are provided by local law enforcement and emergency response agencies located in nearby communities. These include the St. Louis County Sheriff, Hermantown Police Department, Hermantown Volunteer Fire Department, Duluth Police Department, Duluth Fire Department, Proctor Police Department, and Proctor Volunteer Fire Department.[193]

Ambulance response provided by local ambulance services include Mayo Clinic Ambulance Services and Arrowhead EMS Association in Duluth. Hospital/Urgent Care Services within the Project area include St. Luke's Miller Creek Medical Clinic & Urgent Care in Hermantown, and Essentia Health-St. Mary's Medical Center in Duluth.

All of these law enforcement, emergency response services and hospitals/Urgent Care Facilities are within 20 miles or less of the Project.

During operation, HVTLs are required to meet certain safety qualifications and standards such as fencing of substations to prevent public access to energized equipment and breakers to deenergize lines in certain situations. Construction of towers or transmission lines must consider potential effects on existing emergency communication systems to avoid line-of-sight disturbances.

Impacts and Mitigation

The construction and operation of the Project is anticipated to have minimal impacts on the security and safety of the local population. Temporary road closures, if required during construction, will be coordinated with local jurisdictions to provide safe access of police, fire, and other rescue vehicles. Local law enforcement resources may be utilized for traffic control and law enforcement during construction activities. In the event that emergency services are needed for local residents during the construction, construction in the vicinity of the emergency site will stop, and any impeding equipment will be relocated so that emergency vehicles may access the emergency site.

The Permittee will coordinate law enforcement agencies, local fire departments, ambulance services, and 911 services to inform them of the construction activities; accidents that may occur during construction

[193] Police - City of Hermantown (hermantownmn.com), Volunteer Fire - City of Hermantown (hermantownmn.com), Police Department (duluthmn.gov), Fire Department (duluthmn.gov), and Public Safety – City of Proctor, MN (proctormn.gov).

of the Project would be handled through these local emergency services. The influx of approximately 25 to 75 workers to construct the Project is not expected to influence emergency or public health services. Once construction is complete, operation of the Project should not impede emergency services. As such, construction and operation of the Project is anticipated to have minimal impacts on the availability of emergency services.

The type and number of responding agencies will depend on the incident requiring emergency services; the Permittee will develop an Operations and Emergency Action Plan for the Project that outlines local contacts (first responders and internal operation and maintenance staff) and emergency procedures for evacuation, fire response, extreme weather, injury, and criminal behavior. Construction will comply with local, state, and federal regulations regarding installation of the solar farm and standard construction practices. Established industry safety procedures will be followed during and after construction of the Project; these include clear signage during all construction activities and fencing of substation facilities to prevent public access.

Proper safeguards would be implemented for construction and operation of the proposed 115 kV and 230 kV transmission lines. The proposed Project will be designed in compliance with state, NESC, and Minnesota Power standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials, and right-of-way widths. Construction crews and/or contract crews will comply with state and NESC standards regarding installation of facilities and standard construction practices.

Minnesota Power's established safety procedures, as well as industry safety procedures, will be followed during and after installation of the transmission line, including clear signage during all construction activities.[194]

The proposed high voltage transmission lines will be equipped with switching devices (circuit breakers and relays located in the substations where the transmission lines terminate). These devices are intended to make, carry, and break line currents under normal conditions and in specified abnormal conditions such as a short circuit or fault. The circuit breakers stop the specified current and can protect other equipment and the extended power system from damaging currents and more extensive outages; however, any electrical facility which becomes isolated by operation of circuit breakers should not be considered de-energized or safe. Downed power lines and other damaged electrical equipment should always be assumed to be energized and dangerous.

No affects to public health and safety are anticipated as a result of the proposed Project.

[194] RPA, at pp. 7-4 to 7-5.

Minnesota Power will ensure that safety requirements are met during construction and operation of the facilities.[195] During active construction, measures will be made to ensure the safety of residents which will include, but is not limited to, signage where active construction is occurring, flaggers at road and railroad crossings, and barriers around active construction zones. Additionally, when crossing roads or railroads during stringing operations, guard structures will be utilized to eliminate traffic delays and provide safeguards for the public. With implementation of these safeguards and protective measures, no additional mitigation is proposed.

5.5 Public Health and Safety

High voltage transmission lines have the potential to negatively impact public health and safety during both construction and operation of a project. Potential health impacts related to the operation of HVTL projects include health impacts from electric and magnetic fields (EMF), stray voltage, induced voltage, impaired air quality, and electrocution.

5.5.1 Electric and Magnetic Fields (An Overview)

Electric and magnetic fields (EMFs) are invisible regions of force resulting from the presence of electricity and are produced by all electric devices, including transmission and distribution lines. Naturally occurring EMFs are caused by the earth's weather and geomagnetic field. Man-made EMFs are caused by electrical devices and are characterized by the frequencies at which they alternate, that is, the rate at which the fields change direction each second. All electrical lines in the United States have a frequency of 60 cycles per second or 60 Hertz (Hz). EMFs at this frequency level are known as extremely low frequency (ELF) EMF.

This chapter summarizes the potential health impacts of transmission line EMF, regulatory standards, and predicted EMF levels from this project. **Appendix E** provides detailed background on EMF health impact research.

5.5.1.1 *Magnetic Field Background Levels*

The wiring and appliances located in a typical home produce an average background magnetic field of between 0.5 mG and 4 mG [196]. A U.S. government study conducted by the EMF Research and Public Information Dissemination Program determined that most people in the United States are on average

[195] RPA, at pp. 7-4 to 7-5.
[196] EPA. 1992. EMF in Your Environment, Magnetic Field Measurements of Everyday Electrical Devices. 1992. https://nepis.epa.gov/.

exposed daily to magnetic fields of 2 mG or less.[197] Typical magnetic field strengths near common appliances are shown in **Table 16**.

Table 16. Typical Sources of Magnetic Field[198]

Source	Distance from Source (feet)			
	0.5	1	2	4
Air Cleaners	180	20	3	-
Copy Machines	90	20	7	1
Fluorescent Lights	40	6	2	-
Computer Displays	14	5	2	-
Hair Dryers	300	1	-	-
Baby Monitor	6	1	-	-
Microwave Ovens	200	4	10	2
Vacuum Cleaner	300	60	10	1

5.5.1.2 Health Studies and Potential Health Impacts

A concern related to EMFs is the potential for adverse health effects due to EMF exposure. In the 1970s, epidemiological studies indicated a possible association between childhood leukemia and EMF levels. Since then, various types of research have been conducted to examine EMF and potential health effects, including animal studies, epidemiological studies, clinical studies, and cellular studies. Scientific panels and commissions have reviewed and studied this research data (**Appendix E**). In general, these studies concur that:

- There is an association between childhood leukemia and EMF exposure. There is no consistent association between EMF exposure and other diseases in children or adults.
- Laboratory, animal, and cellular studies fail to show a cause-and-effect relationship between disease and EMF exposure at common EMF levels. A biological mechanism for how EMF might cause disease has not been established.

Because a cause-and-effect relationship cannot be established, and yet an association between childhood leukemia and EMF exposure has been shown, there is:

- Uncertainty as to the potential health effects of EMF.

[197] National Institute of Environmental Health Sciences. 2002. EMF *Electric and Magnetic Fields Associated with the Use of Electric Power - Questions & Answers*. June 2002. https://www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf.

[198] EPA. 1992. EMF in Your Environment, Magnetic Field Measurements of Everyday Electrical Devices. 1992. https://nepis.epa.gov/.

- No methodology for estimating health effects based on EMF exposure.
- A need for further study of the potential health effects of EMF.
- A need for a prudent avoidance approach in the design and use of all electrical devices, including transmission lines.

5.5.1.3 Regulatory Standards

There are currently no federal regulations regarding allowable electric or magnetic fields produced by transmission lines in the United States. A number of states, however, have developed state-specific regulations (**Table 17**), and a number of international organizations have adopted EMF guidelines (**Table 18**).

Table 17. State Electric and Magnetic Standards[199]

State	Area where limits applies	Field	Limit
Florida	Edge of ROW	Electric	2 kV/m (lines ≤ 500 kV)
		Magnetic	150 mG (lines of ≤ 230 kV) 200 mG (>230 kV - ≤ 500) 250 mG (>500 kV)
	On ROW	Electric	8 kV/m (≤230 kV) 10 kV/m (>230 kV - ≤ 500) 15 kV/m (>500 kV)
Minnesota	On ROW	Electric	8 kV/m
Montana	Edge of ROW(1)	Electric	1 kV/m
	Road crossings	Electric	7 kV/m
New Jersey	Edge of ROW	Electric	3 kV/m
New York	Edge of ROW	Electric	1.6 kV/m
		Magnetic	200 mG
	Public road crossings	Electric	7 kV/m
	Private road crossings	Electric	11 kV/m
	On ROW	Electric	11.8 kV/m
Oregon	On ROW	Electric	9 kV/m
(1) May be waived by landowner.			

[199] National Institute of Environmental Health Sciences. 2002. EMF *Electric and Magnetic Fields Associated with the Use of Electric Power - Questions & Answers*. June 2002. https://www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf.

The Commission has established a standard that limits the maximum electric field under transmission lines to 8 kV/m. All transmission lines in Minnesota must meet this standard. The Commission has not adopted a magnetic field standard for transmission lines. The Commission has, however, adopted a prudent avoidance approach in routing transmission lines and, on a case-by-case basis, considers mitigation strategies for minimizing EMF exposure levels associated with transmission lines.

Table 18 International Electric and Magnetic Field Guidelines[200]

Organization	Electric Field (kV/m)		Magnetic Field (mG)	
	General Public	Occupational	General Public	Occupational
Institute of Electrical and Electronics Engineers	5	20	9,040	27,100
International Commission on Non-ionizing Radiation Protection	4	8	2,000	4,200
American Conference of Industrial Hygienists	-	25	-	10,000/1,000(1)
National Radiological Protection Board	4	-	830	4,200

(1) For persons with cardiac pacemakers or other medical electronic devices.

Some public health scientists have questioned whether state and international EMF guidelines sufficiently protect public health. These scientists have urged state utility commissions to be more rigorous in applying a precautionary or prudent avoidance approach. Dr. David Carpenter, a public health physician at the University of Albany, and Cindy Sage, an EMF researcher, note that there is "strong scientific evidence that exposure to magnetic fields from power lines greater than 4 mG is associated with an elevated risk of childhood leukemia"[201].

They conclude that the evidence for effects on human health from ELF-EMF is strong enough to merit regulatory action to reduce EMF exposure levels. They suggest that "such a reduction could be achieved by setting EMF exposure goals that are lower than levels known to be associated with disease, understanding that these exposure goals are significantly lower than many current exposures." Dr. Carpenter and Ms. Sage, in collaboration with other public health researchers, have also authored the *Bio-Initiative Report*, which argues for a more proactive application of a precautionary approach to radio frequency and ELF-EMF.[202]

[200] International Commission on Non-ionizing Radiation Protection. 2010. *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz – 100 kHz)*. Health Physics. Vol. 99, 6, pp. 818-836. https://www.icnirp.org/cms/upload/publications/ICNIRPLFgdl.pdf.
[201] Carpenter, D. O. and Sage, C. *Setting prudent public health policy for electromagnetic field exposures*. Reviews of Environmental Health. 2008, Vol. 23, 2, pp. 91-117.
[202] Bioinitiative Working Group. 2012. *A Rationale for Biologically based Exposure Standards for Low-Intensity Electromagnetic Radiation*. Prepared for Bioinitiative Working Group. 2007. https://bioinitiative.org/.

For the Brookings County to Hampton 345 kV transmission line project (Commission docket number TL-08-1474), Dr. Carpenter testified before the Commission on behalf of a party which argued that magnetic field levels for that project would exceed safe exposure levels. Testimony was provided in opposition to Dr. Carpenter's opinion by Dr. Peter Valberg. After examining and weighing the competing testimony of Drs. Carpenter and Valberg, the administrative law judge and, ultimately, the Commission, determined that the state's current exposure standard for ELF- EMF (an electric field standard of 8 kV/m) is adequately protective of human health and safety.

The Commission has repeatedly found that there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects. In the Huntley- Wilmarth 345 kV Transmission Line Project, for example, the Commission concluded that "No adverse health impacts from electronic and magnetic fields are anticipated for persons living or working near the Project." Similarly, the Commission has reached similar conclusions for a utility-scale solar project by concluding that, "based on the most current research on electromagnetic fields, and the distance between the [Elk Creek] Project and houses, the [Elk Creek] Project will have no impact to public health and safety due to EMF or magnetic fields."

5.5.1.4 Implantable Medical Devices

Electromechanical implantable medical devices, such as cardiac pacemakers, implantable cardioverter defibrillators (ICDs), neurostimulators, and insulin pumps may be subject to interference from electric and magnetic fields, which could mistakenly trigger a device or inhibit it from responding appropriately.

ICD manufacturers' recommended threshold for modulated magnetic fields is one gauss. Since one gauss is five to 10 times greater than the magnetic field likely to be produced by a high-voltage transmission line,[203] research has focused on electric field impacts. A 2004 Electric Power Research Institute report states that sensitivity to electric fields was reported at levels ranging upwards from 1.5 kV/m, particularly for older (unipolar) pacemakers; some modern (bipolar) units are immune at 20 kV/m. Medtronic and Guidant, manufacturers of various implantable medical devices, have indicated that electric fields below 6.0 kV/m are unlikely to affect most of their devices.[204]

Scholten conducted a theoretical study evaluating the risk for a patient with a unipolar cardiac pacemaker under worst case and real-life conditions under a high- voltage transmission line.[205] This study concluded that a life-threatening situation for cardiac pacemaker patients beneath high-voltage transmission lines is very unlikely; however, an interference between the implant and the electromagnetic fields cannot be

[203] Public Service Commission of Wisconsin. 2013. *Environmental Impacts of Transmission Lines*. https://psc.wi.gov/Documents/Brochures/Enviromental%20Impacts%20TL.pdf.

[204] Electric Power Research Institute. 2004. Electromagnetic Interference with Implanted Medical Devices.

[205] Scholten, A., Joosten, S. and Silny, J. 2005. *Unipolar cardiac pacemakers in electromagnetic fields of high voltage overhead lines*. Journal of Medical Engineering & Technology, Vol. 29, 4, pp. 170-175.

excluded. Definitive conclusions about the real risk can be drawn only by conducting additional studies with pacemaker patients.

In the event that a cardiac device is affected, the effect is typically a temporary asynchronous pacing (fixed-rate pacing), and the device returns to its normal operation when the person moves away from the source of the electric field.[206]

5.5.1.5 Stray Voltage

Electrical systems that deliver power to end-users and electrical systems within the end-user's business, home, farm, or other buildings are grounded to the earth for safety and reliability reasons. The grounding of these electrical systems results in a small amount of current flow through the earth.

Stray voltage (also referred to as neutral-to-earth voltage) could arise from neutral currents flowing through the earth via ground rods, pipes, or other conducting objects, or from faulty wiring or faulty grounding of conducting objects in a facility. Thus, stray voltage could exist at any business, house, or farm which uses electricity— independent of whether there is a transmission line nearby.

However, for purposes of stray voltage, transmission lines may not be completely independent of locally distributed electrical service. Where transmission lines parallel distribution lines, they can, in the immediate area of the paralleling, cause current to flow on these lines (additional current, as the distribution lines already carry current). For properly wired and grounded distribution lines and electrical service, these additional currents are of no consequence. However, for distribution lines and electrical services that are not properly wired and grounded, these additional currents could create stray voltage impacts.

5.5.1.6 Induced Voltage

The electric field from a transmission line could extend to a conductive (metal) object in close proximity to the line, such as a vehicle or a fence. This may induce a voltage on the object. The magnitude of this voltage depends on several factors including the object shape, size, orientation, and location along the ROW.

If the objects upon which a voltage is induced are insulated or semi-insulated from the ground and a person touches them, a small current would pass through the person's body to the ground. This might be accompanied by a spark discharge and mild shock, like what could occur when a person walks across a carpet and touches a grounded object or another person. Modern tires provide an electrical path to

[206] Public Service Commission of Wisconsin. 2013. *Environmental Impacts of Transmission Lines*. https://psc.wi.gov/Documents/Brochures/Enviromental%20Impacts%20TL.pdf.

ground because carbon black, a good conductor of electricity, is added when they are produced. Metal parts of farming equipment are frequently in contact with the ground when plowing or engaging in various other activities. Therefore, the induced charge on vehicles will normally be continually flowing to ground unless they have unusually old tires or are parked on dry rock, plastic, or other surfaces that insulate them from the ground.

The primary concern with induced voltage is the current flow (amps) through a person to the ground. Most shocks from induced current are considered more of a nuisance than a danger, but to ensure the safety of persons in proximity to a transmission line, the NESC requires that any discharge be less than 5 milliamps.

5.5.2 Electric and Magnetic Fields (Duluth Loop Reliability Project)

As stated in the overview (5.5.1), electric and magnetic fields are present around any electrical device. Electric fields arise from the voltage or electrical charges while magnetic fields arise from the flow of electricity or current that travels along transmission lines, power collection lines, substation transformers, house wiring, and electrical appliances. EMF is invisible just like radio, television, and cellular phone signals, all of which are part of the electromagnetic spectrum. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through wires.

Electric fields on a transmission line are solely dependent upon the voltage of the line, not the current. Electric-field strength is measured in kilovolts per meter (kV/m), and the strength of an electric field decreases rapidly as the distance from the source increases. Electric fields are easily shielded or weakened by most objects and materials, such as trees or buildings. As discussed in the overview, there is no federal standard for transmission line electric fields., however, the Commission has imposed a maximum electric field limit of 8.0 kV/m measured at one meter (3.28 feet) above the ground.

Magnetic fields are created by the electrical current (measures in amps) moving through a transmission line. The strength of a magnetic field is proportional to the electrical current and is typically measured in mG. As with electric fields, the strength of a magnetic field decreases rapidly as the distance from the source increases. Unlike electric fields, however, magnetic fields are not shielded or weakened by objects or materials. There are presently no Minnesota regulations pertaining to magnetic field exposure.

The Project will be designed to meet or exceed minimum clearance requirements with respect to the NESC. The NESC establishes minimum electrical clearance zones from power lines for the safety of the general public and transmission owners often acquire easement rights that require clear areas in excess of these established zones. Transmission owners may permit encroachment into that easement for buildings and other activities when they can be deemed safe and still meet the NESC minimum

requirements. Metal buildings may have unique issues due to induction concerns. For example, conductive buildings near power lines of 200 kV or greater must be properly grounded.

Impacts and Mitigation

The predicted intensity of electric fields associated with the various structure configurations of the Project are given in **Table 19** for the edge of ROW and at the location where the maximum electric field will be experienced. Where the Project parallels existing transmission lines, the presence of another energized line nearby will impact the electric field profile around the parallel lines.

Table 19. Calculated Electric Field (kV/M) for the Proposed Project[207]

Corridor Configuration	Line Voltage	Edge of ROW	Maximum Overall		
		Intensity (kV/m)	Intensity (kV/m)	Distance from ROW Centerline (feet)	ROW Width (feet)
Project: 115 kV H-Frame Existing: 115 kV H-Frame Existing 115 kV H-Frame	126.5 kV 126.5 kV 126.5 kV	0.76	1.56	99.0	240.0
Project: 115 kV H-Frame Existing: 115 kV H-Frame	126.5 kV 126.5 kV	0.39	1.91	9.0	160.0
Project: 115 kV Monopole Existing: 115 kV Monopole	126.5 kV 126.5 kV	0.47	1.38	37.0	130.0
Project + Existing: 115 kV Double Circuit Monopole	126.5 kV 126.5 kV	0.08	1.07	10.0	100.0
Project + Existing: 115 kV Double Circuit Monopole Existing: 230 kV Monopole	126.5 kV 126.5 kV 253.0 kV	0.49	3.14	58.0	215.0
Project: 230 kV Monopole Existing: 115 kV H-Frame Existing: 115 kV H-Frame	253.0 kV 126.5 kV 126.5 kV	1.28	3.12	75.0	200.0
Project: 230 kV Monopole Existing: 115 kV H-Frame Existing: 115 kV H-Frame Existing: 115 kV Single Pole	253.0 kV 126.5 kV 126.5 kV 126.5 kV	1.28	3.12	125.0	300.0
Project: 230 kV Monopole Existing: 230 kV H-Frame Existing: 230 kV H-Frame	253.0 kV 253.0 kV 253.0 kV	0.88	4.54	26.0	260.0

Therefore, the predicted intensity of electric fields associated with the various corridor scenarios where the Project's new 115 kV or 230 kV line parallels existing transmission lines are also given in **Table 19**.

[207] RPA, at p. 6-10, Table 6-2.

Because electric fields are particularly dependent on the voltage of the transmission line, the values in **Table 19** were calculated at the lines' maximum continuous operating voltage. Maximum continuous operating voltage is defined for the

Project as the nominal voltage plus 10 percent, in this case either 126.5 kV (for nominally 115 kV lines) or 253 kV (for nominally 230 kV lines). Values were calculated assuming minimum conductor-to-ground clearance (that is, at mid-span) and a height of one meter above ground. The maximum calculated electric field among all possible configurations is 1.28 kV/m, which is well within the Commission's 8 kV/m limit.[208]

Graphical representations of the electric field for each corridor configuration in **Table 19** are provided in **Appendix F**.

The predicted intensity of magnetic fields associated with the various structure configurations of the Project are given **Table 20** and **Table 21** for the edge of ROW and at the location where the maximum magnetic field will be experienced. Where the Project parallels existing transmission lines, the presence of another energized line nearby will impact the magnetic field profile around the parallel lines. Therefore, the predicted intensity of magnetic fields associated with the various corridor scenarios where the Project's new 115 kV or 230 kV line parallels existing transmission lines are also given in **Table 20** and **Table 21**. Because magnetic fields are particularly dependent on the current flowing on the transmission line, magnetic field information is provided for two conditions: the maximum continuous rating of the series element of the transmission facility as determined by Minnesota Power's Facility Ratings Methodology. Projected peak loading for the Project and adjacent facilities was derived from power system modeling of the Project under system normal conditions in a 2023 winter peak power flow case. Values were calculated assuming minimum conductor-to-ground clearance (that is, at mid-span) and a height of one meter above ground.

Graphical representations of the magnetic field for each corridor configuration in **Table 20** and **21** are provided in **Appendix F**.

Project and adjacent facilities, shown in **Table 20**, and the projected peak loading of the Project and adjacent facilities when placed into service, shown in **Table 21**. Maximum continuous rating is defined for the Project and adjacent facilities as the maximum allowable current flow based on the most limiting

Out of all the possible transmission line configurations, the maximum possible magnetic field is 378.70 mG with the maximum possible magnetic field at the edge of the ROW calculated at 99.93 mG. However, the actual loading of the transmission line will be far below the thermal limit of the line, resulting in a maximum magnetic field under expected normal system conditions of 16.44 mG at the edge of the ROW, which is well below the magnetic field levels associated with most of the household electric appliances.

[208] RPA, at pp. 6-8 to 6-10.

Table 20. Calculated Magnetic Fields (mG) for Proposed Project Corridors (Maximum Continuous Rating)[209]

Corridor Configuration	Line Current (Amps)	Edge of ROW	Maximum Overall		
		Intensity (mG)	Intensity (mG)	Distance from ROW Centerline (feet)	ROW Width (feet)
Project: 115 kV H-Frame Existing: 115 kV H-Frame Existing 115 kV H-Frame	1443.0	99.93	293.70	33.0	240.0
Project: 115 kV H-Frame Existing: 115 kV H-Frame	1443.0	51.25	370.60	26.0	160.0
Project: 115 kV Monopole Existing: 115 kV Monopole	1443.0	56.07	227.31	19.0	130.0
Project + Existing: 115 kV Double Circuit Monopole	1443.0	24.67	181.40	0.0	100
Project + Existing: 115 kV Double Circuit Monopole Existing: 230 kV Monopole	1443.0	41.01	237.89	47.0	215.0
Project: 230 kV Monopole Existing: 115 kV H-Frame Existing: 115 kV H-Frame	1384.0	87.81	273.07	8.0	200.0
Project: 230 kV Monopole Existing: 115 kV H-Frame Existing: 115 kV H-Frame Existing: 115 kV Single Pole	1384.0	87.39	271.60	58.0	300.0
Project: 230 kV Monopole Existing: 230 kV H-Frame Existing: 230 kV H-Frame	1475.0	88.26	378.70	17.0	260.0

[209] RPA, at p. 6-12, Table 6-4.

Table 21. Calculated Magnetic Fields (mG) for Proposed Project Corridors (Projected Peak Loading)[210]

Corridor Configuration	Line Current (Amps)	Edge of ROW	Maximum Overall		
		Intensity (mG)	Intensity (mG)	Distance from ROW Centerline (feet)	ROW Width (feet)
Project: 115 kV H-Frame Existing: 115 kV H-Frame Existing 115 kV H-Frame	187.26	15.54	37.32	88.0	240.0
Project: 115 kV H-Frame Existing: 115 kV H-Frame	264.07	9.94	65.62	27.0	160.0
Project: 115 kV Monopole Existing: 115 kV Monopole	264.07	10.38	41.37	20.0	130.0
Project + Existing: 115 kV Double Circuit Monopole	198.81	5.65	23.72	5.0	100.0
Project + Existing: 115 kV Double Circuit Monopole Existing: 230 kV Monopole	259.81	7.73	44.91	47.0	215.0
Project: 230 kV Monopole Existing: 115 kV H-Frame Existing: 115 kV H-Frame	276.63	16.44	69.21	4.0	200.0
Project: 230 kV Monopole Existing: 115 kV H-Frame Existing: 115 kV H-Frame Existing: 115 kV Single Pole	276.63	16.42	69.08	54.0	300.0
Project: 230 kV Monopole Existing: 230 kV H-Frame Existing: 230 kV H-Frame	389.33	16.36	84.04	7.0	260.0

[210] RPA, at p. 6-13, Table 6-5.

5.5.3 Air Quality

Minnesota Rule 7849.1500 requires that this environmental report discuss certain pollutants that can be emitted from large electric power facilities. The rule is directed primarily at generating plants that use carbon fuels (natural gas, coal) that have air emissions and that reject waste heat into the environment, typically through cycled water.

Transmission line projects have the potential to impact air quality through temporary, construction-related impacts from vehicle emissions and dust. Operation of transmission lines has the potential to create ozone due to corona discharges which can affect air quality.

The air quality in Minnesota is generally good and, for most pollutants, has been improving. Minnesota has been in compliance with all national ambient air quality standards since 2002. Air quality trends in the Project area mirror those in the state overall, with air quality generally improving over the last several years.[211]

In Minnesota, air quality is tracked using air quality monitoring stations across the State. The MPCA uses data from these monitors to calculate the Air Quality Index (AQI), on an hourly basis, for ozone (O3), particulate matter (PM10/PM2.5), sulfur dioxide (SO2), nitrogen dioxide (NO2), and carbon monoxide (CO). The pollutant with the highest AQI value for a particular hour sets the overall AQI for that hour. The AQI is used to categorize the air quality of a region as one of five levels of quality: good, moderate, unhealthy for sensitive groups (USG), unhealthy, or very unhealthy.[212]

The nearest air quality monitor station to the Project is in Duluth, Minnesota.[213] This station monitors for PM2.5. The AQI for Duluth for the past six years is provided in **Table 22**. Air quality has been considered good for the majority of the past six reported years in Duluth. Since 2015, the largest number of days classified as moderate occurred in 2018. No days have been classified as unhealthy or very unhealthy.

Greenhouse gases (GHG) are compound gases that trap heat or longwave radiation in earth's atmosphere; their presence in the atmosphere makes the earth's surface warmer. Sunlight or shortwave radiation easily passes through these gases and the atmosphere. This radiation is absorbed by the surface of the earth and released as heat or longwave radiation. The molecular structure of GHGs allows them to absorb the heat released and re-emit them back to the earth. This heat-trapping phenomenon is known as the greenhouse effect. The accumulation of GHGs since the industrial revolution has accelerated this greenhouse effect, causing global warming and climate change.[214]

[211] Annual AQI summary reports | Minnesota Pollution Control Agency (state.mn.us).
[212] Annual AQI summary reports | Minnesota Pollution Control Agency (state.mn.us).
[213] Minnesota's air monitoring network | Minnesota Pollution Control Agency (state.mn.us).
[214] https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions - electricity. | US EPA.

Table 22. Days in Each Air Quality Index Category (Duluth, Minnesota)[215]

Year	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy
2020	338	28	0	0	0
2019	342	23	0	0	0
2018	330	30	0	0	0
2017	342	21	0	0	0
2016	343	19	0	0	0
2015	332	22	0	0	0

Source: MPCA, 2021c.

Climate change refers to any significant change in measures of climate lasting for an extended period. Greenhouse gases (GHG) are gaseous emissions that trap heat in the atmosphere. These emissions occur from natural processes and human activities. The most common GHGs emitted from human activities include carbon dioxide, methane, and nitrous oxide. A warming climate is expected to cause increased flooding, storms, and heat wave events. These events, especially an increased number and intensity of storms, could increase risks to the electrical grid, (storms and high winds could damage system components causing outages). More extreme storms also mean more frequent heavy rainfall events. Heat wave events could change demands on the electrical transmission and generation systems, especially as more indoor space is equipped with cooling systems.

In 2019, the electricity sector was the second largest source of U.S. greenhouse gas emissions, accounting for 25 percent of the U.S. total. Greenhouse gas emissions from electricity have decreased by about 12 percent since 1990 due to a shift in generation to lower- and non-emitting sources of electricity generation and an increase in end-use energy efficiency.[216]

Impacts and Mitigation

Potential air quality impacts associated with the transmission project come from two primary sources:

- short-term emissions from construction activities, and
- ozone and nitrogen oxide (NOX) emissions from operating the facility.

Dust will be generated during construction of the transmission line. The amount of dust generated would be a function of construction activity, soil type, soil moisture content, wind speed, precipitation, vehicle traffic, vehicle types, and road surface characteristics. Dust emissions would be greater during dry periods and in areas where fine-textured soils are subject to surface activity.

[215] Annual AQI summary reports | Minnesota Pollution Control Agency (state.mn.us).
[216] Ibid.

Ionization of air molecules surrounding the conductor (corona effect) produces a small amount of ozone and NOX, both of which are reactive compounds that contribute to smog and could adversely affect human and animal respiratory systems, crops, vegetation, and buildings. Because of their detrimental effects, air concentrations of these compounds are regulated by both the EPA and the MPCA. The state of Minnesota has an ozone limit of 0.07 parts per million (ppm) (Minnesota Rules, part 7009.0080), which matches the federal ozone limit of 0.07 ppm (8-hour limit).[217] Because the total emissions of ozone and NOX from operating a transmission line are very small, the transmission project is not expected to create any potential for concentrations of ozone that might exceed these standards. A corona signifies a loss of electricity and transmission line projects are engineered to limit the corona. Design of the transmission line influences its ozone production rate. The production rate decreases significantly as the conductor diameter increases and is greatly reduced for bundled conductors, as proposed here, over single conductors. The production rate of ozone increases with applied voltage, however, the emission of ozone from the operation of a transmission line of the voltages proposed for the Project are not anticipated to have a significant impact on air quality and no mitigation is proposed.

Emissions from operating the proposed line are anticipated to have negligible impacts on air quality. Minor short-term air quality impacts from construction could be mitigated by equipping construction equipment with appropriate mufflers, using a water truck to reduce dust, and promptly reseeding areas of disturbed vegetation. Emissions of dust and PM can also be reduced by reducing the speed of truck traffic on unpaved roads and by covering open-bodied haul trucks.

The transmission system in the Duluth area has historically been supported by several coal-fired baseload generators located along Minnesota's North Shore; these local generators have contributed to the reliability of the transmission system by delivering power to the local area and providing system support. The idling of these generators has led to an increased reliance on the transmission system to deliver replacement power and system support to the Duluth area and along the North Shore. Absent these local generators, the replacement power will be drawn from a mixture of Minnesota Power's generation portfolio. Minnesota Power relies on a mixture of wind, solar, hydro, coal, and biomass to generate power for its customers. In its recent Integrated Resource Plan (IRP),[218] Minnesota Power laid out its clean-energy transition over the next 15 years, reflecting plans to expand wind and solar resources and to achieve coal-free operations at its facilities by 2035.

Total GHG emissions for project construction are estimated to be approximately 9,350 tons of carbon dioxide (CO2). Most emissions are due to the use semi-trucks and trailers and light-duty pickup trucks. Total emissions for the state of Minnesota in 2018 were approximately 161 million tons. Thus, GHG emissions for project construction are anticipated to be an insignificant amount relative to the state's

[217] MPCA. *Ozone standard in Minnesota*. https://www.pca.state.mn.us/air/ozone-standard-minnesota.
[218] Minnesota Power 2021 Integrated Resource Plan, February 1, 2021. Docket No. E015/RP-21-33.

overall annual emissions. Potential impacts due to construction GHG emissions are anticipated to be negligible.

Once operational, the Project will generate minimal GHG emissions. Emissions that do occur would result from vehicle usage to and from the transmission lines and substation for operation/maintenance activities. GHG emissions for Project operation are estimated to be approximately 440 tons of CO2 annually. Potential impacts due to operational GHG emissions are anticipated to be negligible.

Emissions of air pollutants and greenhouse gases can be minimized by keeping vehicles and equipment in good working order, and not running equipment unless necessary.

5.6 Land Based Economies

High voltage transmission lines have the potential to impact land-based economies through introduction of a physical, long-term presence which could prevent or otherwise limit use of the land for other purposes.

5.6.1 Agriculture

The placement of transmission line structures in cultivated cropland has the potential to interfere with farming operations which may negatively impact farm income. Activities associated with construction could impact farmland through soil compaction and rutting, accelerated soil erosion, crop damage, temporary disruption to normal farming activities, and introduction of noxious weeds to the soil surface.

The United States Department of Agriculture (USDA) 2017 Census of Agriculture for St. Louis County states 779 farms in the county with an average size of 178 acres per farm. Approximately 138,753 acres of farmland exist in the county. Over $16 million was generated from crop and livestock sales in 2017 (USDA 2017).
There is no prime farmland within the proposed route or proposed substation expansions. There is approximately 60.3 acres and 576.5 acres of Farmland of Statewide Importance within the proposed 230 kV route and the proposed 115 kV route, respectively. There is about eight acres and 34.3 acres of Farmland of Statewide Importance within the proposed 230 kV ROW and the proposed 115 kV ROW, respectively. There is approximately 3.3 acres of Farmland of Statewide Importance within the proposed Ridgeview and Hilltop substation expansions.

Figure 9 illustrates the land cover overlapping the Project area; **Tables 12**, **13**, and **14** provide the values for cultivated crop acres along the proposed route and associated ROW.

Impacts and Mitigation

The foremost means of minimizing the potential impacts of transmission lines on agricultural operations is through routing; predominately by following existing linear features, such as transmission lines, roads, and property lines (avoiding greenfield crossings of agricultural fields). Permanent impacts to agricultural land will occur where structures are placed in cultivated fields. Structures in cultivated fields act as barriers and can hinder efficient operation of large machinery.

The proposed route crosses minimal land currently used for agricultural purposes (**Table 15**), since no impacts to agricultural land are anticipated, no mitigation is proposed.

5.6.2 Forestry

High voltage transmission lines if sited on or routed through land used for forest production would limit the continued use of that land for the life of the Project.

While one of the major industries in St. Louis County is paper products and timber, there are no commercial forestry activities within the proposed route. Much of St. Louis County is made up of densely forested land; forested areas within the proposed route are shown in **Figure 9**. Approximately 750 acres of forested land is within the proposed route (**Tables 12**, **13**, and **14**). Forested land within the proposed route has traditionally been used for timber in sawmills and for personal use as a heating source.

There are no tree farms, timber plots, or other commercial forestry operations within the proposed route.

Impacts and Mitigation

Because there are no known commercial forestry operations in the vicinity of the proposed route, there are no anticipated impacts to commercial forestry operations and therefore no mitigation is proposed.

5.6.3 Mining

Mineral resources are resources that have a concentration or occurrence of natural, solid, inorganic, or fossilized organic material in such form, quantity, grade, and quality that it has reasonable prospects for commercial extraction.

Existing mines could be negatively impacted by high voltage transmission lines if sited on or routed through land used for mineral production/extraction by interfering with access to minerals or the ability to remove them.

Impacts and Mitigation

There are no known active gravel pits or other mining activity in the vicinity of the Project.[219]

[219] MNDOTs Aggregate Source Information System (ASIS) data and County Pit Map. Aggregate Sources (state.mn.us).

As no impacts on mining are anticipated, no mitigation is proposed.

5.6.4 Recreation and Tourism

High voltage transmission lines have the potential to impact public use and enjoyment of the area's recreational and tourism opportunities, both short term and long term. In the short term by increases in noise, dust, and impeding public access during construction. Long term through the introduction of a physical, permanent presence which could negatively impact aesthetics or otherwise limit use of the land.

Common recreational activities within St. Louis County include hunting, biking, hiking, snowmobiling, cross-county skiing, fishing, and camping. Tourism in the Project area centers around outdoor recreational opportunities and various community festivals and events.

There are several public trails, parks, rivers, and lakes, that are within a few miles of the Project and serve as focal points for recreation and tourism (**Figure 10**).

The Snowflake Nordic Ski Center is a full-service cross country skiing facility, offering a spacious, warm chalet with a waxing room, rentals, and over 13 kilometers of expertly groomed trails.[220] The Center and associated property is located on the northeast side of Rice Lake Road, along the southside of the existing 19 Line and new 52 Line (**Appendix B, plate 2**). Other trails that are intersected by the proposed route include the Hermantown Missing Link Trail and the Rocky Run Trail.

Hermantown Central Park (Fichtner Field) lies within the proposed route (**Appendix B, plate 10**). Fichtner Field and Park lie in the heart of the Hermantown, at the intersection of Maple Grove and Ugstad. Besides the baseball fields, there is a park pavilion at this location that can be reserved for family events and group activities.[221]

The Chester Creek Aquatic Management Area (AMA) is made up of four subunits that were acquired in 2010 (**Figure 10**). Subunits 1 and 2 are located approximately 0.3 miles from the northwest boundary of the proposed route. Subunit 1 is a 1.54-acre area directly adjacent to the south side of Norton Road. Subunit 2 is a 2.83-acre area located approximately 415 feet south of Norton Road.[222] Angling is the only allowable use in Chester Creek AMA and Chester Creek is a designated trout stream.

The Miller Creek AMA is made up of 7 subunits, but only subunit 1 is located near the proposed route (**Figure 10**). Subunit 1 is a 10.75-acre area located approximately 0.4 miles west of the Swan Lake Road

[220] Snowflake Nordic Ski Center – Healthy Outdoor Sports (skiduluth.com).
[221] Parks & Recreation - City of Hermantown (hermantownmn.com).
[222] Duluth Streams - chester creek (lakesuperiorstreams.org).

Substation.[223] Miller Creek AMA was acquired in 1966 and the only allowable use is angling. Miller Creek is a designated trout stream.

The Midway River AMA is made up of six subunits, but only subunit 1 is near the proposed route (**Appendix B, plate 14**). Subunit 1 is a 9.96-acre area located approximately 0.25 miles from west boundary of the proposed route and 0.40 miles south of Hermantown Road. Midway River AMA was acquired in 1966 and the only allowable use is angling. Midway River is a designated trout stream.

Impacts and Mitigation

Construction and operation of the transmission line will not impact public participation in the regional community cultural events or recreational activities.

The new transmission line will be parallel to the existing transmission line through the Hermantown Central Park (Fichtner Field) and Snowflake Nordic Ski Center, reducing the overall ROW width needed for two separate lines and thereby minimizing the visual impacts from park users. Park and Ski Center users will have temporary restricted access during construction; signs informing the public of construction in the area and the restricted access will be posted.

Construction activities such as tree clearing, lighting and noise from heavy construction equipment may temporarily disturb nearby wildlife and habitat. Permanent disturbance is anticipated to be minimal with implementation of BMPs, however, incremental impacts are expected to be concentrated to areas of new construction where tree clearing will be most prominent.

Changes in the riparian areas (the land adjacent to a stream) that will require stream crossing can impact trout and the many other fish, insects, and organisms found in streams. Riparian area are zones of transition between aquatic and terrestrial ecosystems in which the terrestrial ecosystem influences the aquatic ecosystem and vice-versa. Riparian areas are ecologically and socially significant in their effects on water quality and quantity, as well as aesthetics, habitat, bank stability, timber production, and their contribution to overall biodiversity.[224]

Trout need cold water, gravel streambeds and shelter from predators. Healthy riparian areas minimize fluctuations in water temperature, reduce sediment washing into the stream, and help control water flows in streams.[225] The proposed 115 kV transmission line and underground fiber optic line would cross MDNR Public Waters; therefore, the permittee would be required to obtain licenses from the MDNR and to comply with the conditions therein. The Applicant has stated that they will work with the MDNR to

[223] Duluth Streams - Miller Creek (lakesuperiorstreams.org).
[224] RiparianZoneMgmt-TroutStreams_64164_7.pdf (inghamdrains.org).
[225] RiparianZoneMgmt-TroutStreams_64164_7.pdf (inghamdrains.org).

obtain these licenses once a route is approved, and sufficient engineering work is completed to support the application process.[226]

The Applicant has also stated that they will coordinate with the MDNR, USFWS, Hermantown Parks and Recreation Department, and Duluth Parks and Recreation Department to ensure construction of the proposed route will not cause any significant impacts to the area's recreation and tourism opportunities.[227]

5.7 Archaeological and Historic Resources

Cultural resources, including archaeological and historic artifacts and features, contribute to the record of human occupation and alteration of the landscape. Archaeological resources include historic and prehistoric artifacts, structural ruins or earthworks and are often partially or completely below ground. Historic resources include extant structures, such as building and bridges, as well as districts and landscapes.

Construction and operation of high voltage transmission lines has the potential to impact archaeological and historic resources. Archaeological resources could be impacted by the disruption or removal of subsurface archaeological materials, structural remains, or earthworks during construction. Historic architectural resources may be impacted by the siting and routing facilities within the established viewshed of an historic property, which could affect the integrity of the viewshed in a way that decreases the historic value of the resource.

In Minnesota, there are three primary laws regarding the protection of archaeological and historic resources:

- **Minnesota Historic Sites Act.** This act establishes the State Historic Sites Network and the State Register of Historic Places and requires that state agencies consult with the Minnesota Historical Society before undertaking or licensing projects that may affect properties on the network or on the State or National Registers of Historic Places (Minnesota Statutes, section 138.661-138.669).

- **Minnesota Field Archaeology Act.** This act establishes the office of the State Archaeologist; requires licenses to engage in archaeology on nonfederal public land; establishes ownership, custody and use of objects and data recovered during survey; and requires state agencies to submit development plans to the State Archaeologist, the Minnesota Historical Society and the Minnesota Indian Affairs Council for review when there are known or suspected archaeological sites in the area (Minnesota Statutes, section 138.31-138.42).

[226] RPA, at p. 9-3.
[227] RPA, at p. 7-13.

- **Minnesota Private Cemeteries Act.** A portion of this legislation protects all human burials or skeletal remains on public or private land (Minnesota Statutes, section 307.08).

At a federal level, compliance with Section 106 of the National Historic Preservation Act (NHPA) is required for all projects under federal jurisdiction. The purpose of Section 106 is to compel federal agencies to consider the effects of a project on archaeological and historic resources and applies to resources that are listed on, or eligible for listing on the National Register of Historic Places (NRHP). However, at this time, no National Environmental Policy Act (NEPA) or federal Section 106 nexus has been identified for this Project.

The following subsections present an overview of previously recorded archaeological and historic architectural resources in and within one mile of the Project and discuss how the Project may affect these cultural resources and what measures are available to mitigate identified potential impacts.

5.7.1 Previously Recorded Archaeological and Historic Architectural Resources

The Applicants conducted background research on known cultural resources; data regarding known cultural resources information resulting from previous professional cultural resources surveys and reported archaeological sites and historic architectural resources were received from the various agencies and reviewed. This work employed the expertise of consultants (HDR Engineering, Inc.) doing Phase 1a and Phase 1 cultural resource surveys. These studies were used to identify types of archaeological sites that may be encountered and landforms or geographic features that have a higher potential for containing significant cultural resources. The results of the Phase Ia literature reviews and the Phase I surveys are summarized below.

The archaeological and historic architectural resources review extended to within one mile of the Project and within the route's width (**Table 23**).[228]

The Phase Ia Literature Search identified six previously recorded archaeological sites and two historic cemeteries (unrecorded) within a 1-mile buffer of the proposed route.[229] Only one of the archaeological sites, the Getchell Homestead, is in the vicinity (approximately 160 feet east) of the proposed route. Additionally, the recorded historic boundaries of the Sunrise Memorial Cemetery and Hermantown Cemetery overlap the proposed route. None of the archaeological sites or cemeteries have been formally evaluated for the NRHP.

[228] RPA, at p. 7-16 to 7-18, and Appendix H.
[229] Ibid.

Consultation with the Fond du Lac Band of the Lake Superior Chippewa's THPO, identified two areas of concern regarding cultural resources near the proposed route alternatives.[230] One area is Mogie Lake, considered a wild rice lake by the THPO, that is about 400 feet north the proposed route (**Appendix B, plates 18 and 19**). The second area is a historic trail called the *Rice Lake Trail* that led from Lake Superior, through Chief Buffalo's Tract, and northward to Wild Rice Lake (**Appendix B, plate 2**). The proposed route crosses this historic trail near the existing Line 19 and Line 56 intersect.

Table 23. Summary of Previously Recorded Archaeological and Historic Architectural Resources[231]

Cultural Resource Types	Total Within 1 mile of Proposed Route	Number that Overlaps or in Vicinity of Proposed Route	Total NRHP-Eligible or Listed
Archaeological Sites	6	1 (vicinity)	0
Historic Cemeteries	1	2 (overlaps)	0
Ethnographic Study Place Names	1	0	0
Fond du Lac THPO-Identified Resources	2	2 (1 vicinity, 1 overlaps),	0
Historic Architectural Resources	70	1 (overlaps)	1 (does not overlap)

The Phase Ia Literature Search identified 35 historic architectural resources (SHPO- inventoried properties), 32 Works Progress Administration (WPA) era homes that have not been formally inventoried, and three linear resources (Trunk Highway 53; Trunk Highway 61 - West Duluth bypassed segment; and Skyline Parkway District's *Western Extension Segment*) within a 1-mile ROI of the proposed route.[232] Only the Trunk Highway 53 intersects the proposed route. The Skyline Parkway District's *Western Extension Segment* is listed in the NRHP and four of the historic architectural resources associated with the district have been determined non- contributing resources. Additionally, one other historic architectural resource has been determined not eligible for the NRHP. None of the other 30 historic architectural or two linear resources have been formally evaluated for the NRHP.

Impacts and Mitigation

The proposed route crosses the historic boundaries of the Sunrise Memorial Cemetery and the Hermantown Cemetery. The proposed route crosses the current boundary of the Hermantown Cemetery. However, the current boundary of the Sunrise Memorial Cemetery is located beyond the proposed route. The proposed 115 kV transmission line will avoid the Hermantown Cemetery and is parallel to an existing transmission line that is located east of the Hermantown Cemetery. The proposed route will span Trunk

[230] RPA, at Appendix M, Notes from April 9, 2021, meeting.
[231] Ibid, Table 7-7.
[232] RPA, at p. 7-16 to 7-18, and Appendix H.

Highway 53 (Miller Trunk Highway) that is listed as a historic linear feature, parallel to an existing transmission line. The archaeological site, Getchell Homestead, is located beyond the proposed route.

Fond du Lac Band of the Lake Superior Chippewa THPO stated that the Rice Lake Trail is most likely not present, however if construction identifies a historic trail in this area, Minnesota Power has stated that they will notify the THPO.[233] No impacts to Mogie Lake are anticipated as the new line is proposed to be double-circuited with the existing 71 Line and construction is planned to remain on the existing 71 Line ROW.

Findings from the *Phase Ia Cultural Resources Literature Search* shows that 17 previously recorded archaeological sites are within the one-mile ROI. One of the 17 previously recorded archaeological sites is within the proposed route. The fact that sites do exist near and within one mile of the Project gives an indication that yet unrecorded precontact use sites may be within a proposed route.[234]

HDR recommended a thorough field review of a proposed route should be conducted for potential archaeological and historic properties that the Project could adversely affect, either directly or indirectly, within the APE, unless they can be shown to have been adequately reviewed under previous surveys. Any historic property identified within the APE should be evaluated by looking at it within historic contexts as defined, described and developed by the SHPO. Appropriate prehistoric contexts should be used for any precontact archaeological site. For historic-era properties, some contexts might include, among others:[235]

- Minnesota's Iron Ore Industry, 1880s-1945
- Northern Minnesota Lumbering, 1870-1930s
- Railroads and Agricultural Development, 1870-1945
- Shipping, 1870-1940
- The Fur Trade Around Western Lake Superior, 1650-1840
- Early Settlement, pre-1870
- Industry and Commerce, 1870-1940
- Community Institutions, 1870-1940
- Neighborhoods, 1870-1940
- Minnesota Farms 1820-1960

Continuing, HDR stated that it is unknown if any portions of the original trails and roads identified still exist or what condition they may be in. If they can be identified by a field visit, a review of their integrity by a professional historian is warranted.[236]

[233] RPA, at Appendix M, Notes from April 9, 2021, meeting.
[234] RPA, at p. 7-16 to 7-18, and Appendix H.
[235] RPA, at p. 7-16 to 7-18, and Appendix H.
[236] RPA, at p. 7-16 to 7-18, and Appendix H.

Minnesota Power has stated that they will consult with SHPO to develop a field review strategy of the proposed route to survey for potential archaeological and historic properties that the Project could adversely affect.[237]

5.8 Natural Environment

Construction and operation of high voltage transmission lines has the potential to impact the natural environment. These impacts are dependent upon many factors, such as the type of facility and how it is designed, constructed, and maintained. Other factors such as the environmental setting must also be considered. Impacts can and do vary significantly both within, and across, projects.

5.8.1 Surface Waters

Transmission line projects have the potential to impact water resources and floodplains. These projects could directly impact water resources and floodplains if these features cannot be avoided through project design. Indirectly, these projects have the potential to adversely impact surface waters though construction activities which move, remove, or otherwise handle vegetative cover and soils. Changes in vegetative cover and soils can change runoff and water flow patterns.

Public Waters are wetlands, water basins, and watercourses of significant recreational or natural resource value in Minnesota as defined in Minnesota Statutes Section 103G.005. The MDNR has regulatory jurisdiction over these waters, which are identified on the MDNR Public Waters Inventory (PWI) maps. In addition to Public Waters, certain surface waters in Minnesota are designated as trout streams or lakes by the State of Minnesota, according to Minn. Stat. § 6264.0050 which are considered Public Waters and are regulated by the MDNR.

Watercourses (rivers, streams, creeks, and drain ditches) are surface water features that consist structurally of a bed and bank, which creates a channel which can have both flowing and non-flowing water or may be dry depending on the time of year and recent precipitation events. Generally, watercourses have permanent inundation, which are fed by surface and/or ground water sources.

Water bodies (lakes, ponds, and larger wetlands) are characterized by a distinct basin area comprising the extent of the feature, and there is not a noticeable flow of water or channel through the water body. Water bodies are generally permanently inundated but may include areas of exposed substrate when the necessary hydrology to maintain inundation is lacking.

[237] RPA, at p. 7-16 to 7-18

There are several federal and state laws that regulate watercourses and water bodies. The Clean Water Act (CWA) establishes the structure for regulating the discharge of materials into waters of the United States and for developing water quality standards for surface waters (33 U.S.C. 1344 and 1311et seq). The CWA could potentially regulate several types of activities and their impacts associated with these large projects.

Under Section 303(d) of the Clean Water Act, states are required to assess all waters of the state to determine if they meet water quality standards, list waters that do not meet standards and update the list biannually and conduct total maximum daily load studies to set pollutant-reduction goals needed to restore waters to the extent that they meet water quality standards for designated uses. The list, known as the 303(d) list, is based on violations of water quality standards. The MPCA has jurisdiction over determining 303(d) waters in the State of Minnesota. Section 303(D) of the CWA requires states to publish every two years a list of streams and lakes that are not meeting their designated uses, because of excess pollutants (impaired waters). The list is based on violations of water quality standards. In Minnesota, the MPCA has jurisdiction over determining 303(d) waters. These waters are described as "impaired".

Watercourses and water bodies may be regulated under both Section 10 of the Rivers and Harbors Act (33 U.S.C. 401 et seq.) and Section 404 of the CWA (33 U.S.C. 1344). The Rivers and Harbors Act regulates activities such as excavating and dredging in, placing structures and materials on, or altering the course of Section 10-designated waterways (33 U.S.C. 403). Section 404 of the CWA prohibits discharge of dredged or fill materials without a permit. It extends to more waterbodies than the Rivers and Harbors Act, namely all waters of the United States, including navigable waters, interstate waters and wetlands (33 CFR 320.1(d); 33 CFR 328.3). The U.S. Army Corps of Engineers (USACE) holds both Section 10 and Section 404 permitting authority.

Many activities regulated under either Section 10 or Section 404 must obtain a state Section 401 water quality certification to ensure that the project would comply with state water quality standards. Section 401 of the CWA is administered by the EPA; in Minnesota, the EPA has delegated Section 401 certification to MPCA.

When stormwater drains off a construction site, it carries sediment and other pollutants that can harm nearby surface waters. The federal government requires National Pollutant Discharge Elimination System (NPDES) permit coverage of construction sites that disturb one or more acres. The NPDES Stormwater Program is a comprehensive national program for addressing polluted runoff. In Minnesota, the Minnesota Pollution Control Agency (MPCA) administers this federal program as well as the related State Disposal System (SDS) permit program. The states combined NPDES/SDS construction stormwater permit fulfills federal and state requirements by requiring permittees to control runoff. Regulated parties must develop a complete and accurate Stormwater Pollution Prevention Plan (SWPPP) as part of the NPDES/SDS program.

Floodplains are flat, or nearly flat, land adjacent to a river or stream that experiences occasional or periodic flooding. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which includes areas covered by the flood, but which do not experience a strong current. Floodplains prevent flood damage by detaining debris, sediment, water, and ice. The Federal Emergency Management Agency (FEMA) delineates floodplains and determines flood risks in areas susceptible to flooding. The base flood that FEMA uses, known as the 100-year flood, has a one percent chance of occurring during each year.

At the state level, the DNR oversees the administration of the state floodplain management program by promoting and ensuring sound land use development in floodplain areas in order to promote the health and safety of the public, minimize loss of life, and reduce economic losses caused by flood damages. The DNR also oversees the national flood insurance program for the state of Minnesota. Floodplains are also regulated at the local level.

Hydrologic features located within the proposed route, include wetlands, lakes, rivers and floodplains; these features perform several important functions within a landscape, including flood attenuation, groundwater recharge, water quality protection and wildlife habitat production (**Figure 11**). The proposed Project lies within the St. Louis River watershed, in the southern portion of the Great Lakes Basin.

No streams are located within the proposed 230 kV Route (**Figure 11**). The proposed 115 kV transmission line crosses a total of eight river and stream features, with some features being crossed multiple times for a total of 31 crossings, 12 of the crossings would be new crossings (**Table 24**) and 19 of the crossings would occur at existing crossing locations along either rebuilt or double circuit segments of the Project (**Table 25**). Six existing crossings of the Midway River and four crossings of other unnamed stream features would be removed because of the Project. The Project would also result in three existing crossings of Rocky Run and one existing crossing of an unnamed stream being buried as part of other upgrades associated with the Project.

The proposed transmission line crosses eight MDNR public waterways, all of which are designated trout streams (**Figure 11** and **Table 24** and **Table 25**). In addition to mapped designated trout streams, the MDNR provided the Applicant with point locations of unmapped trout stream tributaries within the proposed route.

Mogie Lake is the only lake located near the proposed route; it is a MDNR Public Water Basin and is located approximately 800 feet north of the proposed 71 Line / 176 Line double-circuit 115 kV transmission line, near the intersection of Lavaque Road and Youngdahl Road (**Figure 11** and **Appendix B, plates 18** and **19**). The MDNR does not list Mogie Lake as a wild rice lake, however the Fond du Lac Band of the Lake Superior Chippewa THPO considers it a wild rice lake.

Table 24. New River and Stream Crossings by the Proposed 115 kV Transmission Line[238]

MDNR Hydro ID Number	Feature Name	Number of Crossings	MDNR PWI Water	Designated Trout Stream	Appendix B Plate Number
113455	Chester Creek East Branch	2	Yes	Yes	1
113446	Chester Creek	2	Yes	Yes	3
111728	Miller Creek	1	Yes	Yes	5
111740	Unnamed Stream	5	Yes	Yes	4 and 5
111906	Midway River	1	Yes	Yes	14
111972	Unnamed Stream	1	Yes	Yes	16

Table 25. Existing River and Stream Crossings to be Rebuilt of Double Circuited Proposed 115 kV Transmission Line[239]

MDNR Hydro ID Number	Feature Name	Number of Crossings	MDNR PWI Water	Designated Trout Stream	Appendix B Plate Number
113455	Chester Creek East Branch	1	Yes	Yes	1
113446	Chester Creek	1	Yes	Yes	3
111728	Miller Creek	1	Yes	Yes	5
111740	Unnamed Stream	10	Yes	Yes	4 and 5
111978	Unnamed Stream	4	Yes	Yes	10
111763	Kingsbury Creek	1	Yes	Yes	17
111972	Unnamed Stream	1	Yes	Yes	16

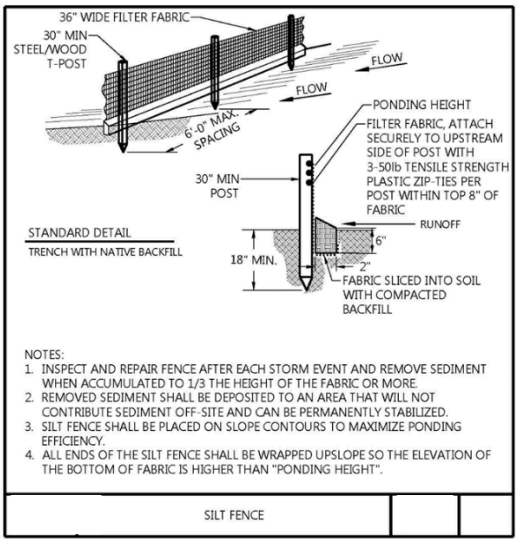
The proposed 115 kV route crosses two impaired streams, Miller Creek and Kingsbury Creek (**Figure 11**). There are no impaired streams within the proposed 230 kV route. Both streams are listed as having an impaired designated use of aquatic life and recreation.

Impacts and Mitigation

When stormwater drains off a construction site, it carries sediment and other pollutants that can harm nearby surface waters. If the Commission issues the requested permit (HVTL Route Permit) for the Project, the Permittee would be required to obtain a MPCA construction stormwater permit/SWPPP for the Project prior to construction (**Appendix C**). The Applicant has stated that they will apply for authorization to discharge stormwater associated with construction activity under the MPCA NPDES/SDS Construction Stormwater General permit (MNR100001). The SWPPP must include a description of all erosion prevention and sediment control BMPs (silt fencing/erosion control devices [**Diagram 8**], revegetation plans, and management of exposed soils, etc.) to be utilized on the site to control sediment and other pollutant discharges from the site.[240]

[238] RPA, at p. 7-22, Table 7-7.
[239] RPA, at p. 7-22, Table 7-8.
[240] Guidance for construction stormwater, Guidance for construction stormwater | Minnesota Pollution Control Agency (state.mn.us).

Diagram 8. Silt Fencing



Additionally, no fueling or maintenance of vehicles or application of herbicides would occur within 100 feet of streams, ditches, and waterways to protect against introduction of these materials into surface or groundwater systems. Materials such as fuels, lubricants, paints, and solvents required for construction would be stored away from surface water resources according to appropriate regulatory standards. Any spills or leaks would be cleaned up immediately and leaking equipment removed from the area for proper maintenance. In the area of impaired waters, the Project will implement BMPs in accordance with section 23.1 of MNR100001 which defines additional requirements for discharges to special (Prohibited, Restricted, Other) and impaired waters.

Because the proposed route does not span Mogie Lake, there are no anticipated impacts to lakes. Aside from construction stormwater discharge BMPs, no additional mitigation is proposed.

The proposed transmission line crosses eight trout streams, for a total of 31 different crossings, due to the sinuous nature of the streams (**Table 24** and **Table 25**). The Midway River would be spanned at a new location in a more perpendicular orientation. The existing 57 Line will be relocated away from the Midway River, where it parallels the river for approximately 0.4-miles (**Appendix B, plates 13** and **14**). The proposed 115 kV Route span of the Midway River will result in improved condition for the river as the removed existing 57 Line ROW revegetates.

The other proposed stream crossings are either parallel, rebuild, or double circuit to existing transmission lines. Additional clearing will be necessary for the parallel crossings; however, the new line will share (overlap) the ROW of the existing line, therefore reducing the overall cleared ROW that would be necessary if not for the overlapping of ROWs (from two separate 100-foot-wide rights-of-ways (200-foot-wide) to a combined 160-foot-wide ROW).

Trout rely on cold water habitat, therefore clearing of trees along MDNR designated trout streams and their tributaries may result in adverse warming of the stream water. Shade provided by trees and shrubs is important to minimize thermal impacts to trout streams. The Applicant has stated that they will work with the MDNR, through the obtaining of licenses to cross Public Waters. Through the license approval process, the MDNR will determine the appropriate mitigation measures for Public Water crossings, including trout streams. These mitigation measure may include restrictions (vegetation buffer zones, special clearing setbacks, hand-clearing methods, and leaving woody vegetation rootstocks in place) and construction exclusion dates.

Through the NPDES permitting process the Project will be required to comply with Section 23.1 of MNR100001 which includes designated trout streams within the definition of special waters. Best management practices such as redundant perimeter controls and the stabilization of exposed soils immediately upon completion of work within the 75-foot buffer would be implemented to minimize erosion near MDNR designated trout streams.

On June 18, 2021, the Applicant was informed of a potential project to re-meander Miller Creek by the South St. Louis County Soil and Water Conservation District (SWCD). This Miller Creek re-meander project crosses Minnesota Power's existing 52 Line ROW (**Appendix B, plate 6**). The Applicant has stated that they will continue to work with the SWCD on their proposed Miller Creek re-meander project and issues relative to the proposed Project.[241]

5.8.2 Wetlands

Construction and operation of high voltage transmission lines has the potential to impact wetlands. Wetlands are areas with hydric (wetland) soils, hydrophilic (water-loving) vegetation, and wetland hydrology (inundated or saturated during much of the growing season). Wetland types include marshes, swamps, bogs, and fens. Wetlands vary widely due to differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors.[242]

Wetlands are important to the health of waterways and communities that are downstream. Wetlands can be one source of hydrology in downstream watercourses and water bodies, detain floodwaters, recharge groundwater supplies, remove pollution, and provide fish and wildlife habitat. Wetland health also has economic impacts because of their key role in fishing, hunting, agriculture, and recreation.

These large infrastructure projects could temporarily or permanently impact wetlands if these features cannot be avoided through project design. During construction, temporary disturbance of soils and vegetative cover could cause sediment to reach wetlands which could in turn affect wetland functionality.

[241] RPA, at p. 7-23.
[242] EPA. Wetlands - Wetland Types. https://www.epa.gov/wetlands/classification-and-types-wetlands#marshes.

If permanent facilities or impervious surfaces are placed in wetlands this would result in a total loss of wetland functionality and potentially affect water resources downstream.

The Minnesota Wetland Inventory (MWI) is a publicly available GIS database that provides information on the location and characteristics of wetlands in Minnesota. The inventory is a 2008 update of the USFWS National Wetlands Inventory (NWI) that was completed for Minnesota in the 1980s. Wetlands listed on the MWI may be inconsistent with local wetland conditions; however, the MWI is the most accurate and readily available database of wetland resources within the Project area and were used for desk-top identification of wetlands along the proposed route.

Wetland types within the MWI are classified using the cowardin wetland habitat classification system.[243] The cowardin classification system is hierarchical and defines wetland habitats based on vegetative and sediment class along with water regime. Approximately two acres of wetlands are located within the proposed 230 kV route and no wetlands are located with the proposed 230 kV ROW (**Figure 11**). Approximately 391.6 acres of wetlands occur within the proposed 115 kV route with approximately 50.6 acres of wetland within the proposed 115 kV ROW (combined existing and new ROWs, **Table 26** and **Table 27,** and **Figure 11**). Eight wetland habitat types/type combinations are mapped as occurring within the proposed route: palustrine emergent (PEM), palustrine forested (PFO), palustrine scrub/shrub (PSS), palustrine unconsolidated bottom (PUB), and riverine. PEM wetlands are habitats dominated by emergent herbaceous plant species. PFO wetlands are habitats dominated by woody tree species. PSS wetlands are habitats dominated by woody shrub species. PUB wetlands are associated with ponds, less than 20 acres in size and have less than 30 percent vegetative cover.

Impacts and Mitigation

Both permanent and temporary impacts to wetlands would result from construction of the Project. Permanent fill impacts would constitute the placement of permanent fill material within the wetland area, such as the placement of a transmission line structure or grading work associated with the expansion of the Hilltop and Ridgeview substations.

Permanent conversion impacts would constitute the clearing of forested wetlands within the ROW where these resources would not be allowed to revegetate to a forested wetland due to safety requirements but would be managed to be either emergent or shrub wetlands. It is estimated that 7.6 acres of permanent conversion impacts to forested, forested/emergent, and forested/shrub wetlands would be converted to either emergent or shrub wetlands within the existing and new ROW (**Table 28**).

Temporary fill impacts to wetlands would occur in the form of the placement of temporary construction matting along access routes, transmission line structure work areas, and wire pull sites. No anticipated impacts from the Proposed 230 kV transmission line, since no MWI mapped wetland are located within

[243] Cowardin, Lewis M.; Golet, Francis C. (1995-06-01).US Fish and Wildlife Service 1979 wetland classification ISSN0042-3106.

Table 26. MWI Wetlands within the Proposed Route[244]

Wetland Type	Wetland within Proposed 230 kV Route (acres)	Wetland within Proposed 115 kV Route (acres)
Freshwater Emergent Wetland	1.7	101.7
Freshwater Forested Wetland	0	79.5
Freshwater Pond	0.1	2.3
Freshwater Shrub Wetland	0	129.4
Freshwater Forested/Emergent Wetland	0	12.4
Freshwater Forested/Shrub Wetland	0	34.8
Freshwater Shrub/Emergent Wetland	0.2	29.3
Riverine	0	1.6
Total	**2.0**	**391.6**

Table 27. MWI Wetlands within the Proposed 115 kV Transmission Line Right-of-Way [245]

Wetland Type	Wetland within Proposed Right-of-Way (existing and new) (acres)	Wetland within Proposed Right-of-Way (New) (acres)
Freshwater Emergent Wetland	30.2	2.1
Freshwater Forested Wetland	4.8	1.8
Freshwater Pond	0.4	0.1
Freshwater Shrub Wetland	8.0	4.2
Freshwater Forested/Emergent Wetland	0.9	0
Freshwater Forested/Shrub Wetland	1.9	0
Freshwater Shrub/Emergent Wetland	4.4	1.2
Riverine	0.08	0.03
Total	**50.6**	**9.5**

the Proposed 230 kV Route. Approximately 0.55 acres of permanent fill would result from construction of the proposed 115 kV transmission line. Of this permanent fill, about 2,373 square feet (0.05 acres) is associated with the placement of transmission line structures within wetland areas, approximately 0.03 acres of permanent impacts of fill would occur as a result of expansion of the Hilltop Substation, and about 0.47 acres of permanent fill would occur as a result of expansion of Ridgeview Substation (**Table 28** and

[244] RPA, at p. 7-24, Table 7-10.
[245] RPA, at p. 7-52, Table 7-11.

Table 29). A total of 26.6 acres of temporary impacts would occur as a result of the proposed 115 kV transmission line (**Table 28**).

Table 28. Proposed 115 kV Transmission Line Wetland Impacts [246]

MWI Wetland Type	Permanent Fill Transmission Structure Placement[1]	Permanent Conversion Impacts[2]	Temporary Fill[3]
Freshwater Emergent Wetland	1,528 sq. ft.	0	14.5 acres
Freshwater Forested Wetland	331 sq. ft.	7.60 acres	3.4 acres
Freshwater Pond	0	0	0.1 acres
Freshwater Shrub Wetland	379 sq. ft.	0	4.9 acres
Freshwater Forested/ Emergent Wetland	0	0	0.3 acres
Freshwater Forested/Shrub Wetland	0	0	2.1 acres
Freshwater Shrub/Emergent Wetland	135 sq. ft.	0	1.2 acres
Riverine	0		0.07 acres
Total	**2,373 sq. ft.**	**7.60 acres**	**26.6 acres**

1-Permanent structure placement includes both H-Frame structure placement (56.5 sq. ft. per structure) and Monopole Structure Placement (78.5 sq. ft. per structure)
2-Permanent conversion impacts assumes that all forested, forested/emergent, and forested/shrub wetlands would be cleared and converted to either emergent or shrub wetlands within the existing and new right-of-way.
3-Temporary fill impacts include access routes (30-foot-wide travel path along the proposed centerline of the project), structure work areas (100-foot by 100-foot per structure), and wire stringing areas (approximately 0.66 acres per location).

Table 29. Proposed Substation Expansion Wetland Impacts [247]

Impact Type	MWI Wetland Type	Impact Amount
Ridgeview Substation Expansion Permanent Fill	Freshwater Emergent Wetland	0.47 acres
Hilltop Substation Expansion Permanent Fill	Freshwater Emergent Wetland	0.03 acres

Wetland impact avoidance measures that may be implemented during design and construction of the Project includes spacing and placing the transmission structures at variable distances to span and avoid wetlands, where practical. When it is not practical to span the wetland, several measures can be utilized to minimize impacts during construction:

- When possible, construction will be scheduled during frozen ground conditions.
- When construction during winter is not possible, construction mats (e.g., wooden mats and/or a

[246] RPA, at p. 7-26, Table 7-12.
[247] RPA, at p. 7-26, Table 7-13.

composite matting system) will be used to protect wetlands. Additionally, all-terrain construction vehicles may be used, which are designed to minimize impact to soils in damp areas.
- Construction crews will attempt to access the wetland with the least amount of physical impact to the wetlands.
- Utilizing the existing road system for access and material deliver to minimize travel through wetlands.

Initial coordination between the Applicant and the USACE regarding the proposed Project indicated that impacts associated with the proposed Project will likely meet conditions to be authorized under the USACE St. Paul Regulatory District Utility Regional General Permit.[248] Mitigation may be required by the USACE, typically in the form of wetland replacement credits, for permanent fill of wetland areas. A wetland permit from the appropriate Local Government Units (LGU) may be required in compliance with the Minnesota WCA.

5.8.3 Floodplains

The proposed route crosses both FEMA-designated 100-year and 500-year floodplains areas in locations associated primarily with waterbodies such as the Midway River, Miller Creek, Chester Creek, and Kingsbury Creek (**Figure 11**). A total of about 292 acres of 100-year floodplain and 0.28 acre of 500-year FEMA-designated floodplains occur within the proposed 115 kV route. A total of 6.3 acres of 100-year floodplain and no 500-year FEMA-designated floodplains occur within a proposed ROW for the 115 kV transmission line.

No FEMA-designated floodplains are located within the proposed 230 kV route, the Ridgeview Substation, or the Hilltop Substation.

Impacts and Mitigation

The Project may require up to five new transmission line structures to be placed within FEMA designated 100-year floodplain areas, which corresponds to less than 0.1 acre of total impact. The temporary impacts during construction are estimated to be approximately 16 acres from access routes, structures work areas, and wire pull sites. The placement of transmission line structures in floodplains is not anticipated to alter the flood storage capacity of the floodplain.

5.8.4 Groundwater

Ground water in Minnesota is largely a function of local geologic conditions that determine the type and properties of aquifers. The Minnesota DNR divides the state into six ground water provinces based on

[248] RPA, at p. 7-27.

bedrock and glacial geology.[249] Most groundwater originates from rain and melting snow and ice that infiltrate into the ground; it is the source of water for springs and wells. It is relied on as a source for drinking water, irrigation, and industrial use. Groundwater can be sourced from shallow surficial aquifers or from deeper confined aquifers. Activities that reduce the quantity of available water or introduce contaminants into these aquifers can affect groundwater resources and the people and industries that rely on them.

The EPA defines a sole source aquifer (SSA) or principal source aquifer area as one that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer, where contamination of the aquifer could create a significant hazard to public health, and where there are no alternative water sources that could reasonably be expected to replace the water supplied by the aquifer.[250]

Under the Safe Drinking Water Act (SDWA), each state is required to develop and implement a Wellhead Protection Program to identify the land and recharge areas contributing to public supply wells and prevent the contamination of drinking water supplies. Public and non-public community water supply source-water protection in Minnesota is administered by the MDH through the Wellhead Protection program. Wellhead Protection Program Areas (WHPA) for public and community water-supply wells are delineated based on a zone of capture for 10-year groundwater time-of-travel to the well and are available through a database and mapping layer maintained by MDH.[251]

The DNR defines an area as sensitive if natural geologic factors create a significant risk of groundwater degradation through the migration of waterborne contaminants. The near-surface sensitivity assessment estimates the time required for water to travel from the land surface, through unsaturated sediment, and finally to the water table. Transmission rates are based on the soil type and the texture of surficial geologic units; the travel time varies from hours to approximately a year. The pollution sensitivity of buried sand and gravel aquifers and of the first buried bedrock surface represents the approximate time it takes for water to move from land surface to the target (residence time).[252]

Relatively high sensitivity does not mean that water quality has been or will be degraded. If there are no contaminant sources, pollution will not occur. Low sensitivity does not guarantee protection. Leakage from an unsealed well for example, may bypass the natural protection, allowing contamination to directly enter an aquifer.

[249] DNR. *Minnesota Groundwater Provinces* (https://www.dnr.state.mn.us/groundwater/provinces/index.html).
[250] https://www.epa.gov/dwssa/overview-drinking-water-sole-source-aquifer-program#What_Is_SSA.
[251] https://www.pca.state.mn.us/water/wellhead-and-source-water-protection-programs.
[252] https://www.dnr.state.mn.us/waters/groundwater_section/mapping/sensitivity.html.

The County Well Index (CWI) is the most complete record of well construction and location in Minnesota and is kept up-to-date and maintained by the Minnesota Geological Survey, in cooperation with the MDH.[253]

This section assesses the potential for construction and operation of the Project to affect the quantity of available water or to introduce pollutants that would degrade the quality of groundwater resources.

The Applicant conducted a review for SSA, wells listed on the CWI, and MDH WHPAs.[254]

The proposed Project is located within both the Arrowhead/Shallow Bedrock Province and the Central Province.[255] The Arrowhead/Shallow Bedrock Province is described as exposed or shallow Precambrian bedrock with limited groundwater. The Central Province is described as sand aquifers in generally thick sandy and clayey glacial drift overlying Precambrian and Cretaceous bedrock.

A review of the CWI identified seven private wells occur within the proposed route (**Figure 11**). No municipal water supply wells are located within the proposed route. No WHPAs occur within the proposed route. No SSAs occur within the proposed route.

Impacts and Mitigation

Impacts to groundwater are not anticipated from construction and operation of the Project.

New wood pole structures will be installed directly into the ground (direct embed), by augering or excavating a hole typically 8 to 14 feet deep and 3 to 4 feet in diameter for each pole. The new wood poles will then be set and backfilled with the excavated material, native soil, or crushed rock. In poor soil conditions, a galvanized steel culvert may be installed vertically with the structure set inside, or in some case a wood framed 'bog shoe' is used to help support the poles.

Steel pole structures are expected to be foundation supported with the drilled concrete pier foundations being the predominate foundation type. Concrete pier foundations are expected to vary from 4 feet to 6 feet in diameter. Structure foundations will generally range from 25 feet to 60 feet in depth. All foundation materials would be non-hazardous materials; any effects on water tables would be localized and short term and would not affect hydrologic resources.

The Applicant will conduct geotechnical investigations to identify subsurface conditions to inform foundation requirements and final design.

[253] https://www.mngs.umn.edu/cwi.html.
[254] RPA, at p. 7-19.
[255] Minnesota groundwater provinces 2021 | Minnesota DNR (state.mn.us).

5.8.5 Soils, Topography, and Geology

High voltage transmission lines have the potential to impact soils during the construction and maintenance process. Construction may require some amount of grading to provide a level surface for safe operation of construction equipment; potential soil impacts may result from the excavation, stockpiling, and redistribution of soils during installation of project components. Localized soil erosion, compaction, and topsoil and subsoil mixing could affect revegetation within temporary work areas.

Soil varies considerably in its physical and chemical characteristics, these characteristics strongly influence the suitability and limitations that soil has for construction, reclamation, and restoration.

The proposed route is located within the North Shore Highlands Subsection of the Laurentian Mixed Forest Province as defined by the MDNR Ecological Classification System. The landscape of the Laurentian Mixed Forest Province ranges from poorly drained peatlands to rolling plains with deep glacial drift to rugged terrain with thin glacial deposits and exposed bedrock. The North Shore Highlands Subsection parallels the shoreline of Lake Superior and follows the Highland Moraine along the lake. Approximately three percent of the subsection is made up of lakes and several short streams run along the Highland Moraine, ending at Lake Superior.

Elevations along the proposed route vary from 1,400 feet above sea level to around 1,250 feet from the Ridgeview Substation to the Hilltop Substation. Slopes of about 5-6 percent grade are present throughout the proposed route with more prominent slopes near waterbody and stream banks. The gradual rolling topography of the area is characteristic of the North Shore Highlands Subsection.

Continental glacier activity is evident in the rugged shoreline along Lake Superior as well as exposed igneous intrusions of the Duluth Complex.[256] Skyline Parkway, located approximately 0.3 miles east of the Hilltop Substation, follows one of the highest stretches of Lake Superior called the Glacial Lake Duluth level. Bedrock is composed of Upper Precambrian granite, sandstone, shale, basalt, gabbro, anorthosite, rhyolite and diabase. Exposed bedrock is common in this area due to thin glacial drift. Geologic landforms found in the vicinity of the proposed route includes gabbro intrusions and outcrops of volcanic lava flows along streambeds.

The Applicant assessed the soil characteristics within the Project area using the Soil Survey Geographic database (SSURGO).[257] The SSURGO database is a digital version of the original county soil surveys developed by NRCS for use with GIS. It provides the most detailed level of soils information for natural resource planning and management. Soil maps are linked in the SSURGO database to information about the component soils and their properties.

[256] OFR 16-4, Preliminary geologic maps of Lake and St. Louis Counties, northeastern Minnesota (umn.edu).
[257] Description of SSURGO Database | NRCS Soils (usda.gov).

The relevant soil map units within the Project area are listed on **Table 30** and illustrated on **Figure 12**.

There is no prime farmland within the proposed route and proposed substation expansions. There is about 60.3 acres and 576.5 acres of Farmland of Statewide Importance within the proposed 230 kV route and proposed 115 kV route, respectively. There is approximately eight acres and 34.3 acres of Farmland of Statewide Importance within the proposed 230 kV ROW and proposed 115 kV ROW, respectively.

Table 30. Soils Within the Proposed Route [258]

	Proposed Route		Proposed 230 kV Route		Proposed 115 kV Route	
Soil Type	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**
Hermantown-Ahmeek (s3676)	165.06	10.03%	44.4	45%	120.7	8%
Hermantown-Finland (s3672)	1425.53	86.64%	0	0%	1425.5	92%
Dusler-Duluth (s3677)	54.81	3.33%	54.8	55%	0	0%
Total	**1645.40**	**100%**	**99.1**	**100%**	**1546.2**	**100%**

There is about 3.68 acres of Hermantown-Finland (s3672) soils within the proposed Ridgeview and Hilltop substation expansions. Approximately 3.3 acres of Farmland of Statewide Importance within the proposed Ridgeview and Hilltop substation expansions

Impacts and Mitigation

Construction of the proposed Project is not anticipated to have significant impacts on the overall soil profile of the area since no extensive grading or excavating activities are expected during construction. **Table 31** lists the anticipated soil impacts of the proposed 230 kV and 115 kV routes.

Table 31. Soil Impacts from the Proposed 230 kV and 115 kV Routes[259]

	Proposed 230 kV Transmission Line		Proposed 115 kV Transmission Line	
Soil Type	**Temporary Direct Impacts (acres)**[1]	**Permanent Direct Impacts (acres)**[2]	**Temporary Direct Impacts (acres)**[1]	**Permanent Direct Impacts (acres)**[2]
Hermantown-Ahmeek (s3676)	8.4	<0.1	3.6	0
Hermantown-Finland (s3672)	0	0	135.9	0.5
Dusler-Duluth (s3677)	3.5	<0.1	0	0
Total	**11.9**	**<0.1**	**139.6**	**0.5**

1-Temporary direct impacts include access routes (30-foot-wide travel path along the proposed centerline of the project), structure work areas (100 foot by 100 foot per structure), and wire stringing areas (approximately 0.66 acres per location).
2-Permanent structure placement includes both H-Frame structure placement (56.5 sq. ft. per structure) and Monopole Structure Placement (78.5 sq. ft. per structure)

[258] RPA, at p. 7-36, Table 7-18.
[259] RPA, at p. 7-36, Table 7-19.

There is approximately 3.6 acres of permanent impacts to Hermantown-Finland (s3672) soils from the proposed Ridgeview and Hilltop substation expansions. There is approximately 3.3 acres of permanent impacts to Farmland of Statewide Importance within the proposed Ridgeview and Hilltop substation expansions.

The Permittee will implement measures to reduce soil compaction and to implement soil decompaction during restoration of workspaces. Impacts to soils would be temporary and minor and would be mitigated through the proper use and installation of BMPs, such as minimizing the number of vehicles and protection and maintenance of topsoil, during ROW clearing and tie line construction. The Permittee will be required to develop a SWPPP that complies with the MPCA rules and guidelines; implementation of the protocols outlined in the SWPPP will minimize the potential for soil erosion during construction.

Construction of the proposed route will have minimal to no impacts to the topography of the area; therefore, no mitigation is proposed.

Construction of the proposed route will not alter the geology of the region; therefore, no mitigation is proposed.

5.8.6 Flora

High voltage transmission lines have the potential to impact flora through the removal or disturbance of vegetation during construction and during maintenance activities. Additionally, flora may be impacted by the possible introduction of invasive species, or by changes in habitat (soil disturbances, water flows) that adversely impact plant growth.

The Project is in the North Shore Highlands Subsection of the Laurentian Mixed Forest Province.[260] Pre-settlement vegetation was forest, consisting of white pine, red pine, jack pine, balsam fir, white spruce, and aspen-birch. White pine-red pine forest was most common on the clay lake plain and on thin soil over bedrock in the southern half of the subsection. Mixed hardwood-pine forest, with sugar maple, was concentrated on the ridges of the dissected clay lake plain and the Highland Flutes. In the northern half of the subsection, aspen-birch was dominant, with very little white pine-red pine forest or mixed hardwood-pine forest. Mixed hardwood-pine forest persisted on ridgetops in areas within 6-10 miles of the shoreline. Almost the entire subsection remains forested, with forest management and recreation as the major land uses (**Figure 9**). Following logging, the extensive white pine-red pine forests have been replaced by forests of quaking aspen-paper birch.

The proposed route will overlap approximately 700 acres of forested land and 600 acres of woody wetlands, which are the two largest land use categories overlapped by the proposed ROW after developed

[260] Laurentian Mixed Forest Province | Minnesota DNR (state.mn.us).

land (**Tables 12** and **13**). The Ridgeview and Hilltop substation parcels currently have approximately 2.3 acres in forested land use, 0.13 acres in developed land use and approximately 1 acre in herbaceous/scrub shrub land use (**Table 14**).

Impacts and Mitigation

Construction of the Project will result in short-term adverse impacts on existing vegetation, including localized physical disturbance and soil compaction. Construction will result in long-term impacts on vegetation by permanently removing vegetation at each structure and within portions of the ROW that are currently dominated by forest or other woody vegetation; permanent conversion of forested areas and shrub lands to low-stature vegetation by clearing woody vegetation throughout the entire ROW where present.

The disturbance would be minimized by using the existing road system to the extent practical and traveling within the ROW. Additionally, the transmission line may span sensitive resources, such as streams and wetlands. Also, the Project transmission lines are mostly being constructed parallel to existing transmission lines, rebuilding existing transmissions, and double circuiting on existing transmission lines. Approximately 88 percent (roughly 12.2 of 13.9 miles) of the proposed 115 kV route would parallel or double-circuit existing transmission ROWs, minimizing impacts to previously undisturbed vegetation in those areas.

Construction activities could lead to the introduction or spread of invasive species and noxious weeds through ground disturbance that leaves soils exposed for extended periods, introduction of topsoil contaminated with weed seeds, vehicles importing weed seed from a contaminated site to an uncontaminated site, and conversion of landscape type, particularly from forested to open settings.

Impacts to flora can also be mitigated by a number of strategies, including:

- placement of the alignment and of specific structures to avoid trees and other tall-growing species (utilization/sharing of existing road ROWs to the maximum level available).
- spanning low growing plant communities.
- constructing during fall and winter months to limit plant damage.
- leaving or replanting compatible plants at the edge of the transmission line ROW.
- replanting on the transmission line ROW with low growing, native species.
- avoiding the introduction of invasive species – on equipment or through seeds or mulches.
- Revegetating disturbed areas using weed-free seed mixes and using weed-free straw and hay for erosion control.
- Removal of invasive species via herbicide and manual means consistent with easement conditions and landowner restrictions.
- Cleaning and inspection construction vehicles to remove dirt, mud, plant, and debris from vehicles prior to arriving at and leaving from construction sites.
- Minimizing disturbance to native plant communities.
- Limiting traffic through and access to weed-infested areas.

- limiting vehicle traffic to roads along the right-of-way.

Mitigation and restoration measures for impacts to flora are standard Commission route permit conditions (**Appendix C**).

5.8.7 Wildlife

Wildlife can potentially be impacted by high voltage transmission line projects. Wildlife such as birds, mammals, fish, reptiles, amphibians and insects, can be permanent or migratory. Many species may utilize the available habitat in and adjacent to a given project's area for forage, breeding and shelter.

Wildlife species in St. Louis County include bald eagles, woodcock, ruffed grouse, wild turkeys, songbirds, white-tailed deer, black bear, beaver, muskrat, river otter, grey wolf, rabbits, squirrels, red and gray fox, raccoon, migratory waterfowl (geese, ducks, trumpeter swans, herons, raptors), and various birds (meadowlarks, sparrows, thrushes, various woodpeckers, shore birds).

The most common species found along and within the Project's proposed routes tend to be generalists and are able to utilize rural, urban or agricultural habitats. Examples of such species would include deer, squirrel, raccoons, mice, voles, common perching birds, red-tail hawks, reptiles, and amphibians.

Impacts and Mitigation

There is minimal potential for the displacement of wildlife and loss of habitat from construction of the proposed Project. Wildlife that inhabits natural areas could be impacted in the short-term within the immediate area of construction. The distance that animals will be displaced will depend on the species. Additionally, these animals will be typical of those found in forested urban settings and should not incur population level effects due to construction.

Raptors, waterfowl, and other bird species may be affected by the construction and placement of the transmission lines. Avian collisions are a possibility after construction of the proposed Project. Waterfowl are typically more susceptible to transmission line collision, especially if the transmission line is placed between wetlands and fields that serve as feeding areas, or between wetlands and open water, which serve as resting areas. The proposed route minimizes potential impacts by predominantly paralleling existing transmission rights-of way.

Electrocution occurs when an arc is created by contact between a bird and energized lines or an energized line and grounded structure equipment. Electrocution occurs more frequently with larger bird species, such as hawks, because they have wider wingspans that are more likely to create contact with the conductors. To avoid and minimize potential electrocution of avian species, the Applicants indicate that they will construct the HVTL in accordance with the Avian Power Line Interaction Committee's safety

recommendations.[261] These recommendations minimize electrocution risk by providing adequate clearance from energized conductors to grounded surfaces and to other conductors.

Independent of the risk of electrocution, birds may be injured by colliding with transmission line structures and conductors. The risk of collision is influenced by several factors including habitat, flyways, foraging areas, and bird size. Waterfowl, especially larger waterfowl such as swans and geese, are more likely to collide with transmission lines. The frequency of collisions increases when a transmission line is placed between agricultural fields that serve as feeding areas and wetlands or open water, which serve as resting areas. In these areas, it is likely that waterfowl and other birds would be traveling between different habitats, increasing the likelihood of a collision. The Applicants state that they will coordinate with USFWS and MDNR as needed to identify avian movement pathways and migration flyways that may be crossed by the proposed route anticipated alignment and to discuss areas along the transmission line that may need to be marked with avian flight diverters to minimize impacts to birds.[262] Diverters enable birds to better see conductors during flight and avoid collisions with them.

5.8.8 Rare and Unique Resources

Construction of high voltage transmission lines have the potential to negatively impact individual plants and animals or might alter their habitat so that it becomes unsuitable for them. For example, trees used by rare birds for nesting might be cut down, soil disturbance from construction activities may destroy rare plant species or communities, or soil erosion may degrade rivers and wetlands that provide required habitat.

Endangered species are species whose continued existence is in jeopardy. Threatened species are likely to become endangered. Species of special concern have some problems related to their abundance or distribution, although more study is required.

The MDNR Division of Ecological and Water Resources manages the Natural Heritage Information System (NHIS) which provides information on Minnesota's rare and sensitive species. The NHIS is continually updated as new information becomes available and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities and other natural features. Its purpose is to foster better understanding and conservation of these features.[263]

The USFWS Information for Planning and Conservation (IPaC) website is a project planning tool which aids in the streamlining the USFWS environmental review process. IPaC is available to everyone, whether private citizens or public employees, who need information to assist in determining how their activities

[261] RPA, at p.7-28.
[262] RPA, at p. 7-28.
[263] https://www.dnr.state.mn.us/nhnrp/nhis.html.

may impact sensitive natural resources, and who would like to obtain suggestions for ways to address these impacts. IPaC is also designed to assist the USFWS who is charged with evaluating such impacts.[264]

In addition to rare and sensitive species, the MDNR also maps Sites of Biological Significance (SOBS), rare and unique plant communities (prairie) and higher quality examples of more common plant communities (wet meadow).[265] The Minnesota Biological Survey designates and assigns rankings to SOBS, based on landscape context, native plant community, and occurrence of rare species populations.[266] There are four biodiversity significance ranks: outstanding, high, moderate, and below.

Native prairies are typically untilled plant communities that are comprised primarily of native grasses and sedges along with a variety of broad-leaved forbs and scattered shrubs. Approximately 250,000 acres of native prairies ranked good to excellent remain in Minnesota.[267]

Native Plant Communities (NPCs) are assemblages of native plants that have not been substantially impacted by non-native species or human activities. NPCs are formed and classified by hydrology, soils, landforms, vegetation, and natural disturbance regimes such as floods, wildfires, and droughts. NPCs are named by their dominant or characteristic species and/or natural features.[268]

Some areas of the state have not been surveyed extensively or recently, so the NHIS database cannot be relied upon as a sole information source for rare species. Nevertheless, the NHIS database provides a starting point for anticipating potential impacts to rare and unique natural species and communities.
Critical habitat is specific geographical areas designated by the USFWS with biological and physical features that are essential to the recovery of the species. Critical habitat may be occupied or unoccupied at the time of designation. Critical habitat is protected against destruction or adverse modification under Section 7 of the ESA during actions that are funded, permitted, or implemented by a federal agency.[269]

The Wildlife Action Network is comprised of areas with high concentrations or persistent or viable populations of Species of Greatest Conservation Need (SGCN), in addition to SOBS, Lakes of Biological Significance, and streams with exceptional indices of biological integrity. Minnesota's State Wildlife Action Plan proactively addresses the state's conservation needs and catalyzes actions to prevent species from becoming listed under the state endangered species program or the ESA.[270] The SWAP also entailed revisions to the state's list of SGCN. SGCN are native animals with rare, declining, or vulnerable populations and species for which the state has a stewardship responsibility (MNDNR, 2016b).

[264] https://ecos.fws.gov/ipac/.
[265] https://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html.
[266] https://www.dnr.state.mn.us/mbs/index.html.
[267] https://www.dnr.state.mn.us/rys/pg/dryprairie.html.
[268] https://www.dnr.state.mn.us/npc/index.html.
[269] https://www.fws.gov/endangered/what-we-do/critical-habitats.html.
[270] MNWAP Wildlife Action Network - Resources - Minnesota Geospatial Commons.

Records provided by the MDNR indicates that floating marsh marigold (*Caltha natans*), which is a state-listed endangered species, is known to occur within the proposed route.[271] Floating marsh marigold is a circumboreal aquatic species with 2-6 small white flowers about 1 centimeter (cm) across. The leaves are 2-5 cm along and wide with a rounded tip and a deeply notched base. Floating marsh marigold is typically associated with low-gradient riverine systems and has been known to occur in shallow, slow-moving water in streams, creeks, pools, ditches, sheltered lake margins, swamps, and beaver ponds.

The state-listed species of special concern, Northern goshawk (*Accipiter gentilis*) is also mapped as occurring within one mile of the proposed route.[272] Northern goshawk is a large-bodied forest-dwelling hawk with broad wings and a long-rounded tail. Northern goshawks are most found in larger tracts of mature and older upland forest. Special status species, including species of special concern, do not have a legal or protected status but are tracked by the MDNR.

The Blanding's turtle (*Emydoidea blandingii*) a state-listed threatened species may occur in the proposed Project area; however, it is not listed in the NHIS database for the proposed Project area. The Blanding's turtle averages 15-25 cm (5.9-9.8 in.) in length and has a domed upper shell (carapace) and bright yellow chin and throat. The Blanding's turtle preferred habitat includes calm, shallow waters, including wetlands associated with rivers and streams with rich aquatic vegetation.

According to the review of the USFWS IPaC, the following were indicated as being potentially located in the Project area: Canada lynx (*Lynx canadensis)* federally listed as threatened*,* northern long-eared bat (NLEB) (*Myotis septentrionalis*) federally listed as threatened, piping plover (*Charadrius melodus*) federally listed as endangered, and red knot (*Canutus rufa*) federally listed as endangered. Additionally, critical habitat for the Canada lynx occurs partially within the Proposed Route.[273]

The Canada lynx is a mid-sized boreal forest cat species that is approximately 30-35 inches long and weighs about 15-30 pounds. Canada lynx habitat is associated with moist, cool, boreal spruce-fir forests with high snowshoe hare (*Lepus americanus*) densities. The proposed route from Ridgeview Substation to Miller Trunk Highway is mapped as occurring within Canada lynx critical habitat. There is approximately 323 acres of Canada lynx critical habitat within the proposed 115 kV Route.[274]

The NLEB is a medium-sized bat that is 3.0 to 3.7 inches in length with a wingspan of 9 to 10 inches. The species' name is due to its relatively long ears compared to other members of the genus Myotis. In winter, NLEBs hibernate in mines and caves in areas with high humidity, constant temperatures, and no air currents. In summer, the species roosts alone or in colonies in live and dead trees under bark, in cavities, or in crevices. The MDNR maintains a list of townships containing documented NLEB maternity roost trees

[271] RPA, at Appendix R-2.
[272] Ibid.
[273] RPA, at Appendix R-2.
[274] Ibid.

and hibernacula entrances in Minnesota. A review of the MDNR's township list shows that there are no NLEB hibernaculum within 0.25 mile of the proposed route nor are there any NLEB maternity roost trees located within the proposed route.

Piping plover is a small, stocky shorebird with a sand-colored upper body, a white underside, and orange legs. Piping plover habitat consists of wide, flat, open, sandy beaches with very little grass or other vegetation. Due to the lack of available habitat, it is unlikely that piping plovers would occur within the proposed route.

Red knot is a small shore bird with mottled black and gray uppers and a cinnamon brown head. Underparts of some birds show traces of red in the fall, which is where the species name is derived from. In Minnesota they are found almost exclusively along the shore of Lake Superior. Due to the lack of available habitat, it is unlikely that red knots would occur within the proposed route.

Impacts and Mitigation

Stream crossings within the proposed route associated with the potential presence of floating marsh marigold, would be spanned by the transmission line. These stream features fall under the jurisdiction of the MDNR as both Public Waters and designated trout streams. Construction activities in these areas will be governed through the MDNR's License to Cross Public Waters which will require additional construction stormwater BMPs such as work in water timing restrictions, restrictions on activities near the stream bank, maintaining vegetated buffers and redundant erosion control measures adjacent to the streams. Due to the avoidance of work activities within potential floating marsh marigold habitat it is unlikely that the proposed Project would have an adverse effect on floating marsh marigold.

As suitable habitat may be present for the Blanding's turtle in the vicinity of the proposed Project, the Applicants have stated[275] that they will implement the BMPs outlined in the MNDNR's consultation, which may include:

- Avoid wetland impacts during hibernation season, between October 15th and April 15th, unless the area is unsuitable for hibernation:
    - less than 14 inches deep,
    - anoxic conditions, or
    - not a suitable substrate.
- Provide the Blanding's turtle flyer to all contractors working in the area.
- The use of erosion control blanket shall be limited to 'bio-netting' or 'natural-netting' types, and specifically not products containing plastic mesh netting or other plastic components.
    - Also, be aware that hydro-mulch products may contain small synthetic (plastic) fibers to aid in its matrix strength. These loose fibers could potentially re-suspend and make their way

[275] RPA, at p. 7-34.

into Public Waters. As such, please review mulch products and not allow any materials with synthetic (plastic) fiber additives in areas that drain to Public Waters.

- Monitor for turtles during construction and report any sightings to the DNR Nongame Specialist.
- If turtles are in imminent danger, they must be moved by hand out of harm's way, otherwise they are to be left undisturbed.

Due to the transient nature of the Canada lynx within the Project area and the development within the Project Area, it is unlikely that the Canada lynx would persist within the proposed route. There is about 19.4 acres of Canada lynx critical habitat within the proposed 115 kV ROW with about 0.1 acres of impact from the structures and about 31.7 acres of temporary impact during construction. In addition, there is about 3.6 acres of permanent impact from the Ridgeview Substation expansion. Being that the portion of the proposed route located within Canada lynx critical habitat is located adjacent to existing transmission line ROW and the Ridgeview Substation property, it is unlikely that the Project would have an adverse effect on the Canada lynx critical habitat as this habitat has been previously disturbed.

There are no NLEB hibernacula within 0.25 mile of the proposed route, nor are there any known occupied NLEB roost trees located within 150 feet of the proposed route. Minnesota Power has stated that they intend to comply with tree clearing timing restrictions as defined by the USFWS 4(d) Rule for the NLEB by performing clearing activities during the winter months (October 1 through March 31) when the NLEB would not be present within the Project area. Therefore, it is unlikely that the proposed Project would have an adverse effect on the NLEB.

There are no MDNR Wildlife Management Areas and MDNR Scientific and Natural Areas in the proposed route. Additionally, there are no MDNR Minnesota Biological Survey areas of Biological Significance located within the proposed route. The nearest MDNR Minnesota Biological Survey areas of Biological Significance are Norton Road Woods and Hartley Park located about 0.25 miles from the Ridgeview Substation (**Figure 6**).

5.9 Unavoidable Impacts

Where feasible, the EA suggests mitigation measures to be incorporated into the planning, design, and construction of the proposed Project to substantially eliminate the adverse impacts. In other areas of consideration, adverse impacts can be reduced but not eliminated and are therefore determined to be unavoidable. Most unavoidable adverse impacts would occur during the construction phase of the proposed Project and would be temporary.

Unavoidable impacts related to the Project that would last only as long as the construction period include:

- noise emitted from vehicles and equipment during construction that will be audible to neighboring landowners.

- increased traffic on roads that bisect the Project area.
- minor air quality impacts due to fugitive dust.
- potential for soil erosion; and
- disturbance to and displacement of some species of wildlife.

Unavoidable impacts related to the Project that would last as long as the life of the Project would include changes to existing aesthetics of landscape, which will be visible from local roadways and parcels. Transmission projects introduce new transmission line structures and conductors into the area, given the existing transmission line infrastructure these changes in viewsheds would be incremental.

5.10 Irreversible Commitment of Resources

A commitment of resources is irreversible when its primary or secondary impacts limit the future option for a resource. An irretrievable commitment refers to the use or consumption of resources that is neither renewable nor recoverable for later use by future generations. The commitment of resources refers primarily to the use of nonrenewable resources such as fossil fuels, water, and other materials (aggregate minerals, steel/metals, etc.).

Construction activities would require the use of fossil fuels for electricity (portable generators) and for the operation of vehicles and equipment. Use of raw building materials for construction would be an irretrievable commitment of resources from which these materials are produced, excluding those materials that may be recycled at the end of the Project life cycle. The use of water for dust abatement during construction activities would be irreversible. Commitment of labor and fiscal resources to develop and build the Project is considered irretrievable.

The commitment of land for a transmission line ROW is likely an irreversible commitment. In general, lands in the ROW for large infrastructure projects such as railroads, highways, and transmission lines remain committed to these projects for a relatively long period of time. Even in instances where a ROW is abandoned the land within the ROW is typically repurposed for a different infrastructure use, such as a rails-to-trails program, and is not returned to a previous land use. This said, transmission line ROW can be returned to a previous use (row crop, pasture) by the removal of structures and structure foundations to a depth that supports this use.

There are few commitments of resources associated with the Project that are irretrievable. These commitments include the steel, concrete, rare earths, and hydrocarbon resources committed to the Project, though it is possible that some of these components could be recycled at some point in the future. Labor and fiscal resources required for the Project are also irretrievable commitments

5.11 Cumulative Effects

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 haves been laid, regardless of what person undertakes the other projects or what jurisdictions have authority over the projects."[276]

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 may be minimal in the context of a single project may accumulate and become significant when all projects are considered.

A review for foreseeable projects (state, or local unit of governments) in the Project area or along the transmission route, that may affect or be affected by the proposed Project was conducted, including Minnesota Department of Transportation, Minnesota Pollution Control Agency, Minnesota State Board of Soil and Water Resources, Minnesota Department of Natural Resources, Duluth International Airport, South St. Louis County Soil and Water Conservation District, Western Lake Superior Sanitary District; St. Louis County; and several cities including Duluth, Hermantown, Proctor, and Rice Lake.

Current and reasonably foreseeable future projects are summarized in **Table 32** and shown on **Diagram 9**. The majority of these projects are road and highway related.

5.11.1 Human Settlements

Cumulative potential effects on human settlements are anticipated to be minimal. Many projects would have positive effects on human settlements by improving sanitary sewer conditions, improving transportation, and providing additional housing opportunities. Future projects will result in aesthetic impacts. Most will occur in areas that are already well-developed (cities, along existing roads, and highways). A future 103-unit apartment building would change the aesthetics of this area. The Duluth Loop Project will also result in aesthetic impacts (Section 5.4.1). Thus, aesthetic impacts will increase in the project area as a result of foreseeable projects.

[276] Minnesota Rules, part 4410.0200, subpart 11a.

Table 32. Current and Reasonably Foreseeable Projects[277]

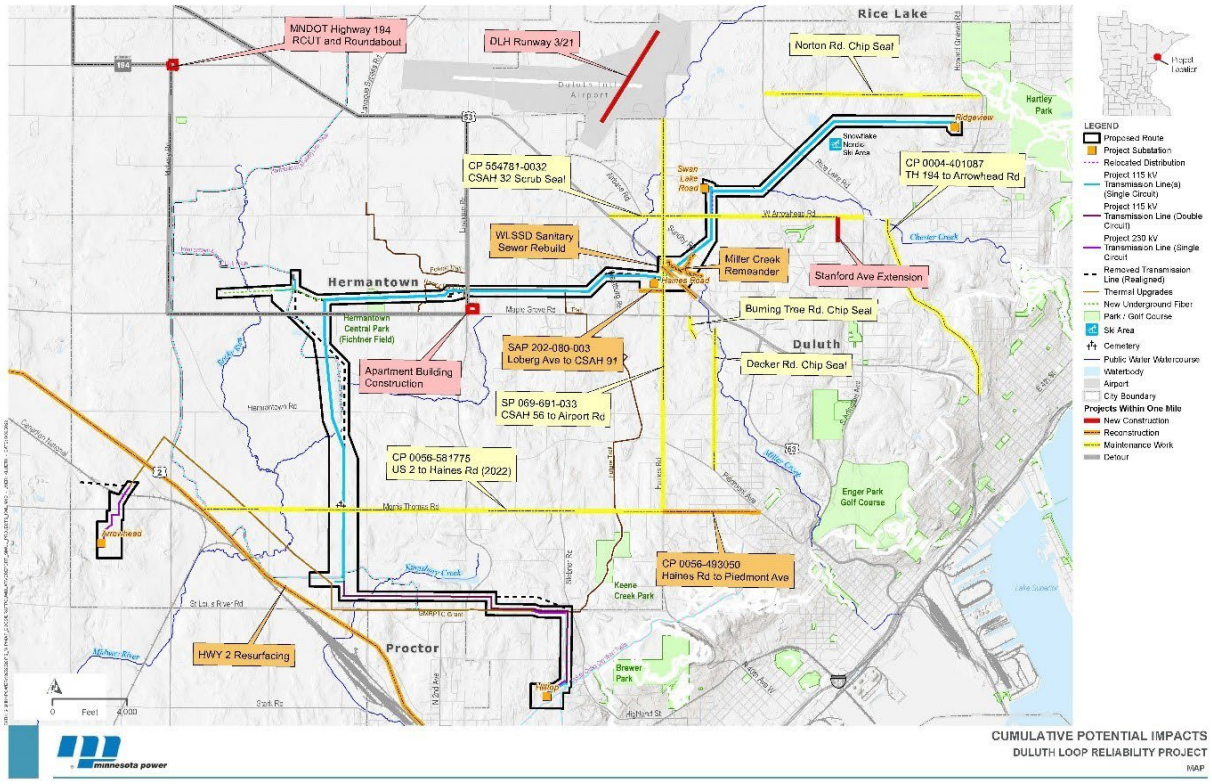
Status	Project Name	General Location	Project Description	Reference
Future	Duluth International Airport Runway 3/21	Within Duluth International Airport Property (see link for location)	Determination if Runway 3/21 (running northeast to southwest) will require expansion/updates.) This project is still in evaluation stage as part of the Duluth Airport Master Plan being developed 2019-2022.	https://duluthairport.com/master-plan/
Future	St. Louis County Morris Thomas Rd Reconstruction (CP 0056-493050)	Haines Road to Piedmont Avenue in St. Louis County	Roadway design of reconstruction of County State Aid Highway (CSAH) 56 (Morris Thomas Road) between Haines Road and Piedmont Avenue in City of Duluth	https://apps.stlouiscountymn.gov/RoadConstViewer/Default.aspx?ProjectNum=CP%200056-493050
Future	St. Louis County Morris Thomas Rd (CP 0056-581775)	US Highway 2 to CSAH 91 (Haines Rd) in St. Louis County	Pavement preventative maintenance	https://apps.stlouiscountymn.gov/RoadConstViewer/Default.aspx?ProjectNum=CP%200056-581775
Future	St. Louis County Five-Year Capital Improvement Plan 2020-2024	Scrub Seal of CSAH 32 in St. Louis County	Scrub Seal of CSAH 32 (Arrowhead Road) to Trunk Highway 53 to Arlington Avenue	https://www.stlouiscountymn.gov/Portals/0/Library/Dept/Public%20Works/2020-2024%20CIP%20Amendment%20with%20TST-TIP%20090120%20OPT.PDF?ver=9LBb1RZoS5qon-b_uh53Fw%3d%3d
Future	MnDOT Future Projects - ST. LOUIS SP 069-691-033 District:1	CSAH 56 to Airport Road in City of Duluth	Bituminous overlay, shoulder paving, and striping	https://mndot.maps.arcgis.com/apps/webappviewer/index.html?id=34f8913831b94d3c94b675298e6fa18d

[277] Email communication with Minnesota Power, July 20, 2022.

Status	Project Name	General Location	Project Description	Reference
Future	MnDOT Current Year - HERMANTOWN SAP 202-080-003 District:1	Richard Avenue and Lindgren Road. From MSAS 107 Loberg Avenue to CSAH 91 Haines Rd in City of Hermantown	Grading, aggregate base, bituminous base, bituminous surfacing, curb and gutter, storm sewer, signing, striping, construction engineering, design engineering, right-of-way acquisition, concrete sidewalk, curb ramps, street lighting, wetland mitigation, erosion control, and reconstruction	https://mndot.maps.arcgis.com/apps/webappviewer/index.html?id=34f8913831b94d3c94b675298e6fa18d
Future	MnDOT Future Projects - ST. LOUIS SAP 069-604-085 District:1	Trunk Highway 194 to Municipal State Aid Street (MSAS) 160 to Arrowhead Road in Duluth.	Existing alignment, bituminous surfacing, shoulder paving, and striping	https://mndot.maps.arcgis.com/apps/webappviewer/index.html?id=34f8913831b94d3c94b675298e6fa18d
Future	MnDOT Highway 2 box culvert replacements	Highway 2 north of Proctor and south of Highway 194	Replace aging box culverts at West Rocky Run Creek, Midway River, and Kingsbury Creek	https://www.dot.state.mn.us/d1/projects/hwy2-box-culvert-replacements/index.html
Future	MnDOT Highway 2 resurfacing through Proctor	12.5 miles on Highway 2, from Highway 194 to Boundary Avenue in City of Proctor	Resurfacing and drainage improvements on Highway 2, bicycle and pedestrian improvements through Proctor, and Intersection safety improvements at Highway 2/Boundary Avenue and Highway 2/Midway Road	https://www.dot.state.mn.us/d1/projects/hwy2-proctor/index.html
Ongoing	MnDOT Highway 194 RCUT and roundabout	Highway 194 at the intersection of Highway 53 in City of Hermantown and Midway Road “Five Corners”	Construct a RCUT at intersection of Highway 194 and Highway 53 and construct a roundabout at intersection of Highway 194 and Midway Road (in partnership with St. Louis County)	https://www.dot.state.mn.us/d1/projects/hwy-194/index.html
Future	Munger Trail Spur in Proctor and Hermantown	Cities of Hermantown and Proctor	A regional trail connection is being evaluated between Proctor, Hermantown, and to the Munger State Trail	https://hermantownmn.com/wp-content/uploads/2020/01/2016-01-21_Master_Plan_Document.pdf https://hermantownmn.com/departments/community-development/planning-studies-analysis/ https://hermantownmn.com/wp-content/uploads/2020/01/Preferred_Alignment_HKGi_040815.pdf

Status	Project Name	General Location	Project Description	Reference
Future	507X Apartment Building, Hermantown, MN	507x Maple Grove Road	Construction of a 103-unit, four story apartment building on 13 acres in the R-3 Zoning District at 507x Maple Grove Road	https://hermantownmn.com/wp-content/uploads/2022/01/January-19-2022-Agenda-Packet-3.pdf
Ongoing	City of Duluth Chip Sealing 2022	Burning Tree Road south of Maple Grove Road, Decker Road from Piedmont Ave to Mall Drive, and Norton Rd from Rice Lake Road to Howard Gneesen Road	Chip sealing several roads in the City of Duluth in 2022	https://duluthmn.maps.arcgis.com/apps/webappviewer/index.html?id=97f73599cb984ebda5a595f92be86a1d
Ongoing	City of Duluth Extension of Standford Ave	Stanford Avenue Extension to Arrowhead Road	Extension of Stanford Avenue	https://duluthmn.maps.arcgis.com/apps/webappviewer/index.html?id=97f73599cb984ebda5a595f92be86a1d
Ongoing	Western Lake Superior Sanitary District	South side of Trunk Highway 53	Rebuilding sanitary sewer pipeline on the south side of Trunk Highway 53	Duluth Loop Reliability Project Certificate of Need and Route Permit Application Appendix M
Future	Miller Creek Channel and Floodplain Restoration Project - South St Louis County SWCD	Miller Creek, north of Trunk Highway 53	Remeander of Miller Creek, north of Trunk Highway 53. Construction is anticipated in 2022	Duluth Loop Reliability Project Certificate of Need and Route Permit Application Appendix M https://www.southstlouisswcd.org/wp-content/uploads/2022/03/Miller-Creek-Channel-and-Floodplain-Restoration-Project-EAW.pdf
Future	Minnesota Power 98 Line Tap Thermal Upgrades	98 Line from the Hilltop Substation to the Arrowhead Substation	The Applicant is planning to upgrade the Iron Range Line No. 98/Tap to Hilltop (98 Line Tap) to a higher thermal rating. This work will be completed as part of the Duluth Loop Project.	Duluth Loop Reliability Project Certificate of Need and Route Permit Application at 2-7

Diagram 9. Cumulative Potential Impacts[278]



5.11.2 Public Health and Safety

Cumulative potential effects on public health and safety are anticipated to be minimal to slightly positive. Impacts on public health and safety as a result of the Duluth Loop Project are anticipated to be minimal (Sections 5.4.10 and 5.4.11). The majority of projects foreseen in the project area are road and highway related. They are being undertaken to maintain and improve local roads to ensure their safe operation and the public's health and safety.

5.11.3 Land-Based Economies

Cumulative potential effects on land-based economies are anticipated to be minimal. The majority of projects are in well-developed areas or along roadways.

5.11.4 Natural Environment

[278] Email communication with Minnesota Power, July 20, 2022.

Cumulative potential effects on the natural environment are anticipated to be minimal. The majority of projects are in well-developed areas in cities or along roadways. Impacts are limited along roadways by the use of existing infrastructure ROW. South St. Louis County SWCD is meandering Miller Creek into the low area on the landscape from its current channelized condition. The project area has many trout streams or tributaries to trout streams and each project disturbing the ground must obtain a construction stormwater permit from the MPCA that has special management practices to minimize construction effects to streams. The Duluth Loop Project was sited to minimize impacts to stream resources (Section 5.8.1).

5.11.5 Rare and Unique Natural Resources

Cumulative potential effects on rare and unique natural resources are anticipated to be minimal. There are few rare and unique species in the project area (Section 5.8.8). The majority of projects are in well-developed areas in cities or along roadways. These areas generally do not provide habitat for rare and unique species, nor do they typically support rare communities. Miller Creek hosts a listed resource and South St. Louis County SWCD is working with the DNR on affects to the resource due to stream meandering. The Duluth Loop Project will span Miller Creek and have negligible impact to the rare resource.

6 Application of Siting Factors (Factors Considered)

The Commission is charged with locating high voltage transmission lines in a manner that is "compatible with environmental preservation and the efficient use of resources" and that minimizes "adverse human and environmental impact(s)" while ensuring electric power reliability (Minnesota Statutes, section 216E.02). Minnesota Statute, section 216E.03, subdivision 7(b) identifies considerations that the Commission must take into account when designating HVTL routes.

Minnesota Rules, part 7850.4100 lists 14 factors for the Commission to consider in its route permitting decisions, including impacts on human settlements, impacts on land-based economies, and impacts on the natural environment:

A. Effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation, and public services.
B. Effects on public health and safety.
C. Effects on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining.
D. Effects on archaeological and historic resources.
E. Effects on the natural environment, including effects on air and water quality resources and flora and fauna.
F. Effects on rare and unique natural resources.
G. Application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity.
H. Use or paralleling of existing rights-of-way, survey lines, natural division lines, and agricultural field boundaries.
I. Use of existing large electric power generating plant sites.
J. Use of existing transportation, pipeline, and electrical transmission systems or rights-of-way.
K. Electrical system reliability.
L. Costs of constructing, operating, and maintaining the facility which are dependent on design and route.
M. Adverse human and natural environmental effects which cannot be avoided.
N. Irreversible and irretrievable commitments of resources.

This Section discusses the proposed route and its merits relative to the *Factors Considered* for routing HVTLs. Factors M and N—*the unavoidable and irreversible impacts of the project*—were discussed in Section 5.9 and 5.10.

Since the Project purpose is to help off-set the voltage stability concerns associated with the cession of coal-based generation located along Minnesota's, Factor I-*the use of existing large electric power generating plant sites*, is not relevant to this Project and is not discussed further here.

Factor G ("mitigate adverse environmental impacts") has several parts and speaks generally to environmental impacts. For purposes of discussion here, and with respect to factor G, it is assumed that the proposed Project is designed to maximize energy efficiencies and accommodate expansion capacity. With respect to environmental impacts, the examination of such impacts suggested by routing factor G is included in the discussion of other factors and elements that more specifically address an environmental impact (as in factor E, effects on flora and fauna). A description of mitigative measures that could be used to avoid and minimize impacts is thoroughly addressed in the descriptions of impacts in previous sections of this document. To the extent that special conditions may be appropriate for particular Elements, those mitigative measures are identified in the individual resource subsections.

6.1 Relative Merits

Generally, an Environmental Assessment, under Minnesota Rules 7850, reviews the proposed project along with the Factors Considered to help ascertain the merits of the project (and any alternatives, if applicable) relative to these factors.

This review looks not only at the Factors, but also the Elements that make up those Factors (Factor: human settlement; Elements: displacement, noise, aesthetics, cultural values, recreation, and public services).

With adherence to BMPs during construction and operation, and to the general permit conditions found in Commission issued HVTL route permits (**Appendix C**) it is anticipated that minimal negative impacts would result from the development of the proposed Project.

6.1.1 Factor: Effects on Human Settlement (A)

Elements: noise, displacement, cultural values, public services, transportation, recreation, property values, electronic interference, emergency services, zoning/land use

Impacts related to noise, cultural values, public services, transportation, recreation, electronic interference, emergency services, and property values are anticipated to be minimal with the use of standard construction techniques and the general conditions in the Site Permit Template. Displacement of residences or business properties is not anticipated in any of the proposed components of the Project.

Element: aesthetics

Aesthetic impacts from development of the Project are anticipated to be minimal; the HVTLs will be visible from adjacent roads ways and parcels but given that most of the proposed route is parallel to existing lines, the impacts are believed to be incremental.

Approximately 88 percent of the 115 kV transmission line is proposed to be parallel or rebuilt with existing transmission lines. The proposed 230 kV transmission line is parallel to existing transmission lines with existing ROWs. The Ridgeview and Hilltop substation expansions will occur at existing substations and on

property owned by Minnesota Power. The sight lines to both substation expansions would be obscured by existing stands of trees.

Element: consistency with local land use and planning

The Project is located within three zoning jurisdictions: St. Louis County and the cities of Duluth and Hermantown. Current land use within the proposed route consists of mainly rural residential, open, and public lands and commercial areas. The proposed Project is compatible with existing land use and zoning regulations.

Impacts to forested land will be the most obvious impact to overall land cover along the proposed route, with an estimated potential impact of 46.5 acres and 6.6 acres of deciduous forest within the 115 kV and 230 kV lines, respectively. Areas requiring new ROW will convert the existing forested land to open, cleared space; much of the proposed 115 kV route is proposed to be parallel or double circuit to existing transmission lines, which will reduce the amount of new ROW needed and cleared.

The construction footprints of the Ridgeview and Hilltop substation expansions are anticipated to be minor, with a total of approximately 2.3 acres in forested land use, 0.13 acres in developed land use and approximately 1 acre in herbaceous/scrub shrub land use being disturbed.

6.1.2 Factor: Effects on Public Health and Safety (B)

Elements: EMF/electric fields, air quality, and safety

Based on the predicted EMF levels for the Project, no adverse health impacts from electric or magnetic fields are anticipated for persons living or working near any of the components of the proposed Project.

Potential air quality impacts associated with the Project come from two primary sources: ozone & nitrogen oxide emissions from operating the HVTL and short-term emissions from construction activities. Emissions from operating any of the proposed lines are anticipated to have negligible impacts on air quality. Air emissions during construction would primarily consist of emissions from construction equipment and would include carbon dioxide, NOX, and particulate matter (PM); dust generated from earth disturbing activities would also give rise to PM; these potential impacts will be minimal and temporary.

Where work areas overlap public areas, such as along roadways, construction activities may present potential impacts to public health and safety. These are anticipated to be minimal with use of standard construction techniques, traffic control measures during deliveries, and the general conditions identified in the Site Permit Template.

Operation of the Project (with the appropriate BMPs and standard HVTL permit conditions) is not anticipated to be a public health or safety concern, especially considering the substation's secured access.

6.1.3 Factor: Effects on Land-Based Economies (C)

Elements: forestry, agriculture, tourism, and mining
Impacts to forestry, agriculture, tourism, and mining are avoided by the proposed Project through the route selection process; therefore, any potential impacts are anticipated to be negligible with the use of standard construction techniques and the general conditions in the Site Permit Template.

6.1.4 Factor: Effects on Archaeological and Historic Resources (D)

The proposed route was developed to avoid or minimize potential affects to previously recorded archaeological and historic architectural resources; impacts are anticipated to be negligible with use of standard construction techniques and the general conditions identified in the Site and Route Permit Templates. No known archaeological or historical sites were identified within the footprint of the proposed ROWs.

The procedures outlined in the Permit Templates provide an outline of the process for resolution should any previously unknown archaeological resource or human remains be encountered.

6.1.5 Factor: Effects on Natural Environment (E)

Element: air
Impacts to air quality (see Section 6.1.2) are anticipated to be negligible with the use of standard construction techniques and the general conditions in the Route Permit Template.

Element: surface water
Impacts to surface waters are anticipated to be minimal with the use of standard construction techniques, MDNR License to Cross restrictions, and the general conditions identified in the Site Permit Template.

The proposed transmission line crosses eight MDNR public waterways; all of the public waters crossed by the proposed transmission line are designated trout streams. Due to the sinuous nature of the waterways this results in a total of 31 crossings, however, through route selection and design efforts (i.e., removal of the 57 Line away from the Midway River, and other proposed stream crossings that are parallel, rebuild, or double circuit to existing transmission lines) the overall potential impact to public waters will be reduced.

Element: wetlands
Impacts to wetlands are expected to be minimal with the use of standard construction techniques and the general conditions in the Site Permit Template.

No wetlands are located within the proposed 230 kV ROW. Approximately 9.5 acres of wetland are within the proposed 115 kV new ROW (existing 115 kV ROW contains approximately 41 acres). It is estimated that 7.6 acres of permanent conversion impacts to forested, forested/emergent, and forested/shrub wetlands would be converted to either emergent or shrub wetlands within the existing and new ROW.

Approximately 0.03 acres of permanent impacts of fill would occur as a result of expansion of the Hilltop Substation, and about 0.47 acres of permanent fill would occur as a result of expansion of Ridgeview Substation.

Element: floodplains

Impacts to floodplains are expected to be minimal with the use of standard construction techniques and the general conditions in the Site Permit Template.

A total of 6.3 acres of 100-year floodplain and no 500-year FEMA-designated floodplains occur within the proposed ROW for the 115 kV transmission line. No FEMA-designated floodplains within the proposed 230 kV Route, Ridgeview Substation, and Hilltop Substation.

Element: soils and groundwater

Impacts to soils and groundwater are anticipated to be minimal with the use of standard construction techniques and the general conditions in the Site Permit Template.

The Minnesota County Well Index identified seven private wells occur within the proposed route and none within the proposed ROW. No municipal water supply wells are located within the proposed route. No MDH wellhead protection areas occur within the proposed route. No USEPA sole source aquifers occur within the proposed route.

There is approximately 0.1 acres and 0.2 acres of permanent impacts to Farmland of Statewide Importance within the proposed 230 kV ROW and the proposed 115 kV ROW, respectively. There is approximately 3.3 acres of permanent impacts to Farmland of Statewide Importance within the proposed Ridgeview and Hilltop substation expansions.

Element: vegetation

Impacts to non-cropland vegetation are anticipated, see Section 6.1.1-Local Land Use; the impacts will be minimized by using the existing road system to the extent practical and traveling within the ROW as allowed, avoiding the need to build new roads. The transmission line has been designed to span sensitive resources and is mostly (88 percent) being constructed parallel to existing transmission lines, rebuilding existing transmissions, and double circuiting existing transmission lines.

With the use of standard BMP construction techniques, restoration efforts, development and compliance with vegetation management (Sections 5.3.9 to 5.3.13) and the other general conditions in the Route Permit Template impacts to vegetation are anticipated to be incremental.

Element: wildlife

Impacts to wildlife are anticipated to be minimal to moderate (temporary displacement to incremental habitat loss) with the use of standard design (APLIC and flight diverters) and construction techniques (BMPs), and the general conditions in the Route Permit Template.

6.1.6 Factor: Effects on Rare and Unique Natural Resources (F)

No direct impacts to any rare and unique natural resources are anticipated; any indirect impacts should be minimal with the use of design (spanning sensitive resources, co-locating the ROW) and construction techniques (BMPs associated with the MDNR License to Cross) and the general conditions in the Route Permit Template.

6.1.7 Factor: Use or paralleling of existing ROW, survey lines, natural division lines, and agricultural field boundaries (H)

The proposed route was designed to maximize the paralleling of existing roads, survey boundaries, field lines, natural division lines, and existing transmission lines.

6.1.8 Factor: Use of existing transportation, pipeline, and existing transmission systems or rights-of-way (J)

The proposed route will mostly be constructed parallel to existing transmission lines, rebuilding existing transmissions, and double circuiting on existing transmission line. Approximately 88 percent (about 12.2 of 13.9 miles) of the proposed 115 kV route would parallel or double-circuit existing transmission ROW.

The proposed 230 kV route is located mostly on Minnesota Power property with the exception of the northern-most 0.15 miles that spans the Canadian National Railroad and private property. The segment does parallel existing 115 kV transmission lines.

6.1.9 Factor: Electrical System Reliability (K)

The Duluth Loop Reliability Project is needed to replace the system support once provided by coal- fired baseload generators located along Minnesota's North Shore by addressing severe voltage stability concerns, relieving transmission line overloads, and enhancing the reliability of Duluth-area transmission sources. The Project will replace the system support once provided by the North Shore coal-fired baseload

generators and is needed to: (1) resolve severe voltage stability concerns; (2) relieve transmission line overloads; and (3) enhance the reliability of Duluth area transmission sources.

6.1.10 Factor: Unavoidable Impacts (M)

See discussion in Section 5.9-*Irreversible Commitment of Resources*.

6.1.11 Factor: Irreversible and Irretrievable Commitments of Resources (N)

See discussion in 5.10-*Unavoidable Impacts*.

FIGURES

Appendix A EA Scoping Decision

Appendix B Detailed Aerial Maps

Appendix C HVTL Route Permit Template

Appendix D Structure Details

Appendix E Appendix F EMF Background Paper

Appendix F Graphical Representation of EMF Calculations