describe, and map progressively smaller areas of land with increasingly uniform ecological features (reference (18)). The ECS splits Minnesota into Ecological Provinces, Sections, and Subsections.

The project is primarily located in the Northern Laurentian Mixed Forest Province, which is characterized by broad areas of coniferous forest, mixed deciduous-coniferous forests, and coniferous bogs and swamps. The landscape ranges from rugged lake terrain with thin glacial deposits over bedrock, to hummocky or undulating plains with deep glacial drift, to large, flat, poorly drained peatlands (reference (18)).

The southern extent of the project is located in the Eastern Broadleaf Forest Province, which serves as a transition zone between semi-arid portions of Minnesota that were historically prairie and semi-humid mixed coniferous-deciduous forests to the northeast (reference (18)).

The project traverses the St. Louis Moraines, Tamarack Lowlands, Pine Moraines and Outwash Plains, and the Mille Lacks Uplands subsections in the Northern Laurentian Mixed Forest Province and the Anoka Sand Plain Subsection in the Eastern Broadleaf Forest Province (Map 5-1). These subsections are briefly summarized here, with additional information provided in Chapter 5.10.4.

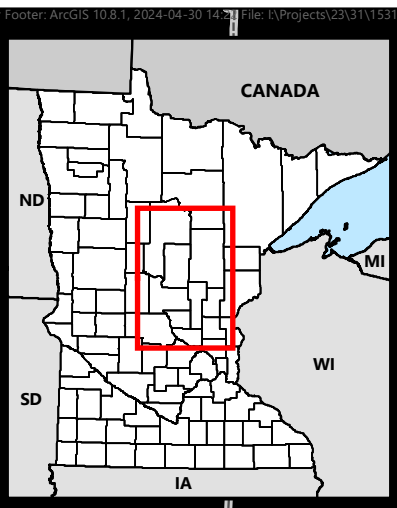
The Tamarack Lowlands Subsection is characterized by level to gently rolling topography. Major landforms include a lake plain (Glacial Lake Upham Plain) and a till plain (Aurora Till Plain) around the edges of the lake plain. Soils in the subsection include extensive areas of peat over both fine-textured (silt and clay-rich) and sandy lacustrine deposits. Presently, much of the land is in public ownership. Forestry and tourism, along with some agriculture, are the most common land uses (reference (18)).

The St. Louis Moraines Subsection is characterized by rolling to steep slopes, with end moraines representing the dominant landform. The subsection is dominated by loamy calcareous soils. Forestry and tourism are the major land uses in the subsection (reference (18)).

The Pine Moraines and Outwash Plains Subsection is characterized by a mix of end moraines, outwash plains, till plains, and drumlin fields. Soils in the subsection are predominantly coarse to moderately coarse in texture (sands and sandy loams). Current land uses include tourism, forestry, and some agriculture (reference (18)).

The Mille Lacks Uplands Subsection is characterized by gently rolling till plains and drumlin fields. Soils in the subsection are described as acid, stony, reddish sandy loams, silt loams, and loamy sands. Presently, forestry, recreation, and agriculture are the most common land uses (reference (18)).

The Anoka Sand Plain Subsection is characterized by small dunes, kettle lakes, and tunnel valleys that create level to gently rolling topography. Sandy terraces are found along the Mississippi River and its tributaries throughout the subsection. Soils in the subsection are generally sandy, droughty upland soils with some organic soils in ice block depressions and tunnel valleys and poorly drained prairie soils along the Mississippi River. Urban development and agriculture are the dominant land uses (reference (18)).



Nashwauk Uplands
Iron Range Substation
Grand Rapids
Chippewa Plains
Itasca County
Cass County
St. Louis Moraines
Tamarack Lowlands
Saint Louis County
Pine Moraines & Outwash Plains
Wadena County
Crow Wing County
Aitkin County
Carlton County
Cuyuna Series Compensation Station
Brainerd
Todd County
Morrison County
Little Falls
Mille Lacs Uplands
Mille Lacs County
Pine County
Kanabec County
Hardwood Hills
Benton County
Benton County Substation
Isanti County
Chisago County
Sartell
Sauk Rapids
Waite Park
Saint Cloud
Stearns County
Cambridge
Anoka Sand Plain
Minnesota River Prairie
Sherburne County
Sherco Substation
Anoka County
St. Paul-Baldwin Plains
East Bethel
Meeker County
Big Woods
Monticello
Elk River

Applicants' Proposed Route
Route Alternative
Alignment Alternative
Benton County Substation
Iron Range Substation
Sherco Substation
Cuyuna Series Compensation Station

Ecological Classification Subsection

Anoka Sand Plain
Big Woods
Chippewa Plains
Hardwood Hills
Mille Lacs Uplands
Minnesota River Prairie
Nashwauk Uplands
Pine Moraines & Outwash Plains
St. Louis Moraines
St. Paul-Baldwin Plains
Tamarack Lowlands

0 5 10 15
Miles

Map 5-1

ECOLOGICAL CLASSIFCATION SYSTEM
Northland Reliability Project

5.3 Human Settlements

Transmission lines have the potential to negatively impact human settlements through a variety of means. Transmission line structures and conductors could change the aesthetics of an area, displace homes or businesses, introduce new noise sources, lower property values, be incompatible with local zoning, and/or interfere with electronic communications.

Impacts to human settlements resulting from the project are anticipated to range from minimal to significant depending on the route selected. Impacts to human settlements could be minimized by prudent routing (i.e., by choosing routes and alignments that avoid residences, businesses, and other places where citizens congregate). Impacts could also be mitigated by limiting the aesthetic impacts of the structures themselves and by using structures which are, to the extent possible, harmonious with human settlements and activities.

5.3.1 Aesthetics

The aesthetic and visual resources of a landscape are defined as the existing natural and built features which affect the visual quality and character of an area. Determining the relative scenic value or visual importance in any given area depends, in large part, on the individual viewer, or community of viewers, whose perceptions are shaped by their values and experiential connection to the viewing area, as well as their physical relationship to the view, including distance to structures, perspective, and duration of the view.

For the purpose of this EA, it is assumed that landscapes which are, for the average person, harmonious in form and use are generally perceived as having greater aesthetic value. Infrastructure which is not harmonious with a landscape or affects existing landscape features, reflects a change in the aesthetic view that for some, or many, could negatively affect a viewer's perception and expectation of the area. Assessing visual quality reflects the difference between the landscape change and the individual or communal reaction to that change. As noted above, individual or communal perspectives are complex, affected by individual or shared values and experiences with the land. As such, some viewers may perceive the project setting as having high visual quality while others may perceive the area to have less visual quality.

The northern portion of the project, which includes the Iron Range Substation Region and the Hill City to Little Pine Region, is characterized by a rural, forested, and generally undeveloped environment. Viewsheds in this area are characterized by forests and undeveloped land (i.e., land in a natural state that is devoid of man-made improvements).

The existing landscape in the central portion of the project, which includes the Cole Lake-Riverton Region, the Long Lake Region, and the Morrison County Region, is also rural. There is more agricultural land in the central portion of the project, and dominant natural features in the landscape include numerous lakes including Hay Lake, Upper South Long Lake, and South Long Lake. As the project moves further south it is characterized by nearly level to gently rolling plains used as agricultural lands (crop and pasture). Viewsheds in this area are generally broad and uninterrupted.

The southern portion of the project, which includes the Benton County Elk River Region and the Sherburne County Region, is characterized by agricultural land located on nearly level to gently rolling plains. Toward the southern terminus of the project, the setting transitions to one that is more suburban

and developed, and also contains more topographic relief. Viewsheds in these areas are more limited and frequently interrupted by buildings, businesses, and streets.

The project is also shaped by a built environment, where existing transmission line rights-of-way, highways, and county roads, referred to as “horizontal elements,” are consistent throughout the project length.

5.3.1.1 Potential Impacts and Mitigation Measures

The project’s transmission line structures and conductors would create aesthetic impacts. These impacts are anticipated to be minimal to moderate. The degree of these impacts depends on:

- Proximity to homes, schools, churches, etc., where relatively more observers are present to experience aesthetic impacts. Map Book 5A provides an overview of residences and other buildings near the routing alternatives proposed for the project. These nearby residences and potential aesthetic impacts of specific routing alternatives are discussed further in Chapters 6 and 7.
- The presence of terrain and vegetation that could shield views of the transmission line and the preservation of such vegetation.
- The types of structures and structure designs used for the project.
- Use of existing ROW where the project would have an incremental impact relative to existing human modifications to the landscape (i.e., putting like with like). The ability of ROW sharing to mitigate potential aesthetic impacts of specific route alternatives is discussed further in Chapters 6 and 7.

The primary strategy for minimizing aesthetic impacts is prudent routing—that is, choosing routes where a transmission line is most harmonious with the landscape. Other minimization and mitigation measures include:

- Maximizing ROW sharing with existing linear rights-of-way (e.g., transmission lines, roadways, and railroads) to minimize incremental aesthetic impacts.
- Avoiding routing through areas with high-quality, distinctive viewsheds.
- Crossing rivers and streams using the shortest distance possible (i.e., perpendicular to the waterbody).
- Reducing structure heights to minimize impacts within scenic areas.
- Using structures and structure designs that minimize impacts.
- Using construction methods that minimize damage to vegetation near the transmission line.
- Placing structures to take advantage of existing natural screening to reduce the view of the line from nearby residences and roadways.
- Avoiding placing structures directly in front of residences.

- Including specific conditions in individual easement agreements with landowners along the route (e.g., requiring new plantings or landscaping).
- Using the protections of Minnesota Statute 216E.12, subdivision 4 (commonly known as the “Buy the Farm” statute), where available, to move residents away from potential aesthetic impacts.

5.3.2 Property Values

Property values have the potential to be affected by the placement of nearby transmission lines. Prior research has found that potential impacts to property values due to transmission lines are generally connected to three main factors. First, how the transmission line affects the viewshed and aesthetics of a property. Second, the real or perceived risks that buyers have of EMF. Third, the effects to agricultural production on properties that are used for farming operations.

The aforementioned factors play one role in the many interconnecting factors that affect property values. Because of this, it is difficult to measure how much and all the different ways that transmission lines and property values are correlated. A variety of methodologies have been used to research the relationship between transmission lines and property values. Some general conclusions can be drawn from this body of literature. This chapter highlights relevant outcomes of property value research with additional detail provided in Appendix G.

Research does not support a clear cause-and-effect relationship between property values and proximity to transmission lines, but has revealed trends that are generally applicable to properties near transmission lines:

- When negative impacts on property values occur, the potential reduction in value is in the range of 1 to 10 percent.
- Property value impacts decrease with distance from the line; thus, impacts are usually greater on smaller properties than on larger ones.
- Negative impacts diminish over time.
- Other amenities, such as proximity to schools or jobs, lot size, square footage of the home, and neighborhood characteristics, tend to have a greater effect on sale price than the presence of a transmission line.
- The value of agricultural property decreases when transmission line structures interfere with farming operations.

5.3.2.1 Potential Impacts and Mitigation Measures

Property value impacts could be mitigated by minimizing aesthetic impacts, perceived EMF health risks, and agricultural impacts. This can be achieved by selecting alignments that maximize the use of existing ROW and that place the transmission line away from residences and out of agricultural fields. There is potential for impacts to be mitigated by including specific conditions in individual landowner easement agreements along the transmission line. Impacts could also be mitigated by using the protections offered through Minnesota Statute 216E.12 (commonly known as the “Buy the Farm” statute), where available, to move away from potential property value impacts.

5.3.3 Zoning and Land-Use Compatibility

Minnesota authorizes counties and cities to create their own zoning ordinances to implement and work in conjunction with their comprehensive plans. Zoning is a method to regulate the way land is used and create patterns in the way they are used. Zoning is a regulatory device used by local governments to geographically restrict or promote certain types of land uses. Minnesota statutes provide local governments with zoning authority to promote public health and general welfare.

This project is subject to Minnesota's Power Plant Siting Act (Minn. Statute 216E). Under this statute, the route permit issued for a transmission line (Minn. Statute 216E.10):

> *shall be the sole site or route approval required to be obtained by the utility. Such permit shall supersede and preempt zoning restrictions, building or land use rules, regulations or ordinances promulgated by regional, county, local and special purpose government.*

Therefore, the applicants are 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 transmission line routes.

Land cover along the project consists primarily of upland and wetland forests, open and shrub wetlands, and herbaceous agricultural vegetation, consisting of cultivated cropland and hay and pastureland. Several parcels of land under federal, state, county, and municipal ownership are found along the project route, but most of the parcels are under private ownership. Several state conservation easement lands are also found throughout the project.

The project would cross, from north to south, Itasca, Aitkin, Crow Wing, Cass, Morrison, Benton, and Sherburne counties (Map Book 5B). The closest cities to the project include Hill City, Riverton, Trommald, Ironton, Harding, Lastrup, St. Cloud, and Becker. The project route primarily crosses agricultural and farm residential zoning areas with scattered zoned areas of public and open land, single family residential, and natural environment.

In all referenced counties with the exception of Cass, the project passes through shoreland overlay districts. Minnesota Statutes Chapter 103F defines shoreland areas and describes limitations on uses and locations of structures in those areas. These limitations are established through special land use provisions to maintain and restore the natural beauty and attractiveness of shoreland and to provide environmental protection for the water resources.

The project route runs primarily through public and farm residential zoning districts within Itasca County. According to the Itasca County Zoning Ordinance and Itasca County Comprehensive Land Use Plan, transmission lines are considered essential services and are permitted uses within both (reference (19)). The following townships are along the project route in Itasca County: Trout Lake, Little Sand Lake, Blackberry, Wildwood, and Splithand. These townships defer to the zoning regulations of Itasca County.

Within Aitkin County, the project runs primarily through public, farm residential, natural environment, open and shoreland zoning districts. The Aitkin County Comprehensive Plan and Aitkin County Zoning Ordinance consider transmission lines to be an essential service and are a permitted use in all zoning districts (reference (20)). The project goes through the following townships: Northwest Aitkin, Macville, and Hill Lake. These townships defer to Aitkin county's zoning districts. The project goes through a small

portion of city of Hill City in Aitkin County that is zoned as multi-family residential, where essential services are permitted.

In Crow Wing County the project route travels primarily through shoreland, forestry, agricultural, and rural residential districts. The Crow Wing County Comprehensive Plan and Zoning Ordinance state that transmission lines are considered a permitted or conditional use within these districts (reference (21). The project goes through the following townships within Crow Wing County: Ross Lake, Fairfield, Perry Lake, Wolford, Center, Nokay Lake, Maple Grove, Oak Lawn, Irondale, Long Lake, Little Pine, Center, and Platte Lake. These townships defer to Crow Wing county's zoning districts.

The project is in the rural residential zoning district within Morrison County. The Morrison County Comprehensive Plan and Land Use Control Ordinance consider transmission lines as a permitted use within this district (reference (22)). The project route is within the following townships: Pulaski, Harding, Granite, Pierz and Buckman. These townships defer to Morrison county's zoning districts.

The project route runs through primarily agricultural and rural service zoning districts in Benton County. The Benton County 2040 Comprehensive Plan and the Benton County Ordinance consider transmission lines to be essential services and are a permitted use in these zoning districts (reference (23)). In Benton County the project goes through Graham, Mayhew Lake, Saint George and Minden Townships. The project extends through a small portion of the city of St. Cloud in Benton County. The land is zoned as single family residential, where the project would be considered an essential service and a permitted use (reference (24)).

The project route travels primarily through agricultural and general rural zoning districts in Sherburne County. Transmission lines are considered a permitted or conditional use in these zoning districts (reference (25)). The route goes through the following townships within the county: Haven, Palmer, and Becker.

In Cass County the project route crosses public land in Beulah Township. The project is considered an essential service and allowed in all zoning and land use districts (reference (26)). In Becker Township the project goes through the agriculture, general rural, industrial, and heavy industrial districts. Transmission lines are considered to be public utilities and a permitted use in these zoning districts, per the township zoning code (reference (27)).

The City of Becker, within Sherburne County, has its own zoning districts per their zoning code (reference (28)). The project primarily crosses through residential and industrial zoning districts. Transmission lines are considered a public utility per their zoning code and are a permitted or conditional use. Xcel Energy and the City of Becker conducted an Alternative Urban Area-Wide Review (AUAR) of land adjacent to the Sherco Power Plant in Becker in January 2023. Xcel Energy and the City of Becker collaborated on the AUAR to explore options that would benefit existing infrastructure, support community development, and replace some of the tax base that would be lost when Xcel Energy's Sherco coal-fired power plant closes. The AUAR would result in 2,177 acres of land owned partially by Xcel Energy and partially by the City of Becker and Becker Township to transition into mostly industrial zoning districts (reference (29)).

5.3.3.1 Potential Impacts and Mitigation Measures

Potential project impacts to local zoning may be minimal to significant, depending on the project route selected. Potential impacts include reduced property values and taxes, incompatibility with land uses or planned community growth, and impacts to otherwise protected natural resources. The project is

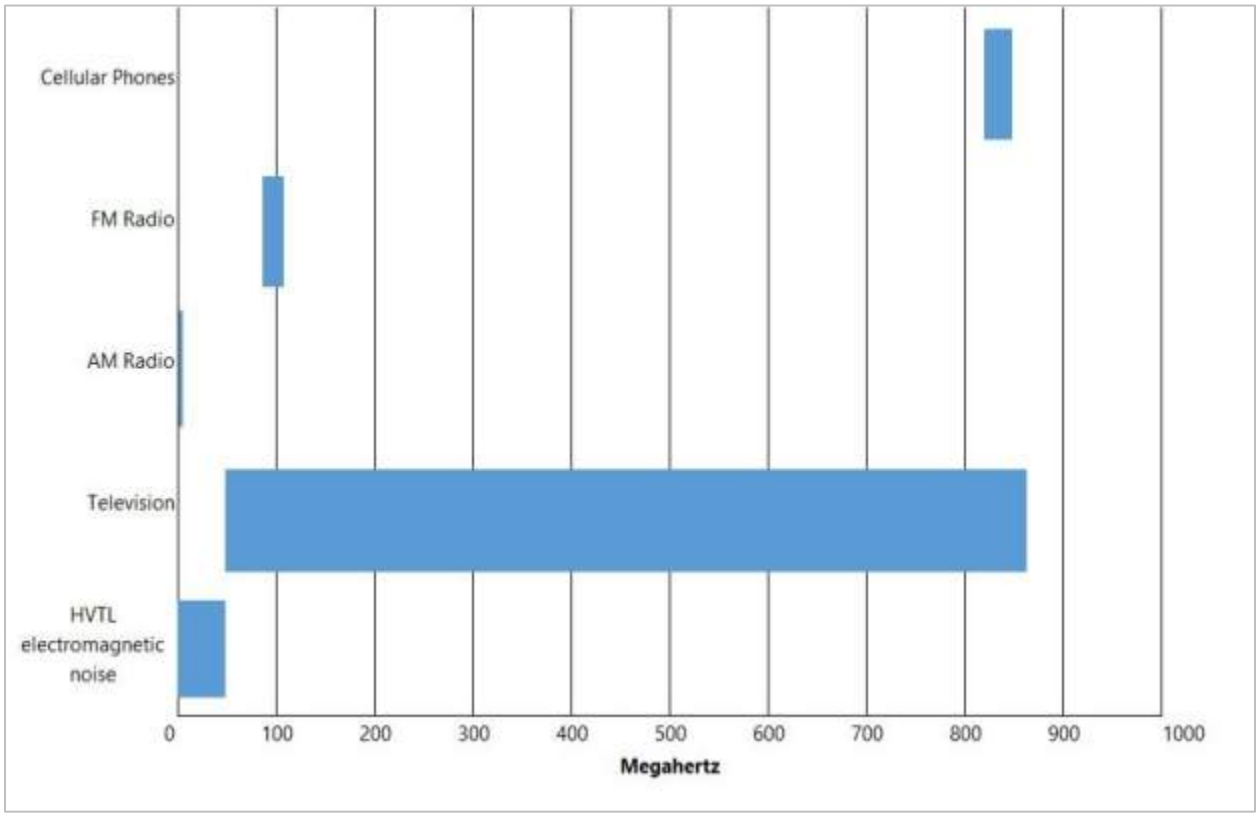
generally compatible with zoning in the more rural, agricultural areas. The project is less compatible with zoning and community planning in the shoreland district areas and more urban parts of Becker.

Project impacts to zoning and to current and future land uses can be mitigated by selecting routes and alignments that are compatible, to the extent possible, with community zoning and land-use plans. Land-use impacts can be mitigated by minimizing aesthetic impacts of the project, to the extent that zoning and land-use plans address aesthetics (e.g., landscaping). Land-use impacts can also be mitigated by using existing ROW to the maximum extent possible.

5.3.4 Electronic Interference

Electronic interference refers to a disturbance in an electronic signal that can impair the proper functioning of an electronic device. Transmission lines do not generally cause interference with radio, television, cellular phone, global position systems (GPS) or other communication signals and reception. Information on medical electronic devices is discussed in Chapter 5.5.2. Figure 5-1 compares the spectrum of transmission frequencies for several communication and media signals to the peak intensity disturbance associated with electromagnetic noise from transmission lines. Additional discussion is provided below for each major type of media or communication signal.

Figure 5-1 Frequencies of Electronic Communications and of Electromagnetic Noise Created by Transmission Lines



Source: references (30), (31), (32)

5.3.4.1 Radio and Television

Generally, transmission lines do not cause interference with radio and television (reference (33)). There are three potential sources for interference that are rare but do exist. These include gap discharges, corona discharges, and shadowing and reflection effects.

Gap discharge interference is the most noticed form of power line interference with radio and television signals, and typically the most easily fixed. Gap discharges are usually caused by hardware defects or abnormalities on a transmission or distribution line causing small gaps to develop between mechanically connected metal parts. As sparks discharge across a gap, they create the potential for electrical noise, which can cause interference with radio and television signals. The degree of interference depends on the quality and strength of the transmitted communication signal, the quality of the receiving antenna system, and the distance between the receiver and the power line. Gap discharges are usually a maintenance issue, since they tend to occur in areas where gaps have formed due to broken or ill-fitted hardware (clamps, insulators, brackets). Because gap discharges are a hardware issue, they can be repaired relatively quickly once the issue has been identified.

Corona from transmission line conductors can also generate electromagnetic noise at the same frequencies that radio and television signals are transmitted, as shown in Figure 5-1. The air ionization caused by corona generates audible noise, radio noise, light, heat, and small amounts of ozone (O_3). The potential for radio and television signal interference due to corona discharge relates to the magnitude of the transmission line-induced radio frequency noise compared to the strength of the broadcast signals. Because radio frequency noise, like EMF, becomes significantly weaker with distance from the transmission line conductors, very few practical interference problems related to corona-induced radio noise occur with transmission lines. In most cases, the strength of the radio or television broadcast signal within a broadcaster's primary coverage area is great enough to prevent interference.

If interference occurs for an AM radio station within a station's primary coverage area where good reception existed before the project was built, reception can be regained by adjusting or moving the receiving antenna system. Interference is unlikely to occur for AM radio frequencies, except for immediately under a transmission line, and interference would dissipate rapidly with increasing distance from the line.

FM radio receivers usually do not pick up interference from transmission lines because corona-generated radio frequency noise currents decrease in magnitude with increasing frequency and are quite small in the FM broadcast band (88-108 Megahertz) (Figure 5-1). Also, the interference rejection properties inherent in FM radio systems make them fairly immune to amplitude type disturbances.

Because the United States has transitioned from analog to digital broadcasting, the potential for television interference from radio frequency noise is unlikely. Digital reception is considerably more tolerant of noise than analog broadcasts. Due to the higher frequencies of television broadcast signals (54 megahertz and above), a transmission line seldom causes reception problems within a station's primary coverage area. In the rare situation where the project may cause interference within a station's primary coverage area, the problem can usually be corrected with the addition of an outside antenna.

Shadowing effect comes from physically blocking communication signals and can impact two-way mobile radio communications and television signals. Television interference due to shadowing and reflection effects is rare but may occur when a large transmission structure is aligned between the receiver and a weak distant signal, creating a shadow effect. In the rare situation where the project may cause

interference within a station's primary coverage area, the problem can usually be corrected with the addition of an outside antenna. 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, the applicants would 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.

5.3.4.2 Internet and Cellular Phones

Wireless internet and cellular phones use frequencies in the 900 MHz ultra-high frequency (UHF) range—a range for which impacts from corona-generated noise are anticipated to be negligible. If internet service at a residence or business is provided by a satellite antenna, this service could be impacted by a line-of-sight obstruction. As with other satellite reception, any interference due to an obstruction could be resolved by moving the satellite antenna to a slightly different location.

5.3.4.3 Global Positioning Systems

GPS works by sending radio-frequency signals from a network of satellites to the receiver. Because of this, buildings, trees, and other physical structures have the potential to interfere with a GPS signal. Research has evaluated the potential for interference in the use GPS satellite-based microwave signals under or near power line conductors. Results of this research indicates it is unlikely that there would be electronic interference while using GPS (reference (34)). Interference would be more likely near a transmission line structure, and unlikely under a transmission line (reference (34)).

5.3.4.4 Potential Impacts and Mitigation Measures

No impacts to electronic devices are anticipated. Interference due to line-of-sight obstruction could occur in select areas but could be mitigated by prudent placement of transmission line poles and electronic antennas. In situations where interference with electronic devices does occur and is caused by the presence or operation of the transmission line, route permits issued by the Commission require permittees to take those actions which are feasible to restore electronic reception to pre-project quality (Appendix H).

5.3.5 Displacement

Displacement is the removal of a residence or building to facilitate the operation of a transmission line. For electrical safety code and maintenance reasons, utilities generally do not allow residences or other buildings within the transmission line ROW. Any residences or other buildings located within a proposed ROW are generally removed or displaced. Displacements are relatively rare and are more likely to occur in more populated areas where avoiding all residences and businesses is not always feasible.

Displacements can be avoided through several means including structure placement, the use of specialty structures, and modifications of the ROW width. The applicants indicated in their route permit application that they are committed to working with landowners to design adequate clearances from buildings and to address landowner concerns. Though the general rule is that buildings are not allowed within the transmission line ROW, there are instances where the activities taking place in these buildings are compatible with the safe operation of the line. The proximity of the line to buildings along specific routing alternatives is discussed further in Chapter 6 and 7.

5.3.5.1 Potential Impacts and Mitigation Measures

There are no churches, schools, daycares, or nursing homes within the rights-of-way of the routing alternatives for the project. There are up to 20 residences and 59 non-residential buildings (e.g., agricultural outbuildings or animal production structures) within these rights-of-way.

5.3.6 Noise

Noise is generally defined as unwanted sound. Noise levels are measured in units of decibel (dB) on a logarithmic scale and can be used to compare a wide range of sound intensities. Certain sound frequencies are given more weight since human hearing is not equally sensitive to all frequencies. The A-weighted decibel scale (dBA) scale accounts for the sensitivity of the human ear. (Table 5-2). Due to the logarithmic dBA, a noise level of 70 dBA is approximately twice as loud as a 60 dBA sound to the average human hearing.

Table 5-2 Common Noise Sources and Levels

Sounds Pressure Levels (dBA)	Common indoor and outdoor noises
110	Rock band at 5 meters
100	Jet flyover at 300 meters
90	Chainsaw or gas lawnmower at 1 meter
85	Typical construction activities
80	Food blender at 1 meter
70	Vacuum cleaner at 3 meters
60	Normal speech at 1 meter
50	Dishwasher in the next room
40	Library
30	Bedroom
20	Quiet rural nighttime

Source: Minnesota Rule 7030

The MPCA has developed protective standards for daytime and nighttime noise levels that vary based on land use at the location where the sound is heard (noise area classification, NAC). All project noises must be within the MPCA noise standards (Table 5-3). The noise standards are expressed as a range of permissible dBA over the course of a 1-hour period; L50 is the dBA that may be exceeded 50 percent of the time within an hour, while L10 is the dBA that may be exceeded 10 percent of the time within 1 hour (Minnesota Rule 7030).

Table 5-3 MPCA Noise Limits by Noise Area Classification

Noise Area Classification (NAC)	Daytime (dBA)L10	Daytime (dBA)L50	Nighttime (dBA)L10	Nighttime (dBA)L50
NAC 1: Residential and Other Sensitive Uses	65	60	55	50
NAC 2: Non-Residential Uses (retail, business and government services, recreational activities, transit passenger terminals)	70	65	70	65
NAC 3: Non-Residential Uses (manufacturing, fairgrounds and amusement parks, agricultural and forestry activities)	80	75	80	75

The primary project noise receptors are residences. Residences are in noise area classification 1 (NAC 1). Noise receptors could also include individuals working outside or using recreational facilities along the project. For most of the project, ambient noise levels are in the range of 30 to 50 dBA, with temporary, higher noise levels associated with wind, vehicular traffic, and the use of gas-powered equipment (e.g., tractors, chain saws).

Community noise levels are usually closely related to the intensity of human activity. Noise levels are generally considered low when below 45 dBA, moderate in the 45 to 60 dBA range, and high above 60 dBA (see Table 5-2). In rural areas, noise levels can be below 35 dBA. In small towns or wooded and lightly used residential areas, noise levels are more likely to be around 50 or 60 dBA. Levels around 75 dBA are more common in busy urban areas, and levels up to 85 dBA occur near major freeways and airports.

5.3.6.1 Potential Impacts and Mitigation Measures

Potential noise impacts from the project can be grouped into three categories: construction noise, transmission line noise, and substation noise.

5.3.6.1.1 Construction Noise

During project construction, 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 noise could temporarily affect residences, schools, businesses, libraries, parks, recreational areas, and related public spaces that are close to the ROW. Any exceedances of the MPCA daytime noise limits would be temporary in nature and no exceedances of the MPCA nighttime noise limits are expected for the project.

5.3.6.1.2 Transmission Line Noise

Noise from transmission lines (electrical conductors) is due to small electrical discharges which ionize surrounding air molecules. The level of noise from these discharges depends on conductor conditions, voltage levels, and the weather conditions. Noise emissions are greatest during heavy rain events when the 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 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. Noise levels are anticipated to be within Minnesota noise standards (i.e., < 50 dBA), and would only be perceptible when ambient noise levels in the project area fall below 40 dBA.

The applicants modeled potential noise levels associated with the project. Corona noise levels were calculated using the audible noise module of CFI8X, a corona noise model created by Bonneville Power Administration. CFI8X calculates audible noise levels due to corona at different distances from the transmission line centerline, expressed as L_{50} noise levels in A-weighted decibels. Calculated audible noise levels associated with the various transmission line structure configurations of the project are provided in Table 5-4 for the edge of ROW (reference (6)).

Where the project parallels existing transmission lines, the presence of another energized line nearby will affect the audible noise profile around the parallel lines. Therefore, the predicted audible noise associated with the various scenarios where the project's new transmission line parallels existing transmission lines are also given in Table 5-4.

Because audible noise is primarily related to the transmission line's electric field, and electric fields are particularly dependent on the voltage of the transmission line, the values in Table 5-4 were calculated at the lines' maximum continuous operating voltage. Maximum continuous operating voltage is generally defined for the project and adjacent transmission lines as the nominal voltage plus 10 percent Values were calculated assuming minimum conductor-to-ground clearance (that is, at mid-span) and a height of 1 meter above ground (reference (6)).

Table 5-4 Calculated L_{50} Audible Noise for the Project

Project Configuration with Existing Transmission Lines	Configuration	Line Voltage	L50 Noise Levels at Edge of Right-of- Way (dBA)
Project alone	Project: Double-Circuit 345 kV	379.5 kV	43.9
Project parallel 92 Line	Existing: 230 kV H-frame Project: Double-Circuit 345 kV	253 kV 379.5 kV	49.8
Project parallel 92 Line & 11 Line	Existing: 115 kV H-Frame Existing: 230 kV H-frame Project: Double-Circuit 345 kV	126.5 kV 253 kV 379.5 kV	49.0
Project parallel 92 Line & 11 Line & 13 Line	Existing: 115 kV H-Frame Existing: 115 kV H-Frame Existing: 230 kV H-frame Project: Double-Circuit 345 kV	126.5 kV 126.5 kV 253 kV 379.5 kV	48.9
Project parallel MR Line & 12 Line	Existing: 115 kV H-Frame Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	126.5 kV 253 kV 379.5 kV	48.9
Project parallel RW Line	Project: Double-Circuit 345 kV Existing: 69 kV Monopole	379.5 kV 75.9 kV	47.8
Project parallel MR Line	Project: Double-Circuit 345 kV Existing: 230 kV H-Frame	379.5 kV 253 kV	49.9
Project parallel MR Line & BP Line	Project: Double-Circuit 345 kV Existing: 69 kV Monopole Existing: 230 kV H-Frame	379.5 kV 75.9 kV 253 kV	49.3
Project parallel MRX Line double-circuit & BP Line	Project: Double-Circuit 345 kV Existing: 69 kV Monopole Existing: Double-Circuit 230 kV	379.5 kV 72.5 kV 241.5 kV	49.6
Project Rebuild: triple circuit EW Line	Project: Triple-Circuit 345 kV with 69 kV	379.5 kV 75.9 kV	46.5
Project Reconfiguration GRE-BS Line and MR Line	Project: 345 kV Monopole Project: Double-Circuit 345 kV	362.3 kV 362.3 kV	48.9

Source: reference (6)

As indicated in Table 5-4, 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. Modeling results in Table 5-4 indicate that project-related audible noise is expected to be within the most stringent MPCA noise standards for all transmission line configurations.

5.3.6.1.3 Substation Noise

Transformers and switchgear operation are the common noises associated with a substation. Noise emissions from this equipment have a tonal character that often sound like a hum or a buzz that corresponds to the frequency of the AC. Transformers produce a consistent humming sound, resulting from magnetic forces within the transformer core. This sound does not vary with transformer load. Switchgear produces short-term noises during activation of circuit breakers; these activations are infrequent.

The project includes expanding the existing Iron Range and Benton County Substations and the construction of a new Cuyuna Series Compensation Station. The applicants indicate that the additions will be designed such that MPCA noise limits will be met at the edge of the substation property. Accordingly, noise levels associated with the substations at receptors outside of the substation property (e.g., residences near the substations), will be within Minnesota noise standards.

5.3.6.1.4 Summary

Project noise impacts are anticipated to be minimal and within Minnesota's noise standards. Operational noise levels for the project are anticipated to be within state standards; however, the project would introduce a new noise source that, in certain situations (e.g., a calm evening) may be heard by residents in the project area. The primary means of mitigating this noise impact is selecting routing options that avoid areas where residents live, work, and congregate. Noise impacts from substation operations could also be mitigated by natural or built sound barriers (e.g., berms or plantings). Route permits issued by the Commission require compliance with Minnesota's noise standards.

5.3.7 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 traverses land that has been home to a variety of persons and cultures. Major infrastructure projects can be inconsistent with the cultural values of an area, resulting in a deterioration of a community's shared sense of self.

In the early to mid-1800s, the area was populated primarily by Dakota Sioux and Ojibwe peoples. By the mid-1800s, Canadian, French, and British fur traders began settling in this area. A large wave of European immigrants arrived around 1850, these settlers were primarily of German, Norwegian, Swedish, Dutch, and British heritage (reference (35)).

Cultural values are also informed by the work and recreation of residents and by geographical features. The project setting is primarily rural and agricultural. Farming and the ability to continue to farm and support livelihoods through farming tend to be strong values in these types of settings. Various recreational opportunities, including fishing, hunting, and snowmobiling, are also available near the project. These opportunities are supported by a variety of natural resources, including lakes, rivers, parks, and WMAs (reference (36)).

5.3.7.1 Potential Impacts and Mitigation Measures

Project impacts to cultural values are anticipated to be minimal. The project would not adversely impact the work of residents that underlie the area's cultural values, nor is it anticipated to adversely impact geographical features that inform these values. Potential impacts to recreation that may also impact cultural values are discussed in Chapter 5.7.

5.3.8 Socioeconomics

Socioeconomic factors provide an indication of how economic activity affects and is shaped by social processes. Socioeconomic measures indicate how societies progress, stagnate, or regress because of their actions and interactions within and between the local, regional, or global economic scales. Transmission line projects contribute to growth and progress at the local level over time; therefore, socioeconomic impacts of the project are anticipated to be positive.

Approximately 75-100 workers would be required for transmission line and substation construction. Transmission line and substation construction are anticipated to begin in the summer/fall of 2025 and be in service by June 2030. The project would generate minor, short-term positive economic impacts, driven by increased construction activity and the influx of contractor employees. Contractors would be used for all construction activities. Local businesses would likely experience short-term positive economic impacts through the use of the hotels, restaurants, and other services used by contractors during construction. In addition, construction materials, such as concrete, may be purchased from local vendors where feasible.

5.3.8.1 Potential Impacts and Mitigation Measures

The project would improve the socioeconomics of the region through the creation of jobs, generation of tax revenue, and providing more reliable electrical service to the surrounding communities.

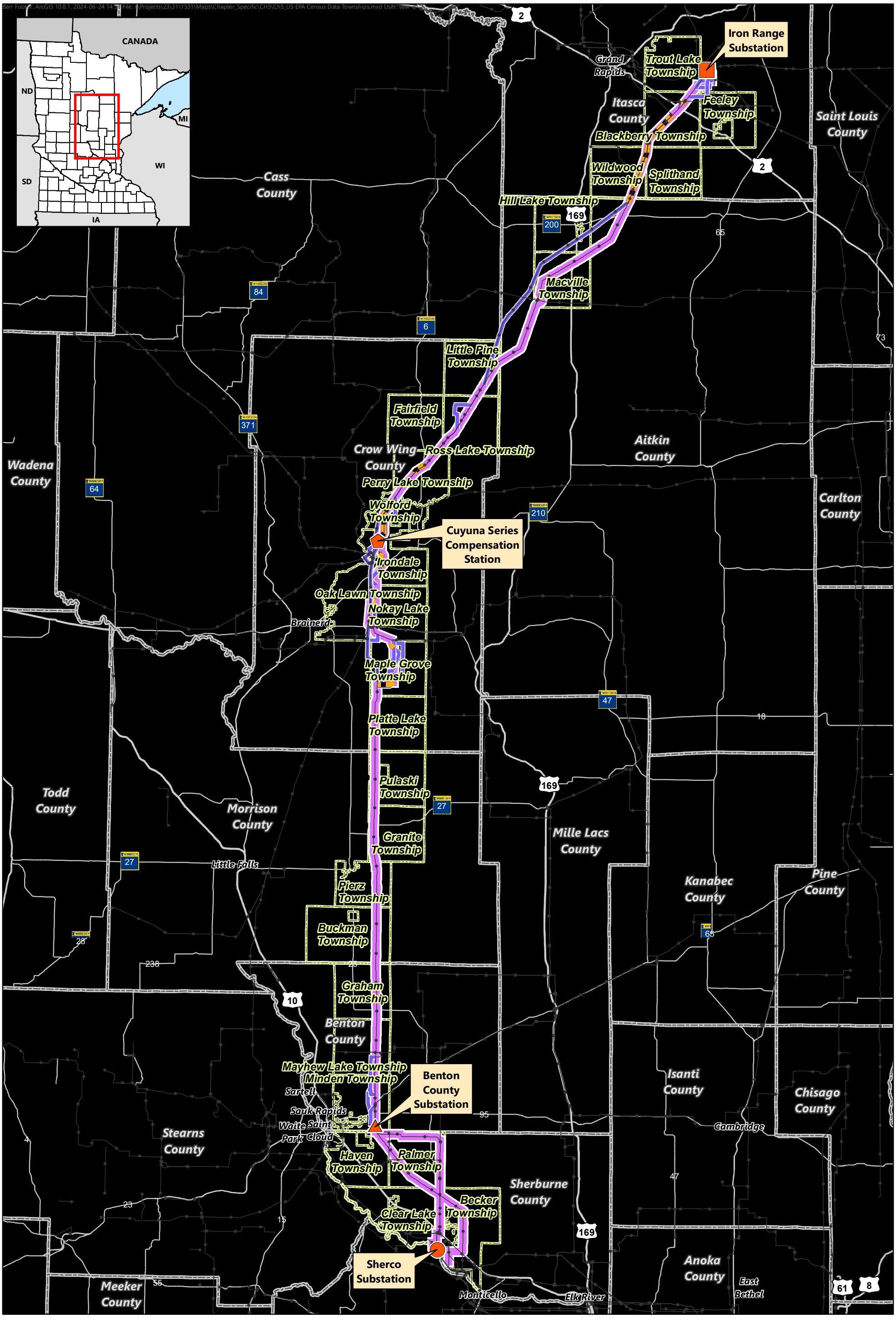
5.3.9 Environmental Justice

Utility infrastructure can adversely impact low-income, minority, or tribal populations. Environmental justice is the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (reference (37))." The goal of this fair treatment is to identify potential disproportionately high and adverse effects from implementation of the project and identify alternatives that may mitigate these impacts (reference (38)).

Minn. Statute 216B.1691 was recently updated to reflect the definition of an EJC. The data defines eight townships within the project as being an EJC area based on the population residing in that township. This means that eight of the townships contain one of the following:

- 40 percent or more nonwhite populations
- 35 percent or more households with income ≤ 200 percent of the poverty level
- 40 percent or more residents with limited English proficiency
- Indian country (Minn. Statute 216B.1691)

Communities with EJCs were identified on a regional basis, comparing data for the townships intersected by the project with average data for the State of Minnesota. Data compiled from the 2020 U.S. Census is summarized in Table 5-5. Townships where census data was analyzed in relation to the project are shown on Map 5-2.



Applicants' Proposed Route
Route Alternative
Alignment Alternative
Existing Transmission Line
Benton County Substation
Iron Range Substation
Sherco Substation
Cuyuna Series Compensation Station
Civil Township

0 5 10 15
Miles

Map 5-2

US EPA CENSUS DATA TOWNSHIPS
Northland Reliability Project

Table 5-5 Census Data Summary

County	Area	Percent Below Poverty	Median Household Income	Total Township Population	Total Individuals with Income Below 200% of Poverty Level (Percent of Population)[1]	Percent Minority	Percent Non-English Spoken at Home
--	State of Minnesota	9.6	$82,338	5,599,770	1,238,999 (22)	23.0	22.0
Itasca County	Little Sand Lake Township	6.1	$56,667	269	41 (15)	2.9	0.0
	Trout Lake Township	9.0	$75,714	1,198	216 (18)	6.4	1.4
	Blackberry Township	1.0	$86,786	835	170 (20)	4.7	4.3
	Feeley Township	18.3	$76,250	290	72 (25)	3.9	2.2
	Splithand Township	11.7	$75,938	453	95 (21)	10.2	1.9
	Wildwood Township	5.9	$51,250	119	45 (38)[(2)]	8.9	0.0
Aitkin County	Hill Lake Township	8.5	$78,194	436	84 (19)	6.4	0.5
	Hill City	16.3	$43,125	510	243 (47) [(2)]	7.5	0.4
	Macville Township	23.3	$50,000	193	71 (36) [(2)]	6.4	0.0
	Northwest Aitkin Township	6.2	$51,970	292	64 (22)	5.6	0.0

County	Area	Percent Below Poverty	Median Household Income	Total Township Population	Total Individuals with Income Below 200% of Poverty Level (Percent of Population)[1]	Percent Minority	Percent Non-English Spoken at Home
Crow Wing County	Beulah Township	9.5	$46,250	95	44 (46) [(2)]	6.9	1.2
	Little Pine Township	16.7	Not available	66	31 (47) [(2)]	11.4	0.0
	Ross Lake Township	2.2	$100,625	228	62 (27)	0.06	0.4
	Fairfield Township	10.6	$67,500	293	48 (16)	2.5	1.4
	Perry Lake Township	3.8	$81,250	316	52 (16)	6.3	0.7
	Wolford Township	8.0	$89,375	387	71 (18)	5.7	1.3
	Trommald City	14.3	$50,729	106	63 (59) [(2)]	5.0	0.0
	Irondale Township	8.2	$71,250	1,142	268 (23)	6.1	0.0
	Riverton City	5.9	$57,083	136	50 (37) [(2)]	11.0	2.3
	Oak Lawn Township	6.9	$75,536	1,699	390 (23)	7.0	5.7
	Nokay Lake Township	11.0	$78,250	887	186 (21)	3.7	2.9
	Long Lake Township	6.1	$73,333	1,230	401 (32)	4.2	0.6
	Maple Grove Township	6.6	$73,646	650	131 (20)	7.7	0.8
Morrison County	Platte Lake Township	7.9	$93,750	355	68 (20)	3.1	2.1
	Pulaski Township	5.6	$61,875	268	71 (26)	1.6	6.3
	Harding City	19.4	$63,750	139	79 (56) [(2)]	5.6	4.4
	Granite Township	7.1	$75,694	453	95 (21)	3.2	1.0
	Pierz Township	6.0	$93,438	546	107 (20)	1.7	1.8
	Buckman Township	4.1	$93,750	790	122 (15)	5.3	3.5

County	Area	Percent Below Poverty	Median Household Income	Total Township Population	Total Individuals with Income Below 200% of Poverty Level (Percent of Population)[1]	Percent Minority	Percent Non-English Spoken at Home
Benton County	Graham Township	2.7	$111,250	586	68 (12)	5.6	1.3
	Mayhew Lake Township	8.0	$99,783	904	117 (13)	2.2	0.7
	Minden Township	1.6	$77,697	1,514	206 (14)	3.7	0.7
Sherburne County	Palmer Township	1.7	$101,150	2,512	304 (12)	4.9	1.0
	Becker Township	2.0	$128,207	5,461	334 (6)	5.1	0.7

Source: reference (39)
1 Counts of individuals do not include the margin of error listed in U.S. Census data.
2 Denotes meets the definition of EJC.

The Environmental Protection Agency (EPA) Environmental Justice Screening Tool (reference (37) was also used to evaluate a 0.25-mile buffer of the project routes to consider the composition of the affected area to determine whether low-income, minority or tribal populations are present and whether there may be disproportionately high and adverse human health or environmental effects on these populations. This tool suggests that the project population's exposure to environmental hazards is similar to, or less than, the state and national average exposure values across a range of variables.

5.3.9.1 Potential Impacts and Mitigation Measures

There are eight townships that meet the definition of communities with EJCs located within or adjacent to the project. No adverse or permanent impacts to the identified EJCs are anticipated, particularly because the routing alternatives proposed in/adjacent to these communities are areas where the project would parallel existing transmission line ROW. There are no known minority populations or low-income populations that would be adversely affected by the project. Thus, environmental justice impacts are not anticipated.

5.4 Transportation and Public Services

Transmission line projects have the potential to negatively impact public services (e.g., roads, utilities, and emergency services). These impacts are typically temporary in nature (e.g., the inability to fully use a road or utility while construction is in process). However, impacts could be more long term if they change the area in such a way that public service options are foreclosed or limited.

Chapters 5.4.1 through 5.4.4 summarize the project's potential impacts on local roadways, utilities, emergency services, and airports. Methods for mitigating these impacts are also summarized. Temporary impacts to public services resulting from the project are anticipated to be minimal. Long-term impacts to public services are also anticipated to be minimal, but impacts would depend on the route selected for the project. Transportation impacts for specific route alternatives are discussed further in Chapter 6.

5.4.1 Roadways/Railways

The project is located primarily in rural areas. St. Cloud is the largest city near the project and a roadway hub. Major roadways located along the project include U.S. Highways 10 and 2; Minnesota Highways 6, 18, 23, 25, 27, 95, 169, 200, and 210; as well as numerous other county, city, and township roads (Map 5-3). The population density near St. Cloud is considerably higher than most areas along the project; therefore, roadways in this area tend to have higher traffic volumes than roadways near the remainder of the project.

There is no passenger rail service near the project; however, several freight lines are present (Map 5-3). The Burlington Northern Santa Fe (BNSF) rail line intersects the project in three separate locations, once at the northern end near Grand Rapids, once in a central portion near Brainerd, and once at the southern end of the project near St. Cloud.

5.4.1.1 Potential Impacts and Mitigation Measures

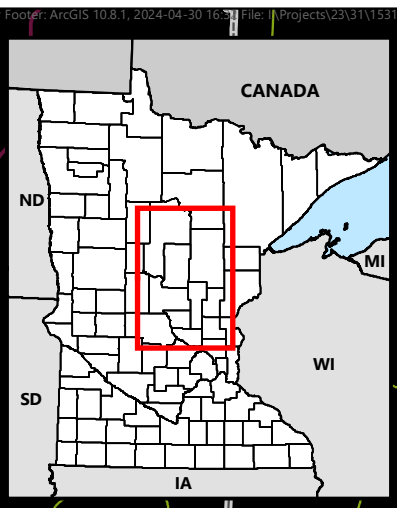
Construction could occasionally cause lanes or roadways to be closed, although these closures would only last for the duration of the construction activity in a given area. Construction equipment and delivery vehicles would increase traffic along roadways throughout project construction, with effects lasting from a few minutes to a few hours, depending upon the complexity and duration of the construction activities.

Drivers could experience increased travel times as a result. In cities, construction vehicles could temporarily block public access to streets and businesses.

The project could impact roadways and roadway users in several ways, including:

- Causing temporary traffic delays, detours, and congestion during construction.
- Interfering with future roadway expansions or realignments.
- Impairing the safe operation and maintenance of roadways.
- Causing safety risks during severe weather, where roadways are within the fall distance of transmission line structures.

Vehicles and equipment that would be used for construction of the transmission line (e.g., overhead line cranes, concrete trucks, construction equipment, and material delivery trucks) are generally heavier than passenger vehicles and may cause more damage to road surfaces. Oversized/overweight load permits must be obtained from the MnDOT when size and/or weight limits would be exceeded.



Iron Range Substation

Cuyuna Series Compensation Station

Benton County Substation

Sherco Substation

Grand Rapids
Itasca County
Saint Louis County
Cass County
Wadena County
Crow Wing County
Aitkin County
Carlton County
Brainerd
Todd County
Little Falls
Morrison County
Mille Lacs County
Kanabec County
Pine County
Benton County
Isanti County
Chisago County
Sartell
Sauk Rapids
Waite Park
Saint Cloud
Cambridge
Stearns County
Sherburne County
Meeker County
Monticello
Elk River
Anoka County
East Bethel

2 169 200 65 84 6 371 64 210 73 27 47 18 25 238 10 95 4 23 15 55 61 8

Applicants' Proposed Route
Route Alternative
Alignment Alternative
Existing Transmission Line
Benton County Substation
Iron Range Substation
Sherco Substation
Cuyuna Series Compensation Station
US Highway
State Trunk Highway
Minnesota Rail Lines

0 5 10 15
Miles

Map 5-3

ROADWAYS AND RAILWAYS
Northland Reliability Project

Construction workers and construction-related vehicles using public roadways to access the transmission line ROW are likely to have localized adverse impacts on traffic volumes. Approximately 75-100 workers would be employed during construction. During the course of construction, workers would be dispersed throughout the project. Accordingly, the increase in vehicle traffic would represent a small increase over existing traffic volumes at any given time and location.

Transmission lines that parallel roads could affect future road expansions or realignments because structures placed along the road ROW might need to be moved to preserve a safe distance between structures and the edge of the expanded roadway. The project does not intend to locate any structures within the existing MnDOT road rights-of-way and coordination with the MnDOT will be completed to confirm that construction of the project will not interfere with routine roadway maintenance. When stringing lines across a road, the applicants will install appropriate traffic control and safety devices, such as H braces, signs, or flaggers. The applicants will work with townships and counties on the appropriate safety measures during stringing and haul routes.

Severe weather, including high winds, ice, snowstorms, and tornadoes, could possibly create safety hazards on any roadways located within the designed fall distance of an overhead transmission line. Snow and ice accumulation and high winds could increase a structure's weight, making it more susceptible to failure or collapse.

The applicants indicate that their design standards exceed NESC requirements for safe design and operation of transmission lines (reference (6)). These standards include designing transmission lines to withstand severe winds from summer storms and the combination of ice and strong winds from winter weather.

No impacts to railways are anticipated as a result of the project. Project construction would not cause delays or interfere with safe operation of the railways. There are very few opportunities for the project's transmission line route alternatives to parallel railways. Thus, the project is not anticipated to impact future rail expansions.

5.4.2 Public Utilities

Electric utilities near the project are provided by GRE, Connexus Energy, Xcel Energy, East Central Energy, Minnesota Power, Crow Wing Cooperative Power & Light Inc., Millie Lacs Electric Cooperative, and Lake Country Power. Four GRE substations, three Xcel Energy substations, and one Southern Minnesota Municipal Power Agency substation are located near the project.

Natural gas for the southern half of the project is provided by CenterPoint Energy. Natural gas for the remainder of the project is provided by Xcel Energy, Northern Natural Gas, and Great Plains Natural Gas Company. In addition to those previously listed natural gas facilities, there are several bulk transportation pipelines near the project. Additional pipelines are operated by Great Lakes Gas Company, ONEOK Inc., Lakehead Pipeline Company, Minnesota Pipeline Company, and Enbridge Energy. These pipelines are crossed by routing alternatives for the project.

Potable water is supplied to the project primarily by local wells. Near urban areas, primarily within municipalities, water mains and other public utilities are provided. Public works and utility departments design, construct, and maintain sanitary sewers, streets and sidewalks, parks, public landscaping, and water mains.

5.4.2.1 Potential Impacts and Mitigation Measures

Project impacts to public utilities are anticipated to be minimal to moderate depending on the project route selected. Potential public utility impacts are discussed further in Chapter 6.

In some areas, the project could cross over existing transmission lines, follow existing transmission line rights-of-way or cross or parallel electric distribution lines. No impacts to electrical service are anticipated as a result of these routing options; however, an overarching project objective is to enhance electrical service in the area. The project crosses over pipeline ROWs in multiple locations; the project crosses two pipelines in Itasca County, one pipeline in Atkin County, one pipeline in Crow Wing County, one pipeline in Morrison County, and two pipelines in Benton County. Potential project pipeline impacts can be avoided and mitigated by coordinating with the appropriate pipeline companies. The applicants indicate that they will use the Gopher State One-Call system to locate and mark all underground utilities to avoid potential impacts.

5.4.3 Emergency Services

Emergency services in the region are provided by local law enforcement and emergency response agencies of various counties and communities. Sheriffs' offices and municipal police departments in the area provide regional law enforcement. Itasca, Atkin, Cass, and Crow Wing Counties each have sheriff departments that provide services to their respective counties. Additionally, the cities of St. Cloud, Brainerd, Cross Lake, Breezy Point, Hill City, Crosby, and Grand Rapids all have local police departments.

Fire services within the region are provided by a mix of city and township fire departments. Grand Rapids, Hill City, Crosslake, Garrison, Brainerd, Little Falls, St. Cloud, Sartell, Rice, Pierz, Crosby, Becker, Emily, Clear Lake, and Mission Township all have fire departments that service surrounding cities and townships adjacent to the project.

Ambulance districts provide emergency medical response services throughout the region. The Mayo Clinic Ambulance – St. Cloud provides response services to Benton County; the Mayo Clinic Ambulance – Little Falls provides response services to Morrison County; North Memorial Ambulance (Brainerd) and Cuyuna Regional Medical Center provide response services to Crow Wing County; the North Memorial Ambulance provides response services to Aitkin County; Meds – 1 Ambulance Service Inc. provides response services to Itasca County; and Remer Area Ambulance Services provides response services to Cass County. Emergency medical response is also available from local hospitals, such as the Grand Itasca Clinic and Hospital, Cuyuna Regional Medical Center Emergency, Essential Health – St. Joseph's Medical Center, CHI St. Gabriel's Hospital, St. Cloud Hospital and CentraCare Health – Monticello (reference (40)).

5.4.3.1 Potential Impacts and Mitigation Measures

The project is not anticipated to impact emergency services. Any temporary road closures required during construction would be coordinated with local jurisdictions to provide for safe access of police, fire, and other emergency service vehicles. Any accidents that might occur during construction of the project would be handled through local emergency services. Given the limited number of construction workers involved in the project and the low probability of a construction-related accident, it is expected that the current emergency services will possess ample capacity to address any potential emergencies that may occur during project construction.

5.4.4 Airports

Transmission line structures and conductors can conflict with the safe operation of an airport if they are too tall and/or too close for the applicable safety zones. Different classes of airports have different safety zones depending on several characteristics, including runway dimensions, classes of aircraft they can accommodate, and navigation and communication systems (reference (12)). These factors determine the necessary take-off and landing glide slopes, which in turn determine the setback distance of transmission line structures.

The FAA and MNDOT have each established development guidelines on the proximity of tall structures to public-use airports. The FAA has also developed guidelines for the proximity of structures to very high frequency omni-directional range (VOR) navigation systems. Transmission lines near public airports are limited by FAA height restrictions, which prohibit transmission line structures above a certain height, depending on the distance from the specific airport. Regulatory obstruction standards only apply to those airports that are available for public use and are listed in the FAA airport directory. Private airstrips and personal use airstrips cannot be used in commercial transportation or by the general public and are therefore not subject to FAA regulatory obstruction standards (Minn. Rule part 8800.2400).

In addition, MNDOT has established separate zoning areas around airports. The most restrictive safety zones are safety zone A, which does not allow any buildings, temporary structures, places of public assembly, or transmission lines, and safety zone B, which does not allow places of public or semi-public assembly such as churches, hospitals, or schools. Permitted land uses in both zones include agricultural uses, cemeteries, and parking lots. Safety zone C, the horizontal airspace obstruction zone, encompasses all land enclosed within the perimeter of the imaginary horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii (5,000 to 10,000 feet) from the center of each end of the primary surface of each runway, and which is not included in zone A or zone B. As with FAA regulations, MNDOT zoning requirements only apply to public airports (Minn. Rule 8800).

One public airport and one private airport are located within the 1-mile ROI. The Hill City/Quadna Mountain Airport is a public airport located outside of Hill City in the Hill City to Little Pine region. It contains one runway. The project is not within safety zones A or B of the Hill City/Quadna Mountain Airport but is located within zone C, the horizontal Airspace Obstruction Zone (reference (41)). The Schroeder Airport is a private landing strip located in Becker Township within the Sherburne County region. The Schroeder Airport is privately-owned and is not subject to public airport zoning ordinances.

There are three FAA-listed, public use airports near the project: St. Cloud Regional Airport, Brainerd Lakes Regional Airport, and Grand Rapids/Itasca County Airport. The St. Cloud Regional Airport is owned by the St. Cloud Regional Airport Regional Authority. The project is located within zone C of the horizontal Airspace Obstruction Zone for the St. Cloud Regional Airport (reference (42)). The Brainerd Lakes Regional Airport is located approximately 2.6 miles west of the project and is owned by the City of Brainerd and Crow Wing County. The Grand Rapids / Itasca County Airport is located approximately 6.8 miles west of the project and is owned by the city of Grand Rapids and Itasca County.

5.4.4.1 Potential Impacts and Mitigation Measures

If the project's transmission line structures are placed along a route near one of the airports identified above, and if these structures were not in accordance with applicable FAA, MNDOT, and airport guidelines, the structures could negatively impact airport use.

Potential airport impacts, as they exist today, are anticipated to be minimal as there are mitigation measures that can be employed to avoid these impacts, such as, routing away from the airport, the use of appropriate height structures to avoid impact to glide or approach slopes, and structure marking or lighting.

5.5 Public Health and Safety

Transmission line projects have the potential to negatively impact public health and safety during project construction and operation. As with any project involving heavy equipment and transmission lines, there are safety issues to consider during construction. Potential health and safety impacts include injuries due to falls, equipment use, and electrocution. Potential health impacts related to the operation of the project include health impacts from EMF, stray voltage, induced voltage, and electrocution.

5.5.1 Electric and Magnetic Fields

EMFs are invisible lines of force that surround electrical devices (e.g., power lines, electrical wiring, and electrical equipment) which are produced through the generation, transmission, and use of electric power. The term “EMF” is typically used to refer to EMF that are coupled together. However, for lower frequencies associated with power lines, EMF are relatively decoupled.

Electric fields are the result of electric charge, or voltage, on a conductor. The intensity of an electric field is related to the magnitude of the voltage on the conductor and is typically described in terms of kV per meter (kV/m). Magnetic fields are created and increase from the strength of the flow of current though wires or electrical devices. The intensity of a magnetic field is related to the magnitude of the current flow through the conductor and is typically described in units of magnetic flux density expressed as Gauss (G) or milliGauss (mG). Magnetic fields, unlike electric fields, are not shielded or weakened by materials that do not conduct electricity (e.g., trees, buildings). Rather, they pass through most materials.

Both magnetic and electric fields decrease rapidly with increased distance from the source. EMF are invisible just like radio, television, and cellular phone signals, all of which are part of the electromagnetic spectrum (reference (43)). EMF are found anywhere there are energized, current-carrying conductors, such as near transmission lines, local distribution lines, substation transformers, household electrical wiring, and common household appliances (reference (43)).

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 (references (44); (45)). 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 exposed daily to magnetic fields of 2 mG or less (reference (43)). Typical magnetic field strengths near common appliances are shown in Table 5-6.

Table 5-6 Typical Magnetic Field Strengths

Source	Distance from Source			
	0.5 foot	1 foot	2 feet	4 feet
	Typical Magnetic Fields (mG)			
Air Cleaners	180	20	3	0
Copy Machines	90	20	7	1
Fluorescent Lights	40	6	2	0
Computer Displays	14	5	2	0
Hair Dryers	300	1	0	0
Baby Monitor	6	1	0	0
Microwave Ovens	200	4	10	2
Vacuum Cleaner	300	60	10	1

Source: reference (43)

5.5.1.2 Research on EMF and Health Impacts

Research on whether exposure to low frequency EMF causes biological responses and health effects has been performed since the 1970s. The U.S. National Institute of Environmental Health Sciences and the World Health Organization have been a part of this research. Their research does not support a relationship or association between exposure to electric power EMF and adverse health effects.

The U.S. National Institute of Environmental Health Science evaluated numerous epidemiologic studies and comprehensive reviews of the scientific literature that examined associations of cancers with living near power lines, with magnetic fields in the home, and with exposure of parents to high levels of magnetic fields in the workplace. They concluded that “no consistent evidence for an association between any source of non-ionizing EMF and cancer has been found” (reference (44)).

Minnesota, Wisconsin, and California have also all performed literature reviews or research to examine this issue. In 2002, Minnesota formed an Interagency Working Group to evaluate EMF research and to develop public health policy recommendations regarding EMF associated with high-voltage transmission lines. The Working Group included staff from a number of state agencies and published its findings in a White Paper on EMF Policy and Mitigation Options. They found that some epidemiological studies have shown no statistically significant association between exposure to EMF and health effects, and some have shown a weak association. The Working Group noted that studies have not been able to establish a biological mechanism for how EMF may cause health impacts.

Worldwide, the majority of scientific panels that have reviewed the research conducted to date conclude that there is insufficient evidence to establish a direct association between EMF and adverse health effects. Based on this work, the Commission has repeatedly found that “there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects” (reference (46)). Appendix I provides detailed background on EMF health impact research.

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; however, a number of states have developed state-specific regulations (Table 5-7), and a number of international organizations have adopted EMF guidelines (Table 5-8).

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. However, the Commission has 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 5-7 State Electric and Magnetic Field Standards

State	Area where limits apply	Field	Limit
Florida	Edge of ROW	Electric	2 kV/m (lines ≤ 500 kV
		Magnetic	150 mG (lines ≤ 230 kV) 200 mG (> 230 kV- ≤ 500 kV) 250 mG (> 500 kV)
	On ROW	Electric	8 kV/m (≤ 230 kV) 10 kV/m (> 230 kV- ≤ 500 kV) 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

Source: reference (43)
1 May be waived by landowner

Table 5-8 International Electric and Magnetic Field Guidelines

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 of Non-ionizing Radiation Protection	4	8	2,000	4,200
American Conference of Industrial Hygienists	0	25	0	10,000/1,000[1]
National Radiological Protection Board	4	0	830	4,200

Source: reference (47)
1 For persons with cardiac pacemakers or other medical electronic devices

5.5.1.4 Potential Impacts and Mitigation Measures

The predicted electric field level associated with the project is shown in Table 5-9 for the edge of ROW and at the location where the maximum electric field will be experienced (typically, under the transmission line). Where the project parallels existing transmission lines, the presence of another energized line nearby would impact the electric field profile around the parallel lines. Therefore, the predicted electric field levels associated with the various project scenarios where new transmission line parallels existing transmission lines are also shown in Table 5-9.

Because electric fields are dependent on the transmission line voltage, the values in Table 5-9 were calculated at the line's maximum continuous operating voltage. Values were calculated assuming minimum conductor-to-ground clearance (that is, at mid-span) and a height of 1 meter above ground. The maximum calculated electric field among all possible configurations is 7.91 kV/m, which is within the Commission's 8 kV/m limit. Lateral profiles of electric fields for each corridor configuration being considered for the project were provided in the RPA (reference (6)) and are in Appendix J.

Table 5-9 Calculated Electric Fields for Transmission Line Configurations

Transmission Line Configuration	Line Voltage	Edge of Right-of-Way, Electric Field (kV/m)	Maximum Electric Field (kV/m)
Project: Double-Circuit 345 kV	379.5 kV	0.54	7.89
Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	253 kV 379.5 kV	0.68	7.80
Existing: 115 kV H-Frame Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	126.5 kV 253 kV 379.5 kV	0.43	7.88
Existing: 115 kV H-Frame Existing: 115 kV H-Frame Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	126.5 kV 126.5 kV 253 kV 379.5 kV	0.54	7.79
Existing: 115 kV H-Frame Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	126.5 kV 253 kV 379.5 kV	0.44	7.80
Existing: 69 kV Monopole Project: Double-Circuit 345 kV	75.9 kV 379.5 kV	0.54	7.91
Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	253 kV 379.5 kV	0.61	7.65
Existing: 69 kV Monopole Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	75.9 kV 253 kV 379.5 kV	0.51	7.90
Existing: 69 kV Monopole Existing: Double-Circuit 230 kV Project: Double-Circuit 345 kV	72.5 kV 241.5 kV 379.5 kV	0.54	7.68
Project: Triple Circuit 345 kV with 69 kV	379.5 kV 72.5 kV	0.58	1.61
Existing: 345 kV Monopole Project: Double-Circuit 345 kV	362.3 kV 362.3 kV	0.12	5.99

The predicted magnetic field level associated with the project is shown in Table 5-10 for the edge of ROW and at the location where the maximum magnetic field will be experienced (typically, under the transmission line). Where the project parallels existing transmission lines, the presence of another energized line nearby would impact the magnetic field profile around the parallel lines. Therefore, the predicted magnetic field intensity associated with the various project scenarios where new transmission line parallels existing transmission lines are also shown in Table 5-9.

Because magnetic fields are dependent on the current flowing on the transmission line, the values in Table 5-10 are provided for the projected typical loading under high transfer conditions for the project. Typical loading for the project was derived from power system modeling of the project during winter peak power flow. Values were calculated assuming minimum conductor-to-ground clearance (that is, at mid-span) and a height of 1 meter above ground. The maximum calculated magnetic field among all possible configurations during typical loading is 173.2 mG. The maximum possible magnetic field at the edge of the ROW was calculated to be 28.5 mG.

Table 5-10 Calculated Magnetic Fields for Transmission Line Configurations

Transmission Line Configuration	Line Current (Amps)	Edge of Right-of-Way Magnetic Field (mG)	Maximum Magnetic Field (mG)
Project: Double-Circuit 345 kV	1549.0	22.6	171.5
Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	39.9 1549.0	25.7	167.0
Existing: 115 kV H-Frame Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	29.6 39.9 1549.0	19.98	170.7
Existing: 115 kV H-Frame Existing: 115 kV H-Frame Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	29.6 88.4 39.9 1540.0	22.4	166.0
Existing: 115 kV H-Frame Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	43.7 376.8 1549.0	17.4	173.2
Existing: 69 kV Monopole Project: Double-Circuit 345 kV	104.6 1549.0	26.4	165.8
Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	376.8 1549.0	28.5	160.4
Existing: 69 kV Monopole Existing: 230 kV H-Frame Project: Double-Circuit 345 kV	67.8 376.8 1549.0	14.9	167.6
Existing: 69 kV Monopole Existing: Double-Circuit 230 kV Project: Double-Circuit 345 kV	67.8 472.9 1549.0	22.8	165.2
Project: Triple Circuit 345 kV with 69 kV	986.3 119.7	21.8	40.6
Existing: 345 kV Monopole Project: Double-Circuit 345 kV	986.3 119.7	19.2	68.2

There is no federal standard for transmission line electric or magnetic fields. The Commission has historically imposed a maximum electric field limit of 8 kV/m measured at 1 meter above ground for new transmission projects. All transmission lines in Minnesota must meet this standard. The Commission has not adopted a magnetic field standard for transmission lines. However, the Commission has 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. No impacts are anticipated for the project, so no mitigative measures are proposed.

5.5.2 Medical Devices

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

appropriately (reference (33)). While EMI can result in either inappropriate triggering or inhibition of a device from responding properly, only a small percentage of these occurrences are caused by external EMI. The American Conference of Governmental Industrial Hygienists (ACGIH) and ICD Manufacturer's recommended magnetic and electric field exposure limits are 1 g and 1 kV/m, respectively, for people with pacemakers (references (48); (33)). One gauss is five to 10 times greater than the magnetic field likely to be produced by a high-voltage transmission line (reference (33)).

5.5.2.1 Potential Impacts and Mitigation Measures

EMF exposure produced by transmission lines generally does not affect implantable devices, but in the event that they are affected it is typically a temporary asynchronous pacing. Electric and magnetic field levels decrease with distance; however, and maximum levels at the edge of the ROW are anticipated to be less than 1.5 kV/m, and, in most instances, less than 1 kV/m (Table 5-9). Maximum levels of magnetic fields at the edge of the ROW are anticipated to be 28.5 mG (Table 5-10). Accordingly, impacts to implantable medical devices and their users are anticipated to be minimal. If a medical device is affected, the device will return to normal operation when the person moves away from the source of the EMF (reference (33)). Therefore, no adverse health impacts or permanent impacts on implantable medical devices are anticipated as a result of the project.

5.5.3 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 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.

Where utility distributions systems are grounded, a small amount of current will flow through the earth at those points. This is called neutral-to-earth voltage (NEV), which is voltage that is associated with distribution lines and electrical wiring within buildings and other structures (reference (49)). Stray voltage is not created by transmission lines, as they do not directly connect to businesses or residences. Site-specific mitigation measures are required to address potential stray voltage impacts (reference (50).

The USDA defines stray voltage as "a small voltage (less than 10 volts) measured between two points that can be simultaneously contacted by an animal" (reference (49)). Stray voltage and its effects on farms have been studied for nearly 30 years. Numerous studies have found that though it is likely to exist on farms, it is rarely strong enough to affect the behavior or production of dairy cattle. (reference (51)). The Commission issued a report in 1998 supporting the conclusion that no credible scientific evidence has been found to show that currents in the earth or associated electrical parameters such as voltages, magnetic fields, and electric currents, are causes of poor health and milk production in dairy herds (reference (51)).

5.5.3.1 Potential Impacts and Mitigation Measures

Stray voltage is, generally, an issue associated with electrical distribution lines and electrical service at a residence or on a farm. Transmission lines do not create stray voltage as they do not directly connect to businesses, residences, or farms. Accordingly, no impacts due to stray voltage are anticipated from the

project. The project would not directly connect to businesses or residences in the area and would not change local electrical service.

5.5.4 Induced Voltage

It is possible for electric fields from a transmission line to extend to a conductive object that is near a line. This may induce a voltage on the object; the magnitude of the voltage depends on several factors such as the size, shape and orientation of the object along the ROW. Smaller conductive objects near the line could cause a nuisance shock to a person, but it is not a potential safety hazard. If there were insulated pipelines, electric fences, telecommunication lines, or other conductive objects with greater lengths and sizes, induced voltage from a transmission line could become unsafe to people who touch them but still this has not been found to be considered a health safety hazard (reference (52)).

5.5.4.1 Potential Impacts and Mitigation Measures

Shocks from induced voltage from transmission lines are considered more of a nuisance than a danger. The transmission line would follow the NESC, which requires the steady-state (continuous) current between the earth and an insulated object located near a transmission line to be below 5 milliamps (mA) (reference (52)). In addition, the Commission limits electric fields to 8 kV/m to prevent serious hazard from shocks due to induced voltage under transmission lines (reference (53)). Any route permits that are issued have to meet the NESC standards and the Commission's electric field limit.

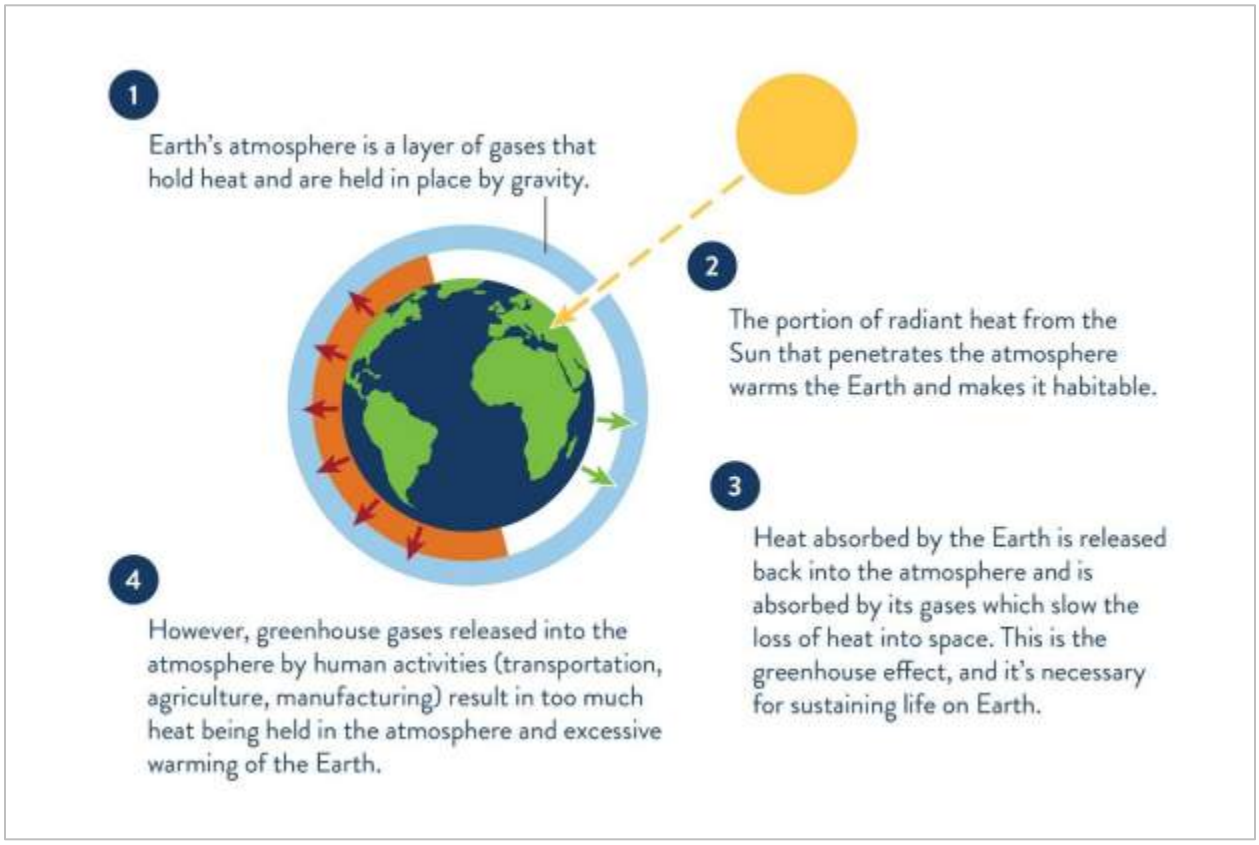
5.6 Climate Change

Chapters 5.6.1 and 5.6.2 describe potential impacts of the project on climate change and the project's climate resilience.

5.6.1 Greenhouse Gases

GHGs are gases that trap heat in the atmosphere. Some of the solar radiation that reaches Earth's surface radiates back toward space as infrared radiation. GHGs trap heat in the atmosphere from the absorption of this infrared radiation, which causes a rise in the temperature of Earth's atmosphere. This warming process is known as the greenhouse effect (reference (54)). This greenhouse effect is illustrated in Figure 5-2.

Figure 5-2 Greenhouse Effect



The most common GHGs include CO_2, methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. Anthropogenic GHG emissions are responsible for about two-thirds of the energy imbalance that is causing Earth's temperature to rise, which has direct and cascading effects on weather and climate patterns, vegetation, agriculture, disease, availability of water, and ecosystems (reference (55)).

Climate change and decarbonization have been discussed for decades at all levels of government, as well as in global, national, and local institutions. There is general agreement that immediate and large-scale progress toward carbon neutrality is needed. Many countries have announced decarbonization initiatives. The first binding global agreement, the Paris Agreement, was established in 2016. The Paris Agreement goal is to keep the rise in mean global temperature to well below 3.6°F, and preferably limit the increase to 2.7°F. To meet this goal, global emissions will need to be reduced as soon as possible and reach net zero by the middle of the 21st century (reference (56)).

More recently in 2021, the United States announced the Net Zero World Initiative to reach net zero by 2050 and the 2030 Greenhouse Gas Pollution Reduction target to achieve a 50-52 percent reduction in greenhouse gas emissions from 2005 levels. The reductions would be accomplished by accelerating transitions to net zero, resilient, and inclusive energy systems (references (57): (58)).

The State of Minnesota has also established a goal for the reduction of GHG emissions, set forth in Minn. Statute 216H.02:

> *It is the goal of the state to reduce statewide greenhouse gas emissions across all sectors producing those emissions by at least the following amounts, compared with the level of*

emissions in 2005: (1) 15 percent by 2015; (2) 30 percent by 2025; (3) 50 percent by 2030; and (4) to net zero by 2050.

Minn. Statute 216B.1691 Renewable Energy Objectives, which became effective in 2023, requires all electric utilities to generate or procure 100 percent of electricity sold to Minnesota customers from carbon-free sources by 2040, with an interim goal of 80 percent (for public utilities) and 60 percent (for other electric utilities) carbon-free electricity by 2030. Carbon-free sources are those that generate electricity without emitting CO_2. Electric utilities are also required to generate or procure 55 percent of electricity sold to Minnesota customers from an eligible energy technology by 2035. Eligible energy technology includes technology that generates electricity from solar, wind, and certain hydroelectric, hydrogen, and biomass sources (Minn. Statute, 216B.1691).

Identified GHG emissions associated with the construction and operation of the project consist of direct emissions generated from combustion sources (e.g., mobile on- and off-road sources) and land use change. Indirect emissions associated with the construction and operation of the project include the GHG emissions associated with electrical consumption. GHG emissions are anticipated to be similar for each routing alternative and are therefore not presented in this chapter. However, calculations for each alternative are summarized in Appendix K.

Construction emissions from mobile combustion were calculated for tree clearing equipment (flatbed trucks, excavators, portable heaters, etc.) and other construction equipment (dump trucks, cranes, bulldozers, etc.). Construction emissions from combustion sources are anticipated to be similar for each routing alternative. Therefore, the total construction combustion emissions and length of the applicants' proposed route were used to calculate an emission rate per route length, in metric tons CO_2e/mile, to quantify combustion emissions for each alternative. Construction emissions from temporary land use changes were calculated with an assumed construction duration of 60 days for each land use change area.

Identified greenhouse gas emissions associated with operation of the project include direct emissions generated from combustion sources (e.g., mobile on- and off-road sources) and land use change, and indirect emissions from electrical consumption. Operational emissions from mobile combustion were calculated for yearly inspection maintenance equipment (ATVs, pickup trucks, helicopters), yearly maintenance or emergency work equipment (helicopters, bucket trucks, personnel carriers), and vegetation management equipment assumed to be used every five years (ATVs, pickup trucks, chainsaws, etc.). Operation emissions from mobile combustion are anticipated to be similar for each routing alternative. Therefore, operation emissions from mobile combustion have only been calculated for the applicants' proposed route. Operation emissions from temporary land use changes were calculated with the assumption that forest land, cropland, and settlement land would be converted to grassland following completion of the project and for the duration of operations. Operational emissions from electrical consumption included the operation of all substations and associated equipment.

Potential emission of the fluorinated gas sulfur hexafluoride (SF_6) is also associated with this project. SF_6 is a powerful GHG that is used in high-voltage circuit breakers in transmission systems. The use of such a substance is extremely common due to its stability and effectiveness at insulating electrical equipment. However, SF_6 emissions from high-voltage circuit breakers are minimal and not expected routinely since they are largely attributed to faulty equipment and leakage.

5.6.1.1 Potential Impacts and Mitigation Measures

The project construction and operations will result in GHG emissions. However, the project is proposed to optimize regional transfer capability as coal-fired generation ceases in northern Minnesota and significant renewable generation comes online in the upper Midwest. The Project would ultimately result in a net decrease of GHG emissions during operation, as it would facilitate the replacement of legacy fossil fuel generation with renewable resources. The project is anticipated to reduce CO_2 emissions in the broader MISO region by 399 million metric tons over the first twenty years. The project would also increase regional transmission reliability and allow additional carbon-free energy sources to be integrated into the power supply. The project will therefore assist in achieving climate goals.

Minimization efforts to reduce project GHG emissions may include efficient planning of vehicle and equipment mobilization and travel, vehicle idle time reduction, proper equipment upkeep, efficient planning of material delivery, proper use of power tools, battery power tools when feasible, and alternative fuel vehicle usage when feasible. Additionally, SF_6 breakers would be properly tracked and maintained at substation sites to ensure leak detection and minimize malfunctions.

5.6.2 Climate Resilience

Climate change is observed as changes in temperature and precipitation patterns, increases in ocean temperatures and sea level, changes in extreme weather events, and ecosystem changes. These changes are largely attributed to the greenhouse effect. As the amount of GHGs in Earth's atmosphere increases, the greenhouse effect causes Earth to become warmer (reference (59)).

There are also naturally occurring climate variations. These are cyclical patterns caused by variations in ocean circulation and atmospheric pressure patterns that occur on timescales of weeks to decades. Increased global surface temperatures may change these natural climate patterns and the resulting impact on regional precipitation and temperature anomalies (reference (60)).

Warmer and wetter conditions have been observed in Minnesota since 1895, especially in the past several decades. An increase in precipitation and precipitation intensity has also been observed, including devastating, large-area extreme rainstorms. A rise in temperatures, particularly during the winter season, has been occurring as well. These trends are expected to continue (reference (61)).

To understand how climate change is anticipated to affect the project location, historical and projected climate data is considered, as well as climate hazard projections. The DNR's Minnesota Climate Explorer tool provides a summary of historical climate data for various regions across Minnesota.

Figure 5-3 summarizes the mean, maximum, and minimum average daily temperature from 1895 to 2023 for counties traversed by the project. It also shows the temperature trends per decade from 1895 to 2023 and from 1994 to 2023 to represent the full record of data and the most recent 30-year climate normal period, respectively. In each temperature statistic, the counties exhibited an increase in daily temperature from 1895 to 2023. The annual average minimum daily temperature has increased at the largest rate of the three temperature statistics.

Figure 5-3 Historical Annual Mean, Maximum, and Minimum Daily Air Temperature (°F) for Counties Traversed by the Project from 1895 to 2023

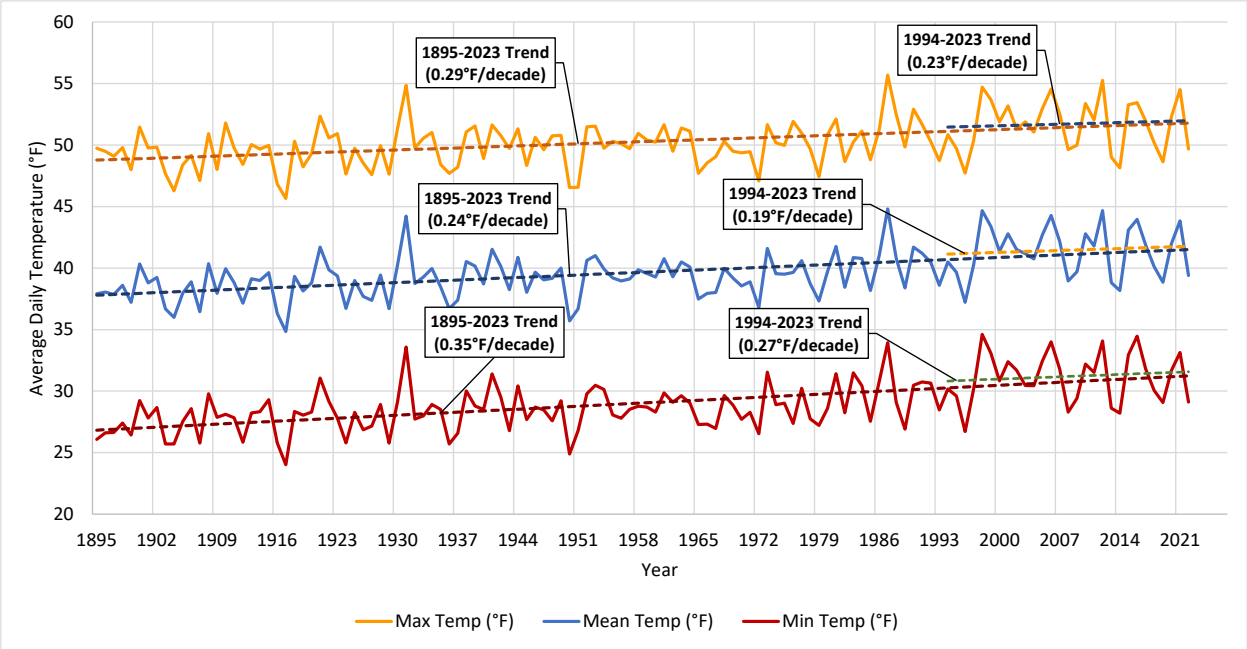


Figure 5-4 shows the total annual precipitation for counties traversed by the project from 1895 to 2023. Total annual precipitation has increased from 1895 to 2023 by a rate of 0.30 in/decade and decreased from 1994 to 2023 by a rate of 0.17 in/decade.

Figure 5-4 Historical Total Annual Precipitation (inches) for Counties Traversed by the Project from 1895 to 2023

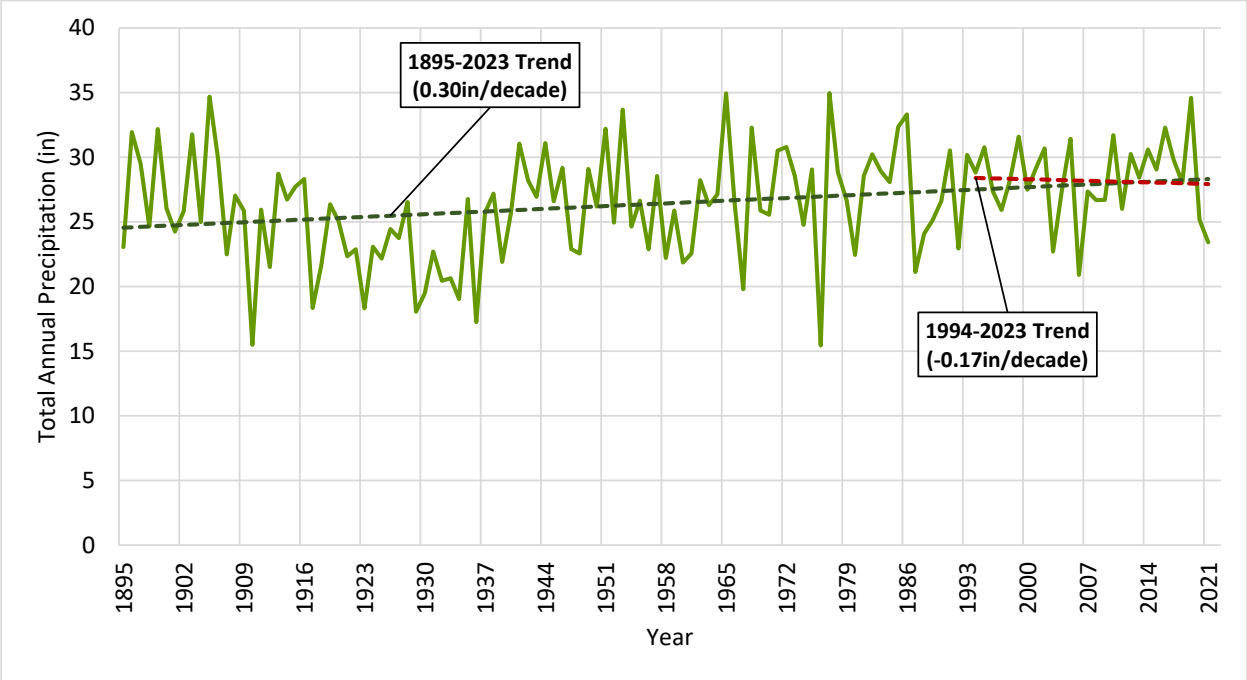
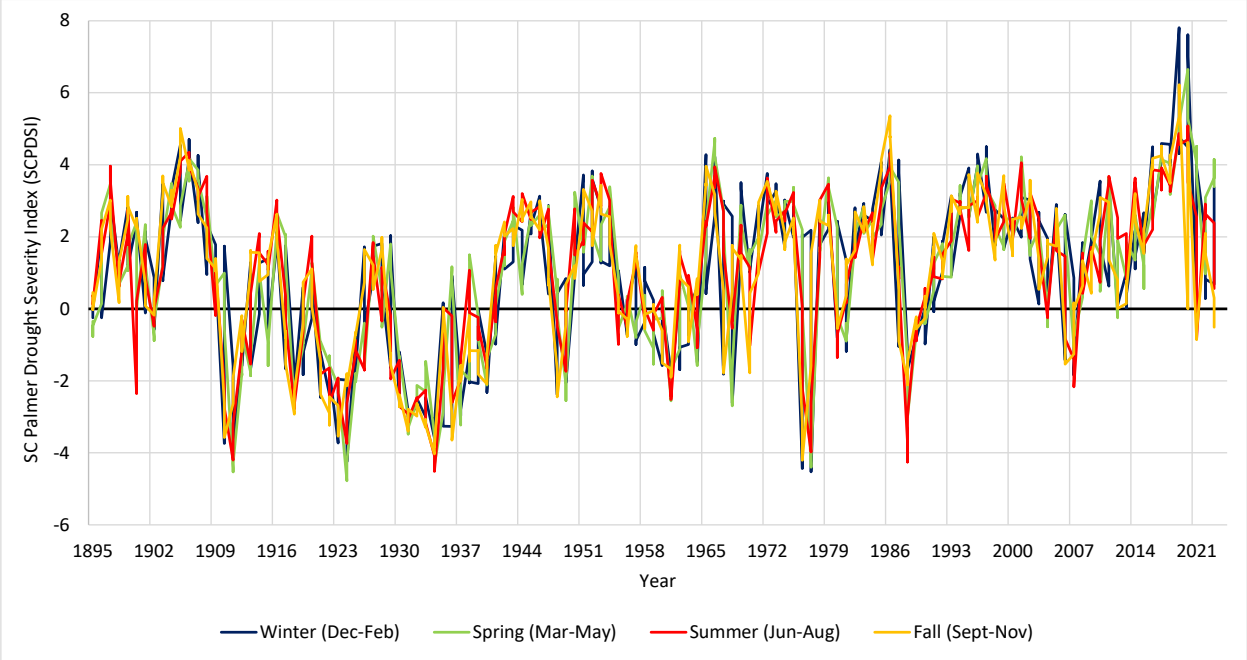


Figure 5-5 shows the seasonal drought severity for counties traversed by the project from 1895 to 2023 using the Self-Calibrated Palmer Drought Severity Index (scPDSI). The scPDSI is a meteorological drought index that measures the departure of moisture. Negative scPDSI values indicate drought conditions, positive values indicate wet conditions, and values near zero indicate normal conditions (reference (62)x). The counties experienced frequent drought episodes from 1910 to 1940 and 1955 to 1965. From 1966 to 2023, seasonal wet conditions have generally been more frequent.

Figure 5-5 Historical Drought Severity for Counties Traversed by the Project from 1895 to 2023



Future projections are based on dynamically downscaled climate model data that was developed by the University of Minnesota and are summarized in two scenarios, Representative Concentration Pathway (RCP) 4.5 and RCP 8.5 (reference (2)). RCP is a measure adopted by the Intergovernmental Panel on Climate Change to represent various greenhouse gas concentration pathways. The numbers (i.e., 4.5 and 8.5) represent the amount of net radiative forcing the earth receives in watts per meter squared where a higher RCP signifies a more intense greenhouse gas effect resulting in a higher level of warming. RCP 4.5 represents an intermediate scenario where emissions begin to decrease around 2040 and RCP 8.5 represents a scenario with no emissions reductions through 2100 (reference (63)).

Figure 5-6 shows the modeled upper limit, average, and lower limit annual mean, maximum, and minimum historical and projected air temperature for counties traversed by the project. The climate models predict the average temperature for the counties to increase by approximately 4°F by Mid-Century (2040 to 2059) compared to Historical Present (1980 to 1999) conditions under the RCP 4.5 scenario. For Late-Century (2080 to 2099), average temperature is projected to increase by approximately 6°F under RCP 4.5 and approximately 10°F under the RCP 8.5 scenario.

Figure 5-6 Historical and Projected Annual Mean, Maximum, and Minimum Temperature for Counties Traversed by the Project

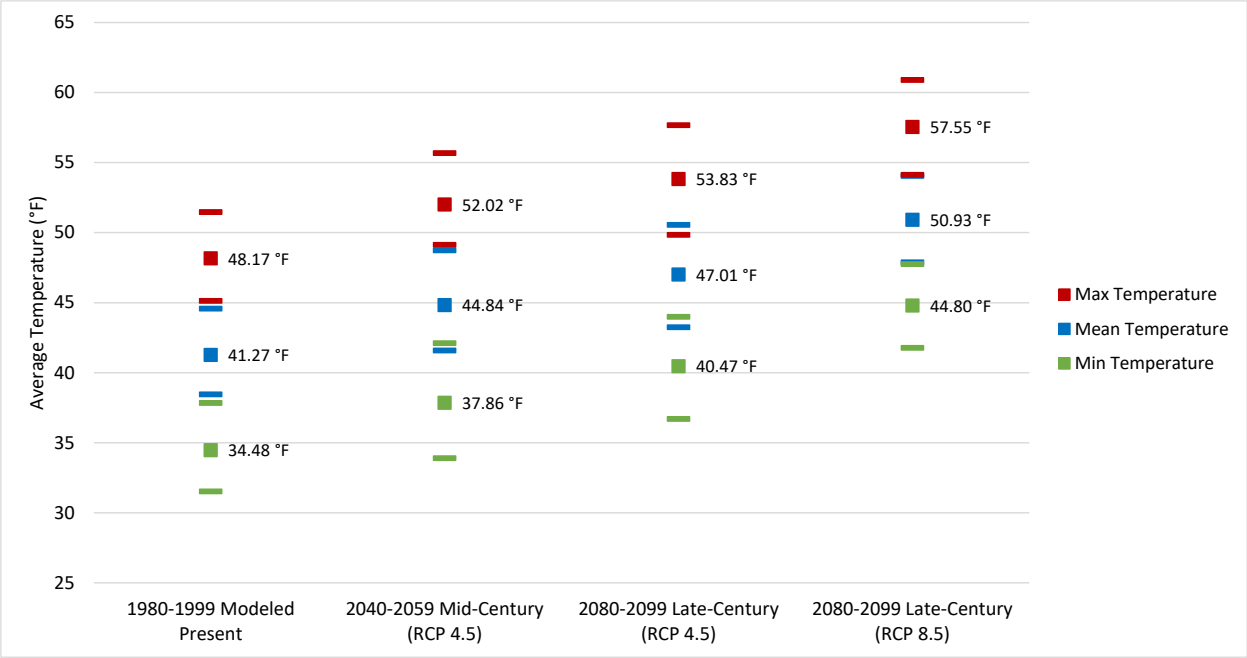
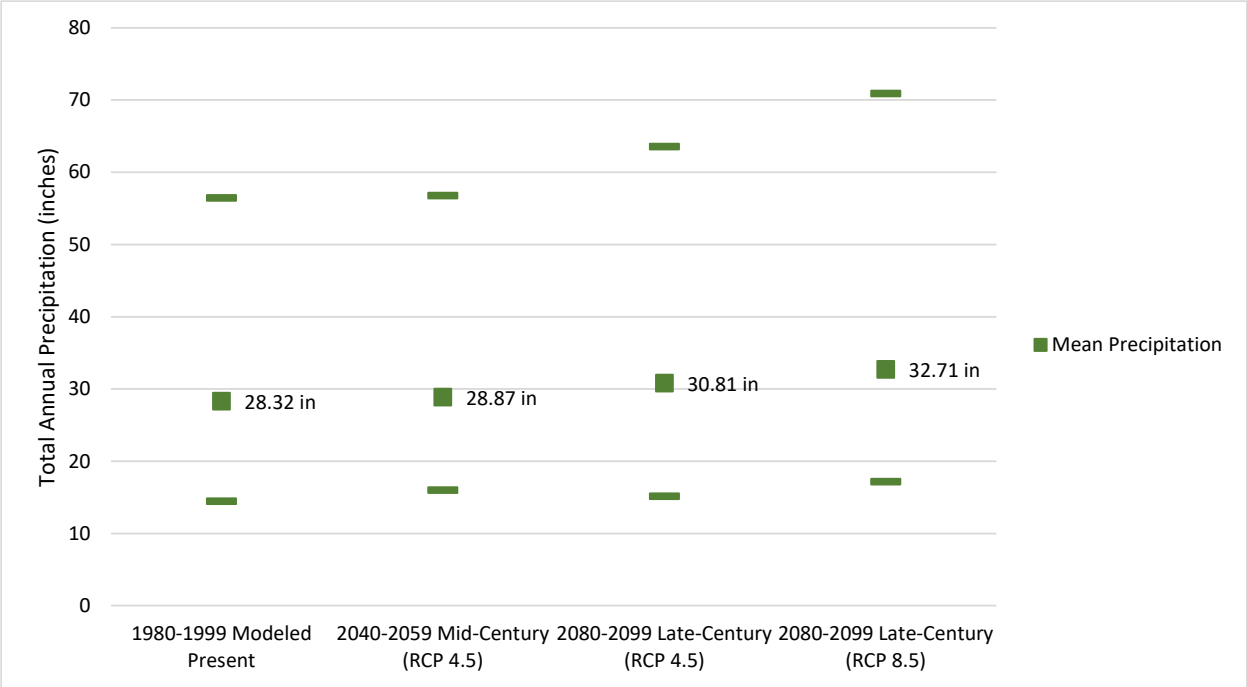


Figure 5-7 shows the modeled upper limit, mean, and lower limit historical and projected total annual precipitation for counties traversed by the project. The model mean shows that from the Historical Present to Mid-Century under RCP 4.5 conditions, there may be a slight increase in average precipitation of 0.55 inches. For Late-Century, the model mean shows an increase of 2.49 inches (RCP 4.5) and 4.39 inches (RCP 8.5) annually.

Figure 5-7 Historical and Projected Total Annual Mean Precipitation (inches) for Counties Traversed by the Project



The EPA Climate Resilience Evaluation and Awareness Tool (CREAT) provides general climate projections to help planning in water, wastewater, and stormwater utilities (reference (64)). For the project area, CREAT anticipates the 100-year storm intensity of 2.1 to 2.5 increasing to a value between 13.1 and 14.4 percent in 2035. CREAT anticipates the 100-year storm intensity of 4.0 to 4.8 increasing to a value between 25.6 and 28.1 percent in 2060. The EPA Streamflow Projections Map summarizes general projections related to streamflow under climate change (reference (65)). The EPA Streamflow Projections Map shows the anticipated general change in average streamflow of streams within the project area by a ratio of 1.24 to 1.30 (90th percentile) under wetter projections and a ratio of 0.74 to 0.78 (10th percentile) under drier projections in 2071 to 2100 (RCP 8.5) compared to baseline historical flow (1976 to 2005).

The risk assessment and map tool was used to create a risk assessment for the counties traversed by the project to help identify current and future climate change risks (reference (65)). Risks for flood, heat, wind, and wildfire are summarized in Table 5-11.

Table 5-11 Climate Change Risks for Counties Traversed by the Project

County	Flood Risk	Heat Risk	Wind Factor	Wildfire Risk
Itasca	Moderate	Minimal	Minimal	Moderate
Aitkin	Minor	Minimal	Minimal	Moderate
Cass	Major	Minimal	Minimal	Major
Crow Wing	Moderate	Minimal	Minimal	Moderate
Morrison	Moderate	Minimal	Minimal	Moderate
Benton	Moderate	Minor	Minimal	Moderate
Sherburne	Moderate	Minor	Minimal	Moderate
Wright	Major	Minor	Minimal	Moderate
Stearns	Moderate	Minor	Minimal	Moderate

The flood risk is moderate for the majority of counties traversed by the project, with the exception of a minor risk for Aitkin County and major risk for Cass and Wright Counties. The heat risk is minor or minimal for all counties. The wind factor is minimal for all counties. The wildfire risk is moderate for a majority of counties traversed by the project, with the exception of a major risk for Cass County.

5.6.2.1 Potential Impacts and Mitigation Measures

The project would be routed and designed to be resilient under changing climatic factors such as increased temperatures and changes in intensity and timing of storm events and associated precipitation. High temperatures can affect the sagging of a transmission line and its thermal tolerance. However, the transmission lines would be built to NERC reliability standards to address thermal limitations. Changes in storm timing and intensity could increase landslide potential in steep areas and increase local flooding. Final structure placement would consider slope to avoid areas with steeper slopes that could be prone to future erosion or landslides from increased, intense precipitation events. During construction, a Stormwater Pollution Prevention Plan would be implemented to manage stormwater and reduce the potential for runoff and erosion. Upon the conclusion of construction, the work areas would be restored. During operation, wildfire prone debris will be removed as a maintenance activity.

5.7 Air Quality

The Clean Air Act (CAA) is a federal law that regulates air emissions from stationary and mobile sources. The CAA requires the EPA to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants, referred to as “criteria pollutants”. The six criteria pollutants are ground-level O_3, particulate matter (PM_{10}/$PM_{2.5}$), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and lead (Pb) (reference (66)). NAAQS are set to address the public health and welfare risks posed by certain widespread air pollutants (references (67); (68)). Compliance with the national and state air quality standards in the state of Minnesota is assessed at the county level. The EPA designates all counties traversed by the project to be in attainment for all NAAQS.

In Minnesota, air quality is monitored using stations located throughout the state. The MPCA uses data from these monitoring stations to calculate the Air Quality Index (AQI) on an hourly basis for O_3, $PM_{2.5}$,

SO_2, NO_2, and CO. Each day is categorized based on the pollutant with the highest AQI value for a particular hour (reference (69).

The Iron Range Substation Region and Hill City to Little Pine Region are located nearest to the Fond du Lac air quality monitor. This station is located approximately 30 miles southeast of the Iron Range Substation Region and 30 miles east of the Hill City to Little Pine Region. The station monitors for O_3 and $PM_{2.5}$. A summary of days in each AQI category at the Fond du Lac monitor for the most recent five-year period available, covering 2018-2022, is provided in Table 5-12.

Table 5-12 Days in Each Air Quality Index Category – Fond du Lac Monitor

Year	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy
2022	354	1	0	0	0
2021	329	32	4	0	0
2020	351	3	0	0	0
2019	346	10	0	0	0
2018	330	24	0	0	0

Air quality has been considered good for the majority of the past five reported years in Fond du Lac. Since 2018, 2021 had the largest number of days classified as moderate or worse. In 2021, 32 days were classified as moderate, and 4 days were classified as unhealthy for sensitive groups.

The Cole Lake-Riverton Region and Long Lake Region are located nearest to the Brainerd air quality monitor. This station is located approximately 3 miles west of the Cole Lake-Riverton Region and 4 miles northwest of the Long Lake Region. The station monitors for O_3 and $PM_{2.5}$. A summary of days in each AQI category at the Brainerd monitor for the most recent five-year period available, covering 2018-2022, is provided in Table 5-13.

Table 5-13 Days in Each Air Quality Index Category – Brainerd Monitor

Year	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy
2022	344	21	0	0	0
2021	304	47	2	2	0
2020	348	11	0	0	0
2019	335	23	1	0	0
2018	311	36	1	0	0

Air quality has been considered good for the majority of the past five reported years in Brainerd. Since 2018, 2021 had the largest number of days classified as moderate or worse. In 2021, 47 days were classified as moderate, 2 days were classified as unhealthy for sensitive groups, and 2 days were classified as unhealthy.

The Morrison County Region, Benton County Elk River Region, and Sherburne County Region are located nearest to the St. Cloud air quality monitor. This station is located approximately ten miles southwest of the Morrison County Region, five miles west of the Benton County Elk River Region, and five miles west of the Sherburne County Region. The station monitors for O_3 and $PM_{2.5}$. A summary of days in each AQI category at the St. Cloud monitor for the most recent five-year period available, covering 2018-2022, is provided in Table 5-14.

Table 5-14 Days in Each Air Quality Index Category – St. Cloud Monitor

Year	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy
2022	246	30	0	0	0
2021	290	66	3	2	0
2020	336	30	0	0	0
2019	313	31	0	0	0
2018	310	54	1	0	0

Air quality has been considered good for the majority of the past five reported years in St. Cloud. Since 2018, 2021 had the largest number of days classified as moderate or worse. In 2021, 66 days were classified as moderate, 3 days were classified as unhealthy for sensitive groups, and 2 days were classified as unhealthy (reference (69)).

5.7.1.1 Potential Impacts and Mitigation Measures

Air emissions during construction would primarily consist of emissions from construction equipment and would include pollutants such as CO_2, nitrogen oxides (NO_x), and PM. Dust generated from earth disturbing activities also gives rise to PM_{10}/$PM_{2.5}$. Emissions from construction vehicles could be minimized by using modern equipment with lower emissions ratings. Adverse effects on the surrounding environment are expected to be negligible due to the temporary disturbance during construction and the intermittent nature of the emission- and dust-producing construction phases. If construction activities generate problematic dust levels, the applicants may employ construction-related practices to control fugitive dust.

During operations, air emissions would be minimal and therefore would not require any air quality permits. Small amounts of emissions would be associated with the intermittent project operation and maintenance activities via mobile combustion and particulate roadway dust generation. If dust levels become problematic during operation and maintenance activities, the applicants may employ fugitive dust control practices such as wetting of unpaved roads. Cleared ROWs, storage areas, and access roads would be restored and revegetated once construction is complete, limiting further dust production. A small amount of O_3 would be created due to corona from the operation of transmission lines. The emission of O_3 during operations is not anticipated to have a significant impact on air quality (reference (70).

5.8 Land-Based Economies

The project's construction and operation have the potential to impact land-based economies. Transmission lines are a physical, long-term presence on the landscape which could prevent or otherwise limit use of land for other purposes. When placed in an agricultural field, transmission line structures have

a relatively small footprint, yet they can interfere with farming operations. In addition, structures and tall growing trees are not allowed in transmission line ROW, a restriction that could affect businesses along the ROW.

Project impacts to agricultural operations are anticipated to range from minimal to moderate depending on the project route selected, the type of structures used, and the configuration of the structures. Agricultural impacts for specific routing alternatives are discussed further in Chapter 6. Impacts to forestry and mining operations are anticipated to be minimal to moderate. Impacts to recreation and tourism are anticipated to be minimal to moderate and generally limited to the aesthetic impacts of the project. The primary means of mitigating impacts to land-based economies is prudent routing (i.e., by choosing routes and alignments that avoid such economies). Impacts can also be mitigated through use of structures and structure configurations that are compatible with land-based economies.

5.8.1 Agriculture

Agriculture comprises approximately 30 percent of the land cover within the project area (Map Book 5C). Agricultural land use is more prevalent in the southern portion of the project area, which includes greater percentages of cultivated crops and farmland of statewide importance in comparison to the northern portion of the project area, which primarily consists of hay/pasture lands.

The USDA Natural Resource Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database (reference (71)) identifies farmland soils based on three categories, which are subject to protection under the Farmland Protection Policy Act (FPPA). These categories include prime farmland, prime farmland when drained, and farmland of statewide importance. Prime farmland is defined by the NRCS as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Prime farmland when drained includes soils that have the potential to be prime farmland but require drainage or hydrologic alteration to achieve high productivity. Farmland of statewide importance includes soils that are nearly prime, but are not as productive due to permeability, slope, erosion potential, or some other soil property. The project includes areas of prime farmland, prime farmland if drained, and farmland of statewide importance.

5.8.1.1 Potential Impacts and Mitigation Measures

Transmission lines have the potential to impact agriculture both temporarily and permanently. Temporary impacts typically include impacts from transmission line construction and annual transmission line inspections. Any construction impacts would cease once the transmission line construction phase is completed. Temporary impacts from annual transmission line inspections would be limited to the ROW and areas where obstructions may require off ROW access. These temporary impacts may result in the displacement of livestock or impacts to crops and soil.

Permanent transmission line impacts result from the placement of transmission line structures within agricultural fields. Permanent structures can have varying sized footprints due to the structure design and distance from each another. The project anticipates using steel monopole structures with concrete pier foundations ranging from 7 to 10 feet in diameter and a span of 800 to 1,000 feet between structures. Examples of permanent impacts resulting from transmission line structures include restriction of farming equipment, interference with aerial spraying, and obstruction of irrigation systems. These impacts have the ability to result in financial impacts through loss of income and decreases in property values.

Impacts to agricultural operations could be mitigated by prudent routing (i.e., by selecting routes that avoid agricultural fields by following existing ROW, field lines, and property lines). Impacts could also be

mitigated by the type and configuration of structures used for the project. The use of double-circuiting, for example, would minimize potential impacts. Impacts to agricultural operations could also be mitigated by limiting temporary construction impacts and ensuring that any impacts are remediated (e.g., repair of drain tile). Impacts could be mitigated by the preparation of an AIMP prepared in collaboration with the MDA. The AIMP identifies measures that the applicants would take to avoid, mitigate, or provide compensation for agricultural impacts resulting from constructing and operating the project. It also specifies procedures for repairing damaged drain tile, alleviating compaction, and removing construction debris. Compliance with an AIMP could be included as a permit condition for the project.

5.8.2 Forestry

Minnesota's forests primarily consist of aspen/birch, spruce/fir, and oak/hickory forest types, which are managed by private/tribal industry (44 percent), state government (24 percent), federal government (17 percent), and counties/municipalities (15 percent) (reference (72)). As of 2020, Minnesota's forest products industry was the state's fifth largest manufacturing sector by employment and provided 64,500 jobs (reference (72)). In 2017, Minnesota's forest products industry produced $17.8 billion of shipment value (gross sales) and provided 8.5 percent of all manufacturing payroll employment.

As of 2018, timberlands constituted the majority (15.8 million acres) of forest land in Minnesota (reference (72)). Total timber harvest in Minnesota began declining from approximately 3.73 million cords per year in 2005 to 2.9 million cords per year in 2016 (reference (72)). Roundwood harvested for pulpwood, sawlogs, and fuelwood has remained stable with typical annual harvest between 2.7 million cords in 2007 and 3.4 million cords in 2016. According to a 50-year projection documented in the Generic Environmental Impact Statement on timber harvest completed in 1994, Minnesota's forests could sustain a total harvest of approximately 5.5 million cords annually (references (73); (74)).

There are extensive forested lands in the project area (Map Book 5C), with the most forested land in the northern portion of the project area. Forested lands within the proposed ROW are composed of DNR state forests, school trust lands and other conservation program lands, state forest lands, and private commercial forest lands. State forests crossed by the project include Crow Wing State Forest, Golden Anniversary State Forest, and Hill River State Forest. State recreation areas crossed by the project include the Cuyuna State Recreation Area. Although there are forested lands that occur within the substation expansion area for both the Cuyuna Series Compensation Station and the Iron Range Substation Expansion, these lands are owned by Minnesota Power.

Timber harvested in Minnesota and the project area is used for construction materials, paper products, and heating for homes, among other commercial goods. Additionally, timber harvested from private commercial forest lands is primarily used in the manufacturing of paper products. As of 2023, 473 furniture manufactures, 99 paper manufactures, 357 wood product manufactures, 215 forestry and logging companies were in operation in Minnesota (reference (75)).

5.8.2.1 Potential Impacts and Mitigation Measures

For safe operation of the project, trees and other tall-growing vegetation must be removed from the transmission line ROW. Vegetation clearing typically consists of initial tree and vegetation clearing before construction, and on-going maintenance within the ROW following construction.

The loss of trees in the ROW could impact forestry production resulting. in negative financial impacts to state owned forest lands and privately owned commercial forest lands. Impacts to forestry could be

mitigated by prudent routing (i.e., by selecting routes that avoid forested areas and by following existing ROW, field lines, and property lines to the extent possible).

5.8.3 Mining

Mining is a significant industry in Minnesota, with mining operations classified into two categories: metallic minerals and non-metallic minerals (reference (76)). Metallic minerals consist of materials such as iron ore, copper, and nickel, while non-metallic minerals consist of materials such as aggregate, peat, and kaolin clay. Aggregate materials are used in construction activities and usually consist of raw materials such as sand, gravel, and crushed stone.

There are multiple aggregate mines present in the project area, consisting of both active and inactive operations (Map Book 5D). No public data is available for Cass, Crow Wing, or Morrison counties; as a result, these areas were evaluated by performing a visual search of available aerial imagery to identify potential mining operations. There are three potentially active aggregate mines within the ROW of the applicants' proposed route. There are no active or idled metallic mineral mines in the rights-of-way of the routing alternatives for the project.

5.8.3.1 Potential Impacts and Mitigation Measures

Transmission line construction and operation can result in potential impacts to mining operations. These impacts may occur if a transmission line inhibits access to and removal of resources. Impacts are most likely to occur during transmission line construction if resource extraction must be ceased temporarily in order to safely string a transmission line. Although there are three active aggregate mines within the ROW of the applicants' proposed project, the project parallels existing transmission lines where it would cross mines and permanent impacts to mining operations would have already occurred in these areas. As a result, minimal mining operation impacts are anticipated as a result of the project.

5.8.4 Recreation and Tourism

Recreation and tourism opportunities in the project area consist of outdoor activities such as recreational use of parks, public trails, rivers and lakes, and state forests. Tourism and recreational activities commonly overlap; the difference between the two is the distance traveled to access these opportunities. Recreational activities are generally located within the vicinity of one's home and easily accessible, while tourism involves activities that require substantial travel and may incur additional expenses as a result.

There are several recreational areas located near the project (Map Book 5E). The Cuyuna Country State Recreation Area offers recreational opportunities including camping, canoeing, fishing, mountain biking, and scuba diving. Multiple state trails also extend throughout the area, attracting outdoor enthusiasts interested in biking, hiking, and off-roading.

State water trails on the Mississippi River are also present. Furthermore, several segments of the Great River Road scenic byway traverse the region. This scenic route traces the path of the Mississippi River, covering 565 miles in Minnesota. There are multiple state forests located near the project, including Golden Anniversary State Forest, Hill River State Forest, Crow Wing State Forest, and Land O'Lakes State Forest. Savanna Portage State Park is located near the eastern edge of the project and provides opportunities for fishing, hiking, snowmobiling, and swimming.

Several snowmobile trails traverse the area. These trails are maintained by the Aitkin Sno-Drifters Snowmobile Club, Inc., Benton County Snowmobile Club, C-I Loop, Great River Trail, Greenway

Snowmobile Club, Inc, Harding Trail, Haypoint Jack Pine Snowmobile Club, Itasca Driftskippers Snowmobile Club, Kathio, Merri Trail, Morrison County Recreational Trails Association, Sherburne County Snowmobile Trail Association, and Smokey Hollow.

Several bodies of water located in or near the project have public water access sites. These include the Mississippi River, Cowhorn Lake, Taylor Lake, Hill Lakes, Upper Dean Lake, Perry Lake, Black Bear Lake, Snowshoe Lake, Hay Lake, Upper South Long Lake, Lake Briggs, Rush Lake, Elk Lake, in addition to multiple unnamed waterbodies near the City of Riverton. In addition, several WMAs used for hunting and wildlife viewing are scattered throughout the project area. Recreational users of these trails, lakes, and wildlife areas are likely to spend money in nearby communities and help support local economies.

5.8.4.1 Potential Impacts and Mitigation Measures

Project impacts on recreation and tourism are anticipated to be minimal and temporary in nature, lasting only for the duration of construction. Short-term disturbances, such as increased noise and dust, could detract from nearby recreational activities and could, depending on the timing, affect hunting by temporarily displacing wildlife. However, wildlife is expected to return to the area once construction has been completed.

Once constructed, the project itself could impact aesthetics in the project area or at a specific recreational feature such that recreation may be less enjoyable for some citizens. Project-related impacts to recreation and tourism are anticipated to be minimal. Mitigating potential impacts is primarily achieved through prudent routing (i.e., selecting routes away from recreational resources). Impacts can also be mitigated by the measures noted above for potential aesthetic impacts (Chapter 5.3.1.1).

5.9 Archaeological and Historic Resources

Cultural resources consist primarily of archaeological sites and historic architectural resources. Archaeological sites are defined as the material remains of past human life or activities (reference (77) Pursuant to the Minnesota Historic and Architectural Survey Manual (reference (78)), historic architectural resources are defined as sites, buildings, structures, or objects that are over 45 years in age (reference (78)) and “create tangible links to the American past, whether in relation to historical events and people, traditional ways of life, architectural design, or methods of construction” (reference (79)). Traditional cultural properties are defined as locations of significance to a community because of their association with important cultural practices and beliefs (reference (80)).

Federal laws and regulations, including Section 106 of the NHPA of 1966 and the Archaeological Resources Protection Act of 1979, provide the standards for cultural resources identification, evaluation, and mitigation of impacts. Pursuant to Section 106 of the NHPA of 1966, a historic property is any archaeological site, historic architectural resource, or traditional cultural property included in, or eligible for inclusion in, the National Register of Historic Places (NRHP).

The proposed project is also subject to the Minnesota Historic Sites Act (Minn. Statutes 138.661 to 138.669) and the Field Archaeology Act (Minn. Statutes 138.31 to 138.42). The Minnesota Historic Sites Act (Minn. Statutes 138.661 to 138.669) requires that state agencies consult with the SHPO before undertaking or licensing projects that may affect properties on the State or National Registers of Historic Places. The Minnesota Field Archaeology Act (Minn. Statutes 138.31 to 138.42) establishes the position of State Archaeologist and requires State Archaeologist approval and licensing for any archaeological work that takes place on non-federal public property.

Under the Minnesota Private Cemeteries Act (Minn. Statute 307.08), if human remains are encountered during construction, construction at that location must be halted immediately and local law enforcement and the Office of the State Archaeologist (OSA) and the Minnesota Indian Affairs Council (MIAC) must be contacted. Construction cannot proceed at that location until authorized by the OSA, MIAC, and local law enforcement.

To determine potential cultural resource impacts, known archaeological and historic sites in or adjacent to the project were identified through a review of the OSA online portal and MnSHIP, the Minnesota SHPO online portal. MnSHIP is a comprehensive database of all documented historic architectural resources for the entire state, while the OSA portal is a database of all previously recorded archaeological sites in the state.

5.9.1 Archaeological Resources

The OSA online portal search indicated that there are 59 known archaeological resources located within 1 mile of the potential project routes (Map Book 5F). Of the 59 archaeological sites, four are considered eligible for listing in the NRHP, one has been determined not eligible, and the remaining properties have not been evaluated for listing. Additional route alternative analysis is provided in Chapters 6 and 7, evaluating the presence of archaeological sites and potential project impacts.

One NRHP eligible site falls within the route width of a routing alternative; this is site 21CW0176/Rowe Mine Concentration Plant and Railroad Grade (post-contact structural ruin, constructed between 1914 and 1919). Three additional archaeological sites within 1 mile of the project are considered eligible for listing on the NRHP and include 21CW0096/Black Bear (pre-contact and post-contact artifact scatter and earthwork), 21CW0156/Zofia's Terrace (pre-contact and post-contact artifact scatter and features), and 21CW0175/Little Rabbit Lake Site (pre-contact lithic scatter).

In addition to these NRHP eligible sites, earthworks are present at 13 sites within the ROI; potential human burials were identified at three of these sites (21CW0010, 21CW0011, and 21SH0002). Site 21SH0002 is a part of a complex of 10 precontact sites in Sherburne County within a proposed county park (Big Elk Lake Park) (reference (81)).

5.9.2 Historic Architectural Resources

Review of the MnSHIP portal indicates that there are 146 known historic architectural resources located within 1 mile of the project, 42 of which are within the route width of a routing alternative (Map Book 5F). Of the 146 resources, three are listed on the NRHP, four are considered eligible for listing on the NRHP, six have been determined not eligible and the remaining properties have not been evaluated for NRHP eligibility. Additional analysis regarding the proximity of these historic architectural resources to specific routing alternatives is provided in Chapter 6.

Two NRHP-listed historic architectural resources are located within the route width of a routing alternative and consist of IC-UOG-017/Frank Gran Farmstead and SH-BKC-012/Herbert Maximillian Fox House (this structure has been relocated twice since 1981). One other resource listed on the NRHP is within the 1-mile ROI and consists of CW-TMC-00001/Trommald Elevated Metal Water Tank.

The four NRHP-eligible historic architectural resources within the ROI consist of resources CW-PLK-001/Perry Lake School, CW-XXX-00001/Cuyuna Iron Range Historic Mining Landscape District (4,693 acre district, dating between 1904-1953; contributing features include open pit mines, stockpiles, structures and foundations, tailings piles, access roads and railroad corridors), IC-UOG-088/Marsh

Rainbow Arch Bridge, and XX-RRD-NRP021/Northern Pacific Railway Company. Of these resources, CW-XXX-00001, IC-UOG-088 and XX-RRD-NRP021 are located within the route width of a routing alternative.

5.9.3 Potential Impacts and Mitigation Measures

Archaeological and historic resource impacts could result from construction activities—ROW clearing, placement of structures, expansion of the existing Iron Range Substation and Benton County Substations, the construction of a new compensation station, construction of access roads, temporary construction areas, and vehicle and equipment operation. Impacts could also result from the removal of historic buildings or structures.

Additional impacts can result from transmission line location and operation. Impacts can occur if the project is located near or within view of a resource (typically a historic building, structure, or TCP) and the resulting change in viewshed negatively affects the setting, feeling, and/or association of the resource. This issue is especially pertinent when considering cultural resources, where the surrounding environment plays a crucial role in defining their character and significance.

The preferred impact mitigation for cultural resources is prudent routing or structure placement (i.e., avoiding known archaeological and historic resources). If archaeological resources are anticipated or known to exist within a specific part of a route, potential resource impacts could be mitigated by measures developed in consultation with the SHPO prior to construction. Additionally, construction workers will receive training to recognize archaeological resources in the field so that work can be halted in the event a relevant resource discovery occurs during construction.

If unanticipated archaeological or historic resources are discovered during construction, Commission route permits require that construction activities cease at that location and that SHPO be contacted to assist in the development of appropriate resource protection measures (Appendix H). In addition, if human remains or suspected burial sites are discovered during construction, the state archaeologist would be contacted, and construction would cease at the location until the applicants and the state archaeologist have developed adequate mitigation measures as per Minn. Statute 307.08.

5.10 Natural Environment

Transmission lines have the potential to impact the natural environment through temporary, construction-related impacts and long-term impacts to water resources, vegetation, and wildlife.

5.10.1 Water Resources

Hydrologic features located within the project include rivers and streams (watercourses), lakes and ponds (waterbodies), wetlands, floodplains and groundwater resources (Map Book 5G). The project crosses the Mississippi River (Grand Rapids, Brainerd, Sartell, St. Cloud) and Pine River watersheds (the Elk River is located within the Mississippi River watershed). The regulatory landscape governing water resources in Minnesota is complex, encompassing various federal and state laws, which is explored further in Chapters 5.10.1.1 through 5.10.1.4.

5.10.1.1 Watercourses and Waterbodies

The Clean Water Act (CWA) establishes the structure for regulating the discharge of pollutants into waters of the United States and for developing water quality standards for surface waters (33 U.S.C. 1344

and 1311 et seq.). The CWA could potentially regulate several types of activities and their impacts associated with the project.

Watercourses and waterbodies such as such as lakes, rivers, and streams, 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 and 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 adjacent to navigable waters (33 CFR 320.1(d); 33 CFR 328.3). The 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; however, the CWA gives the EPA the authority to delegate 401 certification to the states. In Minnesota, the EPA has delegated Section 401 certification to the MPCA.

5.10.1.1.1 Impaired watercourse and waterbodies

Section 303(d) of the CWA requires that states publish a list of streams and lakes that are not meeting their designated uses because of excess pollutants (impaired waters) every two years. The list, known as the 303(d) list, is based on exceedances of water quality criteria and standards. In Minnesota, the MPCA is charged with classifying impaired waterbodies. Consistent with the requirements of the CWA, the MPCA has established water quality standards, including the identification of beneficial uses of the state's waters, numeric standards and narrative criteria, and non-degradation protections for high-quality or unique waters. Minnesota advances the CWA's presumption that a waterbody should sustain healthy aquatic life and recreation uses, and groups the waters of the state into one or more of the following seven designated use classifications:

- Class 1 waters, domestic consumption
- Class 2 waters, aquatic life and recreation
- Class 3 waters, industrial consumption
- Class 4 waters, agriculture and wildlife
- Class 5 waters, aesthetic enjoyment and navigation
- Class 6 waters, other uses and protection of border waters
- Class 7 waters, limited resource value waters

The project could cross 16 impaired streams. Of the impaired streams the project may cross, seven are designated as "Impaired, but a total maximum daily load (TMDL) study has been approved by EPA," eight streams are listed with a designation of "Impaired and a TMDL study is required," and one stream with a designation of "Impaired or threatened but doesn't require a TMDL study because the impairment is due to natural conditions with only insignificant anthropogenic influence" (reference (82)). Stream impairments for these 16 streams include mercury in fish tissue, fish bioassessments, dissolved oxygen, Escherichia

coli (E. coli), turbidity, total mass of suspended particles, and benthic macroinvertebrate bioassessments (reference (82)).

The project could also cross two impaired lakes, Little Rabbit Lake and Upper South Long Lake. Little Rabbit Lake is designated as impaired for mercury in fish tissue, and a TMDL study is required. Upper South Long Lake is designated as impaired for sulfates, and a TMDL has been approved by the EPA (reference (82)).

5.10.1.1.2 Public Waters

DNR-regulated public waters are wetlands, water basins, and watercourses of significant recreational or natural resource value in Minnesota. The statutory definition of a public water is found in Minn. Statute 103G.005, and these waters are documented in the state's public waters inventory (PWI). These water resources are under the jurisdiction of the DNR, and a DNR license to cross public waters would be required when an activity would cross a public water. Additionally, a work in public waters permit would be required for any projects that change or diminish the course, current, or cross-section of public waters by any means, including filling, excavating, or placing materials in or on the beds of public waters.

The DNR regulates work below the ordinary high-water level of PWI wetlands and waters through the public waters work permit program. Examples of work activities addressed by this program include filling, excavation, bridges and culverts, dredging, structures, and other construction activities.

5.10.1.1.3 Potential Impacts and Mitigation Measures

It is anticipated that watercourses and waterbodies would be avoided by either prudent routing or spanning. Most of the watercourse and waterbodies crossed by the project would be less than 1,000 feet wide, which is a spannable distance. These crossings would not require structures to be placed within the features; and no direct impacts to those watercourses and waterbodies are anticipated. Crossings that extend over 1,000 feet would require structures within the waterbodies. These waterbodies would be directly impacted from construction and are identified and discussed further in Chapters 6 and 7.

Indirect impacts associated with crossing these resources could occur. Removal of vegetation and soil cover could result in short-term water quality impacts due to increased turbidity. Construction impacts could also include removal of riparian or shoreline forest areas within the ROW. Vegetation clearing could also increase light penetration to watercourses and waterbodies, potentially resulting in localized increases in water temperatures and changes to aquatic communities.

Mitigation measures would be implemented to prevent or minimize surface water impacts that could affect water quality. The MPCA, through the National Pollutant Discharge Elimination System (NPDES) and under the CWA and the State Disposal System (SDS), regulates construction activities that may impact stormwater runoff. The applicants would apply for authorization to discharge stormwater associated with construction activity under the MPCA NPDES/SDS Construction Stormwater General permit (MNR100001). The project would develop a SWPPP that will identify BMPs that will be implemented during construction to minimize erosion and sedimentation impacts to surface waters. Erosion and sedimentation abatement measures, for example, would be employed to mitigate impacts to impaired waters.

Anticipated BMPs for the project include no vehicle fueling, maintenance, or herbicide application within 100 feet of streams, ditches, and waterways to protect against contamination of surface or groundwater systems. Materials such as fuels, lubricants, paints, and solvents required for construction would be

stored away from surface water resources. Any spills or leaks would be cleaned up immediately and leaking equipment removed from the area for proper maintenance.

In addition, public waters crossed by the project would require DNR utility crossing license. The applicants have indicated that they will work with the DNR to ensure all proper licenses and approvals are obtained for public water crossings. Additionally, through the licensing process, the applicants emphasize that they will work with the DNR to determine appropriate public water crossing mitigation measures.

5.10.1.2 Floodplains

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 flood waters, but which do not experience a strong current. Floodplains function to 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 1 percent chance of occurring during each year.

At the state level, the DNR oversees the state floodplain management program by promoting and ensuring sound land use development in floodplain areas to promote the public health and safety, minimize loss of life, and reduce economic losses caused by flood damages. The DNR also oversees the state of Minnesota national flood insurance program. Floodplains are further regulated at the local level. Along the project, Sherburne County, Benton County, Morrison County, Crow Wing County, Aitkin County, Itasca County, Cass County, and the city of Becker have designated floodplain zoning districts. Associated ordinances allow for utility transmission lines as a conditional use for floodway and floodplain districts.

FEMA has designated floodplains along the following watercourses: Elk River, Briggs Creek, Rice Creek, Ironton Creek, Rabbit River, Mississippi River, Mudd Brook, Swan River, and along several unnamed tributaries.

5.10.1.2.1 Potential Impacts and Mitigation Measures

No impacts to floodplains are anticipated as a result of the project. Should a floodplain crossing be greater than the 1,000-foot typical transmission line span length, the crossing may require permanent placement of fill to construct one or more structure foundations within the floodplain. Where complete avoidance of floodplains is not feasible, it would be expected that structure placement would have limited effects on water flow, flood water storage capacity, or flooding in these floodplains, as the volume displaced by the structures would likely be small in the context of the setting. FEMA does not require mitigation for construction within the floodplain, though local floodplain permitting entities could require mitigation, such as compensatory storage, as part of their floodplain permit conditions.

5.10.1.3 Wetlands

Wetlands are defined in both the 1977 EO 11990-Protection of Wetlands and in Section 404 of the CWA as those areas that are inundated by surface or groundwater with a frequency to support, and under normal circumstances does or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands are protected at the federal level under Section 404 of the CWA and at the state level under the Minnesota WCA and the DNR PWI program.

Similar to watercourses and waterbodies, some wetlands are protected as USACE-regulated waters of the United States under Section 404 of in the CWA. Under Section 404 of the CWA, a permit from the USACE is required for the discharge of dredged or fill materials into wetlands. As part of the USACE permitting process, wetlands along the entire project ROW would be identified and delineated by the applicants. For unavoidable impacts, compensatory mitigation is required to replace the loss of wetland, stream, or other aquatic resource functions.

Minnesota has a number of state level mechanisms protecting wetlands. The Minnesota WCA (Minn. Rule 8420) is administered by the Board of Water and Soil Resources and was established to maintain and protect Minnesota's wetlands and the benefits they provide. The WCA's goal of no-net loss of wetlands requires that proposals to drain, fill, or excavate a wetland must meet one or more the following criteria:

(1) avoid disturbing the wetland

(2) minimize wetland impacts

(3) replace lost wetland acres, functions, and values

Certain activities are exempt from the WCA, allowing projects with minimal impact or projects located on land where certain pre-established land uses are present to proceed without regulation. A second state-level program that offers protection to the state's waters and wetlands is the PWI program administered by the DNR (Minn. Statute 103G.005) as discussed in Chapter 5.10.1.1.2.

In addition, the DNR regulates calcareous fens under Minn. Rule 8420.0935. Calcareous fens are rare and distinctive peat-accumulating wetland that receive hydrology from groundwater that is rich in calcium and other minerals. According to the DNR, there are no known calcareous fens located within the project regions (reference (83)). The closest calcareous fen is located over 13 miles west of the Benton County Elk River Region.

5.10.1.3.1 Potential Impacts and Mitigation Measures

It is anticipated that wetlands in the project would be avoided by either prudent routing or spanning. Thus, no structures, or very few structures, would be placed within wetlands, and potential impacts would be minimal. However, where a wetland is crossed and such crossing requires construction activities within the wetland, there is a strong potential for impacts. Transmission line structure construction typically includes vegetation clearing, movement of soils, and construction traffic. These activities could alter or impair wetland function. Even small changes in hydrology (e.g., periods of inundation, changes in flow, sedimentation) can impair wetland function.

Wetlands can be impacted by soil erosion and sediment deposition during construction. Sedimentation and ground disturbance in wetlands can make them more susceptible to establishment of invasive plant species, such as reed canary grass, which would adversely impact wetland function by reducing vegetative biodiversity and altering wildlife habitat.

Forested wetlands within the transmission line ROW would likely undergo a permanent change of vegetation type as a result of the project. The safe and reliable operation of transmission lines is compromised when trees encroach upon them. Therefore, existing trees must be removed throughout the ROW, including forested wetlands. The applicants may be required to provide wetland mitigation for the conversion of forested wetlands to non-forested wetlands that occurs as a result of the project.

Potential wetland impacts can be mitigated by selecting routes, alignments, and pole placements that avoid wetlands. If wetlands cannot be avoided, there are several strategies to mitigate their impact. These include: use of construction mats; constructing during winter months when the ground is frozen; use of all-terrain construction equipment designed to minimize soil impacts; assembling structures on upland areas prior to site installation; and, transporting crews and equipment, to the extent possible, over improved roads and via routes which minimize transit over wetlands Commission permits require mitigation measures for potential wetland impacts (Appendix H).

The applicants indicate they would restore all wetlands in accordance with USACE requirements and would obtain all necessary state and local approvals for work in wetlands.

5.10.1.4 Groundwater

The DNR divides Minnesota into six groundwater provinces. The project is located primarily within Minnesota's central groundwater province, with a small portion extending into the east-central groundwater province. These provinces are characterized by buried sand aquifers and relatively extensive surficial sand plains, part of a thick layer of sediment deposited by glaciers overlying the bedrock. The east-central province is underlain by sedimentary bedrock with good aquifer properties. The central province has thick glacial sediment, sand and gravel aquifers are common, and the deeper fractured crystalline bedrock has poor aquifer properties and limited use as an aquifer (reference (84)).

The Minnesota Department of Health maintains the Minnesota Well Index (MWI) which provides information about wells and borings such as location depth, geology, construction, and static water level. According to the MWI there are approximately 51 wells within the ROW of the project's routing alternatives. These wells are primarily domestic wells in addition to some exploratory wells, one scientific investigation well, and one abandoned well. Wells in the project area range from 50 to 520 feet in depth (reference (85))

5.10.1.4.1 Potential Impacts and Mitigation

Project groundwater impacts are anticipated to be minimal. Potential project groundwater could occur through: (1) surface water impacts; and (2) impacts directly to groundwater resulting from structure foundations. Surface water impacts can lead to groundwater impacts; thus, concerns are similar (i.e., construction activities which lead directly to sedimentation or through disturbed soils and vegetation). Mitigation of these impacts can be affected by measures to control soil erosion and sedimentation.

Direct groundwater impacts could occur as a result of the construction and placement of transmission line structures. Structure foundations will generally range from 25 to 60 feet in depth. Because wells in the area are at considerably greater depths than the structure foundations and because of the relatively low solubility of concrete components, no direct impacts to groundwater are anticipated. The applicants note that if shallow depths to groundwater resources are identified during geotechnical design of the project, specialty structures with wider, shallower foundations may be used.

5.10.2 Geology

The project area surface geology is dominated by quaternary aged glacial deposits from the most recent Wisconsinian glaciation. Gravelly sand to sandy loam sediments deposited by the Superior glacial lobe are most prevalent within the project and are part of the Cromwell Formation. Deposits from the Grantsburg lobe, Rainy lobe, and the St. Louis lobe are also located within the project, as well as glaciofluvial and glaciolacustrine deposits. Various surface glacial features are present including

ground/end moraines, drumlins, and hummocks (reference (86)). Thickness of the glacial deposits vary depending on the location and type of deposit; thicknesses range from 25-350 feet (reference (87)).

The project area bedrock consists of various Paleoproterozoic aged igneous deposits. Dominant igneous bedrock includes granites, iron formations, mafic intrusions, and interlayered volcanic intrusive rocks. Some sedimentary bedrock is also present, including the Mille Lacs and North Range Groups (reference (87)).

Sand and gravel-rich glacial till can often be mined for aggregate resources. Less than 10 percent of the project has been identified as having significant potential for sand and gravel aggregate resources; the remainder of the project has nonsignificant potential for sand and gravel resources (reference (88)). There are multiple aggregate mines present within the proposed route (Chapter 5.8.3).

The project seismic risk is very low; it is located within an area rated as less than two-percent chance of damage from natural or human induced earthquake in 10,000 years (reference (89)). The most intense earthquake that has been recorded in the area occurred in 1860 and was documented as a seven on the Modified Mercalli Intensity Scale. The majority of the remaining recorded earthquakes were documented as less than 5 on the Modified Mercalli Intensity Scale (reference (90)).

Landslides are common throughout Minnesota due to the unconsolidated glacial till deposits located at the surface. Landslide susceptibility can vary based on several factors including the slope angle, water content, and sediment properties. Landslides most commonly occur in Minnesota due to slope failure during heavy rain events (reference (91)).

5.10.2.1 Potential Impacts and Mitigation Measures

No impacts to geologic resources are anticipated as a result of the project. Transmission line construction and operation can result in potential mining operation impacts; these impacts are discussed further in Chapter 5.8.3. Earthquakes are unlikely to occur in or near the project. Changes in slope are not anticipated during the project and as a result, there would be limited risk of landslides.

5.10.3 Soils

Soil information for the project was obtained from the USDA NRCS SSURGO database (reference (71) (71)). Soil mapped in the area surrounding the project primarily include five soil textural classes: sand, loamy sand, sandy loam, loam, and silt loam. Organic soils are also present within the area consisting of peat, muck, and mucky peat.

According to the SSURGO database, exposed soils within the area have a slight, low, medium, moderate, or severe potential erosion hazard. The ratings in this interpretation indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface.

Soil compaction susceptibility within the area ranges from low to high; however, some soil areas have not been rated. Soil compaction occurs when moist or wet soil particles are pressed together reducing pore space between them and is primarily caused by wheel traffic.

Hydric soils are present throughout the area. A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile. Hydric soils are typically associated with lowlands and wetlands and are rated by their proportion of hydric soil in the map unit.

5.10.3.1 Potential Impacts and Mitigation Measures

Project soil impacts are anticipated to be minimal and temporary. Soil impacts are dependent, to some extent, on the soil surface conditions at the time of construction. Construction activities that occur on wet soils tend to have longer lasting impacts, regardless of the soil type. During dry conditions, soil disturbances will be temporary, minimal, and generally less invasive than typical agricultural practices such as plowing and tilling.

Surface soils would be disturbed by site clearing, grading, and excavation activities at structure locations, substation sites, pulling and tensioning sites, and setup areas. Soil disturbance would occur during the transport of crews, machinery, materials, and equipment over access routes (primarily along rights-of-way). Soil erosion may occur if surface vegetation is removed, especially on fine textured soils that occur on sloping topography, exposing soils to wind and water erosion. Topsoil could be lost to improper handling or erosion and loss of soils could adversely impact water resources in the area. Soil compaction and rutting could occur from movement of construction vehicles on access paths, and at other locations because of heavy equipment activity.

Identifying specific staging areas and associated impacts would be completed during final design. Potential impacts to soils would be minimized by using BMPs for construction of the project as required by the route permit (Appendix H) and other state and federal permits. The applicants have indicated that they would use a variety of methods to minimize soil erosion, including the prompt revegetation of disturbed soils. Common measures employed to minimize soil erosion include:

- Using low ground pressure construction equipment, which are designed to minimize impacts to soils in damp areas.
- Implementing measures to minimize erosion and sedimentation during construction and employing perimeter sediment controls, protecting exposed soil by promptly planting, seeding, using erosion control blankets and turf reinforcement mats, stabilizing slopes, protecting storm drain inlets, protecting soil stockpiles, and controlling vehicle tracking.
- Grading contours so that all surfaces provide for proper drainage, blend with the natural terrain, and are left in a condition that will facilitate re-vegetation and prevent erosion. Returning all areas disturbed during construction to pre-construction conditions.
- Obtaining a NPDES construction stormwater permit from the MPCA and preparing a SWPPP if more than 1 acre of soil will be disturbed during construction.
- Erecting or using sediment control fences that are intended to retard flow, filter runoff, and promote the settling of sediment out of runoff via ponding behind the sediment fence.
- Using erosion control blankets and turf reinforcement mats that are typically single or multiple layer sheets made of natural and/or synthetic materials that provide structural stability to bare surface and slopes.
- Separating topsoil and subsoil and covering stockpiled soils.
- Returning locations, where grading or temporary access is required, to their original land contour and elevation to the greatest extent possible.

- Seeding to establish temporary and permanent vegetative cover on exposed soil. Soils will be revegetated as soon as practicable to minimize erosion.
- Revegetating disturbed areas using weed-free seed mixes and using weed-free straw and hay for erosion control.
- Using mulch to form a temporary and protective cover on exposed soils. Mulch can help retain moisture in the soil to promote vegetative growth, reduce evaporation, insulate the soil, and reduce erosion. A common mulch material used is hay or straw.

5.10.4 Vegetation

As mentioned in Chapter 5.2, the project traverses several ecological subsections, including the St. Louis Moraines, Tamarack Lowlands, Pine Moraines and Outwash Plains, and the Mille Lacks Uplands subsections in the Northern Laurentian Mixed Forest Province and the Anoka Sand Plain Subsection in the Eastern Broadleaf Forest Province; these subsections are shown on (Map 5-1).

Prior to European settlement, vegetation in the St. Louis Moraines Subsection consisted of coniferous and deciduous upland forests, with coniferous swamps and bogs also scattered throughout the subsection (reference (18)). At present, much of the subsection remains forested, and forestry and recreation are the dominant land uses.

The Tamarack Lowlands Subsection consisted primarily of upland and wetland coniferous and deciduous forests and sedge meadows prior to European settlement (reference (18)). At present much of the subsection remains forested and forestry is a dominant land use; agricultural land is also present in the subsection but not abundant.

Prior to European settlement, vegetation in the Pine Moraines and Outwash Plains Subsection was dominated by pine (Jack pine, red pine, and white pine) in coniferous and mixed coniferous-deciduous forests (reference (18)). At present, much of the subsection remains forested and forestry is a dominant land use, along with tourism. Agricultural land is also present in the western part of the subsection but not in the eastern part where the project is located.

The Mille Lacs Uplands Subsection consisted of deciduous, coniferous, and mixed upland and wetland forests prior to European settlement (reference (18)). At present, the western part of the subsection, where the project is located, is dominated by agricultural vegetation, with forested areas more dominant in the central and eastern part of the subsection.

Prior to European settlement, vegetation in the Anoka Sand Plain Subsection consisted of oak barrens in the uplands, with areas of Jack pine, brushland, upland prairie and floodplain forest also present (reference (18)). At present, the subsection is dominated by agricultural vegetation, with urban development rapidly expanding in the subsection.

In general, the vegetation resources across the project include upland and wetland forests, open and shrub wetlands, and herbaceous agricultural vegetation, consisting of cultivated cropland and hay and pastureland. The northern part of the project contains more forested vegetation while the southern part contains more agricultural vegetation, as identified by the National Land Cover Database (NLCD; see Map Book 5C). The NLCD is derived from Landsat imagery along with various other data sources. As such, it provides only an approximation of existing land cover types. Sensitive vegetation resources, such

as native plant communities, are scattered across the project; these resources are discussed in Chapter 5.11.2.

5.10.4.1 Potential Impacts and Mitigation Measures

Project construction would result in short-term impacts on existing vegetation, including localized physical disturbance and soil compaction. Construction activities involving development and use of access roads, staging, and stringing areas would also have short-term impacts on vegetation by concentrating surface disturbance and equipment use. Permanent vegetation clearance will be required in the designated structure installation areas, resulting in an impact area measuring 8 feet in diameter for typical structures and 12 feet in diameter for dead-end and angle structures. Construction would also result in long-term impacts to vegetation by permanently removing forested vegetation within the ROW. The applicants would permanently convert forested areas to low-stature vegetation by clearing woody vegetation throughout the entire ROW where it occurs. The clearing of woody vegetation within the ROW would result in the widening of existing rights-of-way or bisecting (fragmenting) forests to establish new ROWs.

Fragmentation of forest vegetation can negatively impact species that depend on large contiguous blocks of interior forest. Conversion from forest to open habitats in the ROW could have indirect impacts on native vegetation by altering environmental conditions, such as light penetration; this could alter the vegetation community adjacent to the ROW and increase the potential spread of noxious weeds and other non-native species.

Construction and maintenance activities have the potential to result in the introduction or spread of noxious weeds and other non-native species. Noxious weeds could be introduced to new areas through propagating material like roots or seeds transported by contaminated construction equipment. Activities that could potentially lead to the introduction of noxious weeds and other non-native species include ground disturbance that leaves soils exposed for extended periods, introduction of topsoil contaminated with weed seeds, vehicles importing weed seed, and conversion of landscape type, particularly from forested to open settings.

The primary means of mitigating vegetation impacts is to avoid particular vegetation, such as trees, through prudent routing. Mitigation can be achieved, in part, by using existing infrastructure rights-of way (e.g., roadway, transmission line) such that tree removal is minimized. Mitigation can also be accomplished by spanning areas of sensitive vegetation, native plant communities, and other sensitive ecological resources. These resources are discussed further in Chapter 5.11.2.

Vegetation impacts can also be mitigated by a number of other strategies, including:

- Constructing during fall and winter months to limit plant damage.
- Leaving or replanting compatible plants at the edge of the transmission line ROW.
- Replanting the transmission line ROW with low-growing, native species.
- Limiting vehicle traffic to roads along the ROW and within previously disturbed areas.

Potential noxious weed impacts can be mitigated by:

- Revegetating disturbed areas using weed-free seed mixes and using weed-free straw and hay for erosion control.

- Removal of invasive species/noxious weeds via herbicide and manual means consistent with easement conditions and landowner restrictions.
- Cleaning and inspecting construction vehicles to remove dirt, mud, plant, and debris from vehicles prior to arriving at and leaving construction sites.

Vegetation impacts can also be mitigated by providing compensation to individual landowners through negotiated easement agreements. Mitigation and restoration measures for impacts to vegetation are standard Commission route permit conditions (Appendix H).

5.10.5 Wildlife

The project's landscape provides habitat for a variety of resident and migratory wildlife species, such as large and small mammals, songbirds, waterfowl, raptors, fish, amphibians, reptiles, and insects. These species use the area for forage, shelter, breeding, overwintering, and/or as a stopover during migration. Habitat diversity characterizes the area, from densely forested regions in the north to predominantly agricultural landscapes in the south.

The state of Minnesota is in the Central Flyway of North America. The Central Flyway is a bird migration route that encompasses the Great Plains of the U.S. and Canada. Migratory birds use portions of the Central Flyway as resting grounds during spring and fall migration, as well as breeding and nesting grounds throughout the summer. Suitable habitat for migratory birds is present throughout the project's landscapes.

Migratory birds are protected under the Migratory Bird Treaty Act of 1918 (16 USC 703-712), which prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests. Bald eagles (*Haliaeetus leucocephalaus*) and golden eagles (*Aquila chrysaetos)* are protected under the MBTA and the federal Bald and Golden Eagle Protection Act (BGEPA; 16 USC 668-668d), which specifically prohibits the taking or possession of and commerce in, either alive or dead, or any part, nest, or egg of these eagles.

Several lands preserved or managed for wildlife and associated habitat are scattered throughout the geographic area; some of these areas are crossed by the project's ROI for wildlife (the 150-foot ROW), including DNR WMAs, lakes that are part of DNR Shallow Lakes Program, and USFWS Grassland Bird Conservation Areas (GBCA) (Map Book 5H).

The DNR established WMAs to protect lands and waters that have a high potential for wildlife production, public hunting, trapping, fishing, and other compatible recreational uses (reference (92)). The DNR Shallow Lakes Program works to protect and enhance wildlife habitat on larger lakes (greater than 50 acres in size) that are dominated by shallow water (littoral zone) (reference (93)). The USFWS designates GBCAs as priority areas for grassland protection and enhancement that are thought to provide suitable habitat for many or all priority grassland bird species in tall grass prairie.

Additional lands managed or preserved for wildlife are scattered through the area but are not within the project's ROI, including USFWS National Wildlife Refuges, USFWS Waterfowl Production Areas, DNR State Game Refuges, DNR AMAs, and National Audubon Society Important Bird Areas. These lands are shown in Map Book 5H but are not discussed further in this EA. The applicants' route permit application stated that the Wolvert AMA lies within the applicants' proposed route's ROW. However, recent data from the Minnesota DNR website and the latest spatial data downloaded in March 2024 from Minnesota Geospatial Commons do not list this AMA or any others within the project's Region of Influence (ROI) for

wildlife (reference (94)). State forests and state parks also provide habitat for a variety of wildlife; these resources are discussed in Chapter 5.8.4. In addition, there are several sensitive ecological resources, such as native plant communities, which would also provide habitat for wildlife; these resources are discussed in Chapter 5.11.2.

5.10.5.1 Potential Impacts and Mitigation Measures – Non-Avian Species

Construction activities that generate noise, dust, or disturbance of habitat may result in short-term, indirect impacts on wildlife. During project construction, wildlife would generally be displaced within the 150-foot ROW and footprints of associated facilities. Clearing and grading activities could also affect birds' eggs or nestlings and small mammals that may be unable to avoid equipment. Many wildlife species would likely avoid the immediate area during construction; the distance that animals would be displaced depends on the species and the tolerance level of each animal. However, comparable habitat is available adjacent to the project.

Project construction may result in long-term adverse impacts on wildlife due to loss, conversion, or fragmentation of habitat. The applicants would permanently clear forested vegetation within the ROW and footprints of associated facilities. Wildlife species previously occupying forested communities in these areas would be displaced in favor of species that prefer more open vegetation communities. Fragmentation could affect the survival of some species that depend on large areas of undisturbed habitat. Impacts are expected to be minimal in situations where an existing ROW is expanded because fragmented forest would already be present.

The potential long-term project impacts to wildlife are anticipated to be minimal. Potential wildlife impacts can be mitigated or minimized through several strategies. The primary impact mitigation strategy is to select route alternatives away from areas known to contain high-quality habitat or which serve as migratory corridors. Use of existing rights-of-way can minimize habitat loss and fragmentation. Wildlife impacts can also be minimized by spanning habitats and minimizing the number of structures in high-quality habitat through the use of specialty structures.

5.10.5.2 Potential Impacts and Mitigation Measures – Avian Species

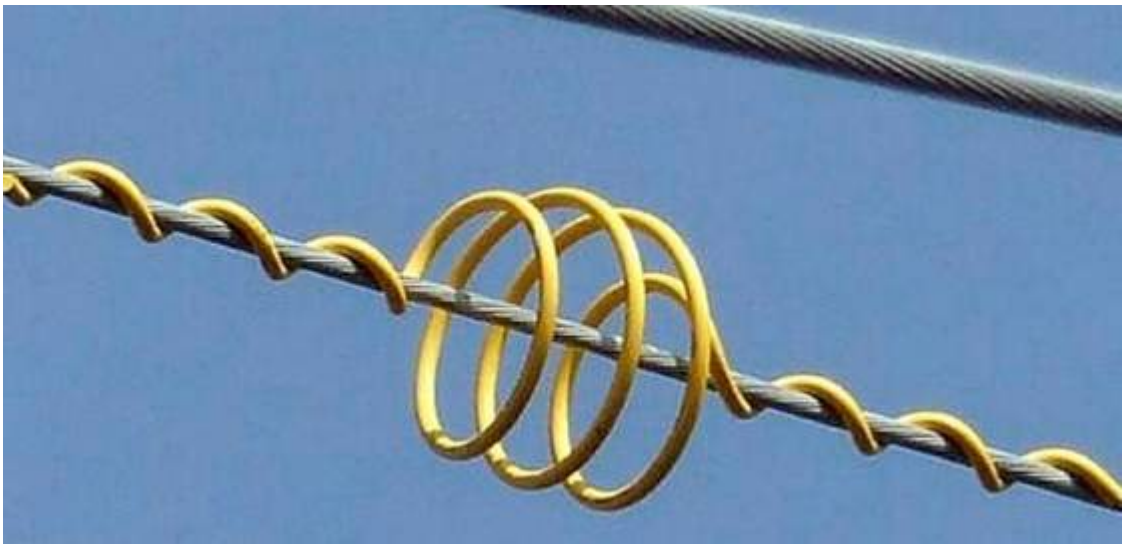
Potential impacts to avian species (e.g., songbirds, raptors, and waterfowl) include those described above for non-avian species, but also include impacts due to electrocution and collision with transmission line conductors. Electrocution occurs when an arc is created by contact between a bird and energized 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 project would be constructed in accordance with the Avian Power Line Interaction Committee's (APLIC) safety recommendations (reference (95)). These recommendations minimize electrocution risk by providing adequate clearance from energized conductors to grounded surfaces and to other conductors.

Independent of the electrocution risk, birds may be injured by colliding with transmission line structures and conductors. The collision risk 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 collision frequency 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 incidence of birds colliding with transmission lines is also influenced by the number of horizontal planes in which the conductors are strung. Stringing the conductors in a single horizontal plane presents less of a barrier to birds crossing the transmission line ROW. A single horizontal plane; however, generally requires a wider structure (e.g., H-frame structure). Conversely, stringing the conductor wires in two or more planes creates a greater barrier to birds attempting to fly, not only across the lines, but over and potentially between them (e.g., monopole structure).

Beyond conductor configuration, bird collisions with transmission lines can also be mitigated by the use of bird flight diverters. Diverters enable birds to better see conductors during flight and avoid collisions with them. A typical diverter installation is shown in Figure 5-8.

Figure 5-8 Bird Flight Diverter



The coiled shape of the bird flight diverter makes transmission lines more visible to birds and minimizes collisions with the lines. Source: reference (7)

5.11 Rare and Unique Natural Resources

This Chapter describes the rare and unique natural resources, including federally and state protected species and sensitive ecological resources, which are present across the project's geographic area.

Federally endangered or threatened species are protected under Section 7 of the Endangered Species Act (ESA) of 1973. Data on federal protected species were reviewed using the USFWS Information for Planning and Consultation (IPaC) online tool.

State endangered or threatened species are protected under the Minnesota Endangered Species Statute (Minn. Statute 84.0895). The DNR Natural Heritage Inventory System (NHIS) database (License Agreement #2022-008) was used to assess the presence of state protected species within 1 mile of the project.

Publicly available GIS datasets and the DNR Conservation Explorer online tool were used to assess the presence of sensitive ecological resources in the area. Sensitive ecological resources may provide habitat suitable for federal and/or state protected species.

5.11.1 Protected Species

5.11.1.1 Federal Protected Species

The USFWS IPaC online tool was queried on March 28, 2024, for a list of federally threatened and endangered species, proposed species, candidate species, and designated critical habitat that may be present within the vicinity of the project (Appendix L). The IPaC query identified seven federal species that could potentially be in the vicinity of the project, including two endangered species, two threatened species, a proposed endangered species, a candidate species, and an experimental population, non-essential species. These species and their typical habitats are summarized in Table 5-15. The project does not traverse any federally designated critical habitat.

Table 5-15 Federal Species Potentially Present in the Vicinity of the Project

Scientific Name	Common Name	Federal Status	State Status	Habitat
Bombus affinis	Rusty patched bumble bee	Endangered	Not listed	Areas with a high number of flowering plants during active season; overwinter a few inches below the soil surface in mesic hardwoods.[1]
Myotis septentrionalis	Northern long-eared bat	Endangered	Special concern	Forested habitat in active season; caves and mines during inactive season.[1]
Canis lupus	Gray wolf	Threatened	Not listed	Forested, shrub, and open areas.[1]
Lynx canadensis	Canada lynx	Threatened	Special concern	Boreal forests where prey (snowshoe hare) is present.[1]
Perimyotis subflavus	Tricolored bat	Proposed Endangered	Special concern	Forested habitat in active season; caves and mines during inactive season.[1]
Danaus plexippus	Monarch butterfly	Candidate	Not listed	Areas with a high number of flowering plants. Presence of milkweed (Asclepias spp.) to complete the caterpillar life stage.[2]
Grus americana	Whooping crane	Experimental population, non-essential	Not listed	Wetlands, lakes, ponds, rivers, and agricultural fields.[3]

1 Habitat information if from reference (96) (97).
2 Habitat information from reference (98)
3 Habitat information from reference (99)

5.11.1.2 State Protected Species

The DNR's NHIS database was queried in February 2024 (Barr License Agreement LA-2022-008), to determine if any state endangered, threatened, or special concern species have been documented within 1 mile of the project. The NHIS database identified records for six endangered, nine threatened, and 31 special concern species within 1 mile of the project. State threatened and endangered species documented in the NHIS database, along with their typical habitats are summarized in Table 5-16. State special concern species documented in the NHIS database within 1 mile of the project are summarized in Appendix M; these species are tracked by the DNR; however, they are not legally protected under the Minnesota Endangered Species Statute.

Table 5-16 Natural Heritage Information System Database Records of State Threatened and Endangered Species Documented within One Mile of the Project

Scientific Name	Common Name	Type	State Status	Habitat[2]
Botrychium ascendens	Upswept moonwort	Vascular plant	Endangered	Fire dependent forests, wet meadows/shrub carr.
Botrychium lineare	Slender moonwort	Vascular plant	Endangered	Fire dependent forests.
Botrychium spathulatum	Spatulate moonwort	Vascular plant	Endangered	Fire dependent forests.
Juglans cinerea	Butternut	Vascular plant	Endangered	Mesic hardwood forests.
Lanius ludovicianus	Loggerhead shrike	Bird	Endangered	Upland prairies.
Utricularia purpurea	Purple-flowered bladderwort	Vascular plant	Endangered	Littoral zone of lakes.
Aristida tuberculosa	Seaside three-awn	Vascular plant	Threatened	Savannas and upland prairies.
Botrychium angustisegmentum	Narrow triangle moonwort	Vascular plant	Threatened	Mesic hardwood forests.
Botrychium oneidense	Blunt-lobed grapefern	Vascular plant	Threatened	Mesic hardwood forests.
Cardamine pratensis	Cuckoo flower	Vascular plant	Threatened	Fens and swamps.
Emydoidea blandingii	Blanding's turtle	Turtle	Threatened	Calm, shallow waters with rich, aquatic vegetation for foraging and adjacent sandy uplands for nesting.
Hudsonia tomentosa	Beach heather	Vascular plant	Threatened	Savannas and upland prairies.
Minuartia dawsonensis	Rock sandwort	Vascular plant	Threatened	Savannas, upland prairie, and rock outcrops.
Platanthera flava var. herbiola	Tubercled rein orchid	Vascular plant	Threatened	Wet meadows and sunny swales in savannas.
Poa paludigena	Bog bluegrass	Vascular plant	Threatened	Forested wetlands that have groundwater seeps.
Myotis septentrionalis[1]	Northern long-eared bat	Bat	Special concern	During winter inactive season, hibernates in caves and mines. During active season, forages and roosts in upland forests.

1 Although *Myotis septentrionalis* is a state special concern species, it is listed in this table because it is a federally endangered species. Records include both individuals and a maternity roost tree.
2 Habitat information if from reference (96)

5.11.1.3 Potential Impacts and Mitigation Measures

Construction-related potential short-term impacts on federal- or state-protected wildlife species would be similar to those described for non-listed species in Chapter 5.10.5 and may include displacement of

protected species during construction activities that generate noise, dust, or disturbance of habitat. Permanent clearing of forested and shrub communities could impact protected species associated with these habitats.

Impacts to protected aquatic species are not anticipated, as waterbodies and watercourses would be spanned and BMPs, such as erosion control measures, would be incorporated to minimize the potential for sedimentation in surface waters crossed by the project.

The primary means to mitigate potential impacts to federally and state protected species is to avoid routing through habitat utilized by these species. Additionally, impacts can be mitigated by incorporating species (or species type) specific BMPs in coordination with the USFWS and/or the DNR. For example, impacts to Blanding's turtles could be minimized by using silt fencing around construction sites and training construction workers to recognize Blanding's turtles. The applicants may be required to conduct field surveys for protected species in coordination with USFWS and/or DNR to determine the presence of particular species along the permitted route (if the Commission issues a route permit). If a protected species is unavoidable, a takings permit may be required, and other permit conditions may be set.

5.11.1.3.1 Federal Species

The species identified in the IPaC query are potentially present in the vicinity of the project in areas where suitable habitat is present. Through implementation of BMPs and mitigation measures, along with the presence of comparable adjacent habitat, impacts to federally protected species are anticipated to be minimal.

The nearest federally designated critical habitat for the gray wolf is located approximately 40 miles north and east of the project's northern extent. The NHIS database does not track the locations of documented gray wolves. Impacts to gray wolves occupying habitats near the project could occur during construction as a result of human activity and noise associated with construction activities. Removal of forested habitat could also impact gray wolves; following existing rights-of-ways, where potential habitat has already been fragmented, would minimize potential impacts to gray wolves.

The nearest federally designated critical habitat for the Canada lynx is located approximately 40 miles east of the project's northern extent. The NHIS database does not track the locations of documented Canada lynx. Impacts to and mitigation measures for Canada lynx would be similar to those described for gray wolves.

As noted in Table 5-16, the NHIS database documents the presence of northern long-eared bats, and a northern long-eared bat maternity roost tree within 1 mile of the project. Impacts to northern long-eared bats could occur if clearing or construction take place during the bat's active season, when the species are breeding, foraging, or raising pups in forested habitat. Bats may be injured or killed if occupied trees are cleared during the active season, and the species may be disturbed during clearing or construction activities due to noise or human presence. Impacts to northern long-eared bats could be minimized by conducting clearing activities while the bats are hibernating in their inactive season habitats.

The tricolored bat is a federal proposed endangered species, which means that the USFWS has determined it is in danger of extinction throughout all or a significant portion of its range and has proposed a draft rule to list it as endangered. Until the rule to list this species is finalized, it is not protected by the take prohibitions of the federal ESA. The NHIS database does not identify any records of tricolored bats within 1 mile of the project; however, habitat suitable for the species is present in the area. Potential

impacts to and minimization measures for tricolored bats would be similar to those described for northern long-eared bats.

The project is not located in the USFWS rusty patched bumble bee high potential zone (an area where the species is likely to be present) and the NHIS database does not identify any records of rusty patched bumble bees within 1 mile of the project. Potential impacts to rusty patched bumble bees could occur due to suitable habitat removal; however, impacts are anticipated to be minimal given the abundance of comparable habitat in the area. Potential impacts could be minimized by conducting clearing activities in the winter months.

The monarch butterfly is a federal candidate species, which means that it is a species for which the USFWS has sufficient information to propose listing them as endangered or threatened under the ESA but their listing is precluded by other higher listing activities. Candidate species have no federal protection under the ESA. The NHIS database does not track documented records of monarch butterflies. Potential impacts to and minimization measures for monarch butterflies would be similar to those described for rusty patched bumble bees.

Whooping cranes are designated as a non-essential experimental population in the state. This designation refers to a population that has been established within its historical range under Section 10(j) of the ESA to aid in recover of the species. Consultation under Section 7(a)(2) of the ESA is only required if project activities would occur within a National Wildlife Refuge or National Park. If project activities are proposed on lands outside of a National Wildlife Refuge or National Park, consultation is not required. The project does not intersect any National Wildlife Refuges or National Parks. Whooping cranes are rare in the state of Minnesota, and the NHIS database does not track documented records of them. Potential impacts to and mitigation measures for whooping cranes would be similar to those described for other waterfowl/avian species in Chapter 5.10.5.2.

5.11.1.3.2 State Species

The state threatened and endangered species identified in Table 5-16 and special concern species identified in Appendix N are known to occur in the project's geographic area where suitable habitat is present. The discussion below is focused on potential impacts to and mitigation measures for state threatened and endangered species; however, impacts to and mitigation measures for special concern species would generally be similar for many species occupying similar habitats. Through implementation of BMPs and mitigation measures and the presence of comparable adjacent habitats, impacts to state protected species are anticipated to be minimal.

The state threatened and endangered vascular plants identified in Table 5-16 may occupy habitats that are traversed by the project. If present, these species and/or their habitats could be impacted as a result of clearing activities associated with project construction. Many state protected vascular plants inhabit areas of native vegetation/sensitive ecological resources. These areas would generally be avoided or spanned to the extent possible, which would minimize potential impacts.

Potential impacts to Blanding's turtles could occur as a result of ground disturbing activities associated with project construction. Potential impacts to Blanding's turtles could be minimized by spanning large wetland complexes with adjacent sandy uplands. The use of silt fencing around construction sites and the training of construction workers would also minimize potential impacts to Blanding's turtles.

Loggerhead shrikes could be present in the project's vicinity and potential impacts to and mitigation measures for this species would be similar to those described for other avian species in Chapter 5.10.5.2.

5.11.2 Sensitive Ecological Resources

The DNR has established several classifications for sensitive ecological resources across the state, many of which are scattered throughout the project area (Map Book 5I). Some of these sensitive ecological resources are crossed by the project's ROI for sensitive ecological resources (the 150-foot ROW), including Sites of Biodiversity Significance (SBS), native plant communities, old growth stands, High Conservation Value Forests, and Lakes of Biodiversity Significance. DNR Scientific and Natural Areas are also scattered throughout the area but they are not within the project's ROI; these areas are shown in Map Book 5I but are not discussed further in this EA.

The DNR maps SBS and assigns a biodiversity significance rank to all sites surveyed across the state. These ranks are used to communicate statewide native biological diversity of each site and help to guide conservation and management activities (reference (100)). The DNR assigns biodiversity significance ranks, as follows:

- Outstanding (best occurrences of the rarest species and native plant communities).
- High (good quality occurrences of the rarest species and high-quality examples of native plant communities).
- Moderate (occurrences of rare species, moderately disturbed native plant communities).
- Below (sites with moderately disturbed native plant communities, but lacking occurrences of rare species).

As shown in Map Book 5I, several SBS have been mapped across the area, many SBS ranked high, moderate, and below are crossed by the project's ROI for sensitive ecological resources.

The DNR also identifies and maps areas containing native plant communities across the state. A native plant community is a group of native plants that interact with each other and their environment in ways that have not been greatly altered by modern human activity or introduced organisms (reference (101)). The DNR provides a state conservation status to each native plant community, as follows:

- S1 – community is critically imperiled
- S2 – community is imperiled
- S3 – community is vulnerable to extirpation or extinction
- S4 – community is apparently secure
- S5 – community is demonstrably widespread, abundant, and secure

As shown in the Map Book 5I, several native plant communities have been mapped across the area, many of which are crossed by the project's ROI for sensitive ecological resources, including the following types and associated state conservation status (or range of statuses if multiple subtypes):

- Dry Barrens Oak Savanna (Southern); S1 or S2
- Red Pine - White Pine Forest; S2

- Northern Wet-Mesic Boreal Hardwood-Conifer Forest; S2-S4
- Graminoid Poor Fen (Basin); S3
- Lowland White Cedar Forest (Northern); S3
- Southern Dry-Mesic Oak (Maple) Woodland; S3 or S4
- Northern Wet Cedar Forest; S3 or S4
- Northern Poor Fen; S3-S5
- Central Mesic Hardwood Forest (Eastern); S4
- Northern Wet-Mesic Hardwood Forest; S4
- Northern Very Wet Ash Swamp; S4
- Red Oak - Sugar Maple - Basswood - (Bluebead Lily) Forest; S4
- Sedge Meadow; S4 or S5
- Northern Shrub Shore Fen; S5
- Alder - (Maple - Loosestrife) Swamp; S5
- Dry Barrens Oak Savanna (Southern); S1 or S2
- Northern Rich Mesic Hardwood Forest; S3
- White Cedar Swamp (Northcentral); S3
- Alder - (Red Currant - Meadow-Rue) Swamp; S3
- Northern Cedar Swamp; S3 or S4
- Northern Wet Ash Swamp; S3 or S4
- Central Dry-Mesic Oak-Aspen Forest; S4
- Northern Mesic Hardwood Forest; S4
- Northern Rich Fen (Basin); S4
- Poor Tamarack - Black Spruce Swamp; S4
- Graminoid Rich Fen (Basin); S4
- Northern Poor Conifer Swamp; S4 or S5
- Poor Black Spruce Swamp; S5
- Willow - Dogwood Shrub Swamp; S5
- Red Pine - White Pine Forest; S2

On state-administered lands, the DNR maps and designates old growth stands, future old growth stands, and candidate old growth stands. As shown on in the Map Book 5I, these stands are sparsely scattered throughout the area. Two candidate old growth stands are crossed by the project's ROI for sensitive ecological resources, both of which are located within northern cedar swamp native plant communities in the Hill River State Forest.

The DNR is required to manage a broad set of objectives and forest resources. The Forest Stewardship Council Forest Management Standard requires certificate holders to identify High Conservation Value Forests and manage such areas to "maintain or enhance" identified High Conservation Values (reference (102) (102)). As shown in the Map Book 5I, High Conservation Value Forests are scattered throughout the area, including one in the northern part of the project that is crossed by the project's ROI for sensitive ecological resources.

The DNR maps certain lakes as Lakes of Biological Significance based on the unique presence of aquatic plants or animals (reference (103)). The DNR assigns biological significance classes (outstanding, high,

or moderate) to these lakes based on a variety of factors, such as the quality of the lake/habitat and presence of certain plants and animals. As shown in the Map Book 5I, several Lakes of Biological Significance have been mapped across the area, three of which (two ranked outstanding and one ranked moderate) are crossed by the project's ROI for sensitive ecological resources.

State and federal lands that are preserved or managed for wildlife would also be considered sensitive ecological resources; these lands are discussed in Chapter 5.10.5.

5.11.2.1 Potential Impacts and Mitigation Measures

Potential project impacts to sensitive ecological resources are anticipated to be minimal, as these resources can often be avoided and/or spanned. Sensitive ecological resources can be impacted by construction activities. The use of construction equipment during site preparation (grading, excavation, and soil stockpiling) could result in localized physical disturbance and soil compaction. The applicants would permanently convert forested and/or shrubland within the ROW to low-growing vegetation. Removal of vegetation and/or conversion to open habitats could increase the potential for the spread of invasive plant species/noxious weeds and could alter the structure and function of sensitive ecological resources, potentially making them less suitable for the rare species that would typically inhabit them.

The primary impact mitigation to manage sensitive ecological resources is prudent routing (i.e., by avoiding and/or spanning these communities if possible). In addition, following existing rights-of way and division lines such as roads, existing transmission lines, and field lines, would reduce the potential for fragmentation of these resources. Where structures must be placed within sensitive ecological resources, a biological survey, conducted in coordination with appropriate agencies, may be required.

5.12 Use or Paralleling of Existing Rights-of-Way

Sharing ROW with existing infrastructure or paralleling existing ROW minimizes fragmentation of the landscape and can minimize human and environmental impacts (e.g., aesthetic and agricultural impacts). The use and paralleling of existing ROW is considered by the Commission when determining the most appropriate route for the project.

There is a difference in potential impacts between using ROW for double-circuiting and paralleling existing ROW. Though both can minimize land-use, agricultural, and natural/cultural resource impacts, double-circuiting with existing transmission lines best minimizes potential impacts because no new ROW would be acquired.

ROW sharing opportunities for the project are shown in Map Book 5J. These opportunities exist where the ROW for the route would be shared with or would parallel the ROW of existing infrastructure—a transmission line, road, or railway—or existing field, parcel, or section lines. Specific analysis and comparisons of ROW sharing and paralleling between routing alternatives is discussed further in Chapters 6 and 7.

5.13 Electric System Reliability

The NERC has established mandatory reliability standards for American utilities. For new transmission lines, these standards require the utility to evaluate whether the grid would continue to operate adequately under various contingencies.

Two contingency categories apply here. Under Category C, NERC requires utilities to analyze the consequences of a single storm or other event that causes simultaneous outages of both circuits on a double-circuit transmission line. The applicable Category D contingencies are loss of all transmission lines along a common ROW and loss of an entire voltage level at a substation. The effects of these transmission contingencies on the system, and the transmission system's ability to serve load, must be monitored and managed by utilities. Route permits issued by the Commission require permittees to comply with NERC standards (Appendix H).

In developing possible project routes, the applicants analyzed whether these routes created reliability concerns. The applicants indicate that there are no reliability concerns with their proposed route and that this route supports and enhances the reliability of the regional electrical system. Thus, no adverse impacts to electric system reliability are anticipated. Specific analysis and comparisons of electrical reliability between routing alternatives is discussed further in Chapters 6 and 7.

5.14 Cost

As outlined in the RPA, the estimated project construction cost is approximately $970 million to $1.3 billion (2022$). Cost will be dependent upon the routing alternatives selected for the project. Construction cost estimates rely on the best available information at the filing time of the RPA. Estimates are made in year-2022 dollars, and include permitting, engineering, materials (e.g., steel, conductor, insulators, etc.), land rights and ROW, and construction costs. The cost estimate assumes the applicants will pay prevailing wages for applicable positions during project construction.

The construction cost estimate of $970 million to $1.3 billion was developed specifically for the applicants' proposed route. To estimate the cost of alternatives, transmission line construction costs were divided by the project's length to develop an approximate cost-per-mile estimate for new double-circuit 345 kV transmission. The cost estimate to remove existing transmission lines was calculated in a similar way. Cost estimates in cost-per-mile for other voltage classes (e.g., route alternative E1) are sourced from recent construction actuals.

Cost estimates vary depending on the addition of costs outside typical construction, referred to as cost "adders" for specialty structures, line crossings, and additional ROW. Multiple alternatives (e.g., route alternative C, alignment alternative AA15, etc.) create new crossings of existing transmission lines. To cross over an existing transmission line, taller, more robust structures (steel, foundation, and insulators), and thus more expensive transmission structures, known as "dead-ends" must be built on each side of the crossing. In other alternatives where a significant change in direction is required (e.g., route alternative E4, E5, and others), more robust (and therefore more expensive) transmission structures known as "heavy-angles" will be required to allow for a "turn" in the transmission line route. Conversely, some alternatives reduce the number of heavy-angle structures relative to the applicants' proposed route and instead allow use of non-specialty structures known as "tangents," which results in a cost savings. Construction costs for specific routing alternatives are discussed in Chapters 6 and 7.

5.15 Cumulative Potential Effects

In Minnesota, cumulative potential effects are impacts on the environment that result from:

> *The incremental effects of a project in addition to other projects in the environmentally relevant area that might reasonably be expected to affect the same environmental resources, including future projects actually planned or for which a basis of expectation has been laid, regardless of*