North Star Solar Project
Environmental Assessment

In the Matter of the Combined Application of North Star Solar PV LLC for a Site Permit and Route Permit for the North Star Solar Electric Power Generating Plant and Associated 115 kV High Voltage Transmission Line in Chisago County

Minnesota Public Utilities Commission Docket no. IP6943/GS-15-33
Office of Administrative Hearings Docket no. 82-2500-32679

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Energy Environmental Review and Analysis

Responsible Government Unit

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Abstract

North Star Solar PV, LLC (North Star) submitted a joint application to the Minnesota Public Utilities Commission (Commission) for a Site Permit to construct 100 MW of photovoltaic solar generation in in North Branch, Sunrise Township and Lent Township in Chisago County, and a Route Permit to build one-half mile of 115 kV transmission line to interconnect the Project at the Chisago Substation. The estimated developed area would cover approximately 800 acres.

North Star submitted its Site and Route Permit Application to the Commission on February 11, 2015. The Application was accepted as complete by the Commission on April 27, 2015. The docket number for the Site and Route Permits joint proceeding is E6943/GS-15-33.

Under the Power Plant Siting Act (Minn. Statute 216E), a site permit from the Commission is required to construct a large electric power generating plant or a high voltage transmission line. Department of Commerce (Commerce) Energy Environmental Review and Analysis (EERA) staff is responsible for conducting the environmental review for site and route permit applications submitted to the Commission (Minn. Rules 7850). Accordingly, EERA staff has prepared this Environmental Assessment (EA) for the North Star Solar Project. This EA addresses the issues required in Minnesota Rule 7850.3700, subpart 4, and those identified in the Department's Scoping Decision of June 24, 2015.

Persons interested in this project can place their names on the Project Mailing List by contacting the Public Advisor: Tracy Smetana at consumer.puc@state.mn.us, 651-296-0406 or 1-800-657-3782. Documents of interest can be found on the Commerce and Commission eDockets system: https://www.edockets.state.mn.us/EFiling/search.jsp (enter the year "15" and the number "33") or http://mn.gov/commerce/energyfacilities/Docket.html?Id=34064.

Following release of this Environmental Assessment, a public hearing will be held in the project area. The hearing will be presided over by an Administrative Law Judge from the Office of Administrative Hearings. Upon completion of the environmental review and hearing process, the record compiled on the Site and Route Permit Application will be presented to the Commission for a final decision. A decision on a Site and Route permit for the Project is anticipated by January 2016.

Acronyms and Abbreviations

ALJ	Administrative Law Judge
BMP	Best Management Practice
dBA	A-weighted sound level recorded in units of decibels
EA	Environmental Assessment
ECS	Ecological Classification System
EERA	Department of Commerce Energy Environmental Review and Analysis
EMF	Electromagnetic field
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
kV	Kilovolt (one thousand volts)
MW	Megawatt (one million watts)
µG	Milligauss
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MNDNR	Minnesota Department of Natural Resources
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
NAC	Noise Area Classification
NEC	National Electrical Code
NEMA	National Electric Manufacturers Association
NLCD	National Land Cover Database
NLEB	Northern Long-eared Bat
NHIS	National Heritage Information System
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
POI	Point of Interconnection
PWI	Public Waters Inventory
RIM	Reinvest in Minnesota
SHPO	State Historic Preservation Office

SPCC	Spill Control and Countermeasure
SSURGO	NRCS Soil Survey Geographic Database
SWPPP	Stormwater Pollution Prevention Plan
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

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1 Introduction

North Star Solar PV, LLC (North Star or Applicant) has made a joint application to the Minnesota Public Utilities Commission (Commission) for a Site Permit to construct 100 megawatts (MW) of photovoltaic (PV) solar generation in North Branch, Sunrise Township and Lent Township in Chisago County, and a Route Permit to build one-half mile of 115 kV transmission line to interconnect at the Chisago Substation (together referred to as the Project). North Star proposes to construct the Project at a single location in Chisago County, covering approximately 800 acres.

The permit application has been made pursuant to Minn. Statute 216E.04 and Minn. Rule 7850.

The Department of Commerce (Department) Energy Environmental Review and Analysis (EERA) staff is tasked with conducting environmental review on applications for site and route permits before the Commission. The environmental review process has produced this Environmental Assessment (EA) to inform the public, the applicant, and decision-makers about potential impacts and possible mitigation measures for the proposed Project.

This Environmental Assessment addresses the issues noted in Minn. Rule 7850.3700, subp. 4, and those identified in the Department's Scoping Decision for the Project (see **Appendix A**), and is organized as depicted in **Table 1** below:

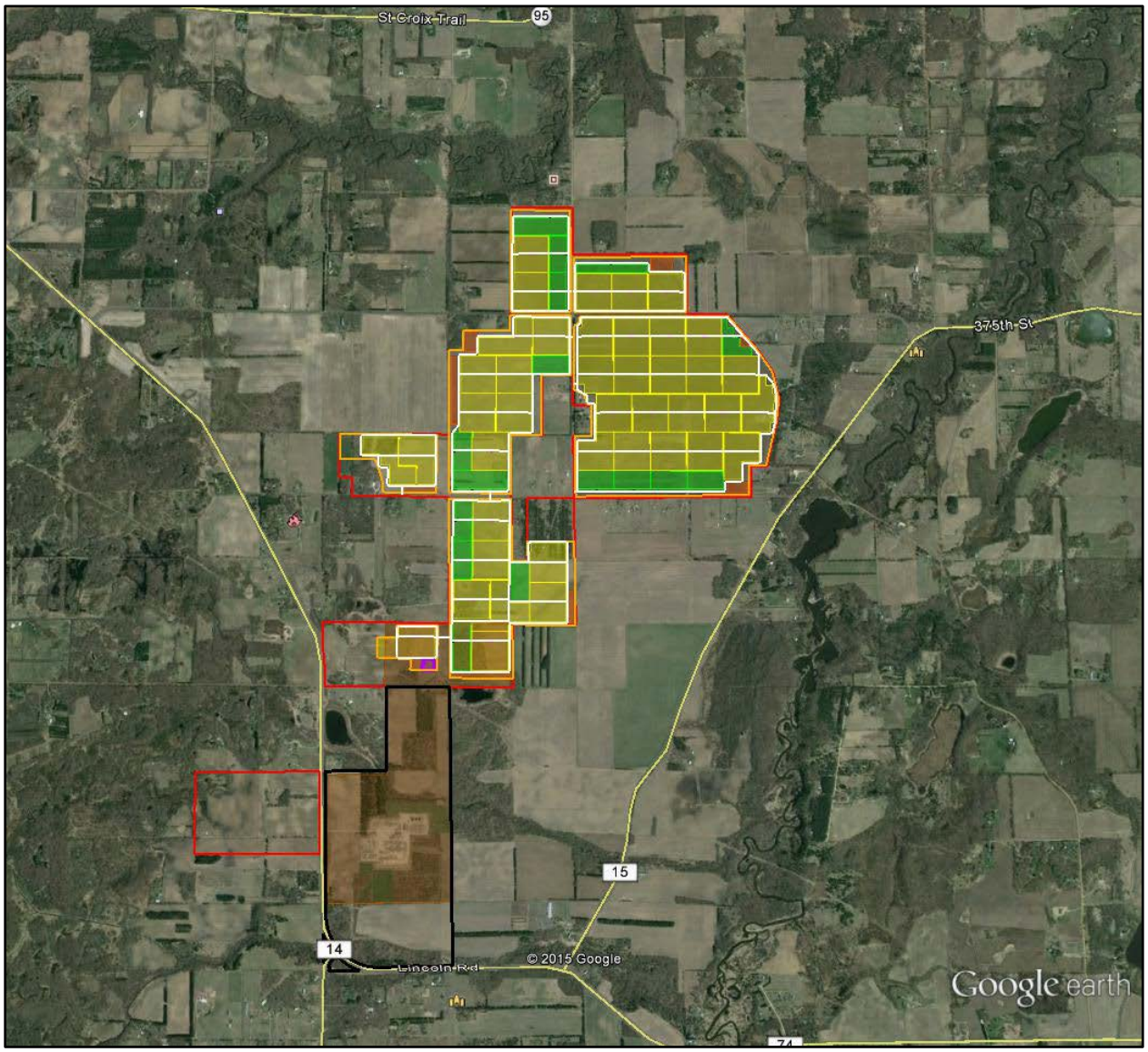
Table 1. EA Organizational Structure

Section	Topic	Focus
1	Introduction	Overview of this document and of the proposed Project.
2	Regulatory Framework	Delineation of the regulatory requirements and milestones associated with permitting and operation of the Project.
3	Proposed Project	Description of the Project as proposed by North Star, including PV arrays, roads and the electrical and transmission system.
4	Alternative Sites	Discussion of alternative sites considered and rejected for further consideration in the EA,
5	Human and Natural Impacts	Detail of the potential adverse impacts of the proposed Project on human and natural environments and measures that could be implemented to avoid, minimize or mitigate the impacts.
6	Siting Factors	Application of the information and data available in the record to date to the factors described in Minn. Rule 7850.4100.

1.1 Project Description

North Star has secured rights for 1,112 acres of agricultural land in southeast Chisago County. The final Project design (see **Figure 1** below) is expected to occupy approximately 800 acres within that boundary. The Project's primary components include PV modules mounted on a linear axis tracking system and solar inverters. The racking system foundations will utilize driven posts that for the most part would not require concrete. Other Project components include electrical cables, conduit, electrical cabinets, switchgears, step-up transformers, SCADA systems and metering equipment. The solar facility would be fenced and seeded in a low growth seed mix to reduce stormwater runoff and erosion.

Figure 1. Project Boundary and Vicinity



North Star expects to interconnect 100 MW of solar generation (accredited capacity of approximately 68 percent) at the 115 kV bus of the Chisago Substation in Lent Township (inside the southernmost portion of the Project boundary). This would require building approximately one-half mile of 115 kV line from the Project substation, across property owned by Xcel Energy to the Chisago Substation.

1.2 Project Purpose

The Project was proposed in response to Xcel Energy's Solar Request for Proposals (RFP) to help fulfill the Minnesota Solar Energy Standard which requires the company to serve 1.5 percent of its retail load with solar energy by the end of 2020. As a result of the RFP, Xcel Energy negotiated Power Purchase Agreements (PPA) with three of the competing proposals for a total of 187 MW. The three solar projects are (1) Marshall Solar, a 62.25 MW project located near Marshall; (2) MN Solar I, a 24.75 MW project located near Tracy; and (3) the North Star 100 MW Project near North Branch. The Commission approved Xcel Energy's "Solar Portfolio" in a March 24, 2015, Order.[1]

1.3 Sources of Information

Much of the information used in this EA is derived from documents prepared by North Star and Westwood Professional Services (Westwood), including the Joint Site and Route Permit Application (Application) and responses to questions from EERA staff (see **Appendix D**). In addition to material provided by North Star, information from scoping comments and from EERA analysis of the facility and the surrounding area, and EERA analysis of other solar facilities was used to prepare this document. GIS assistance was provided by EERA staff Andrew Levi.

[1] Commission Order in the Matter of Xcel Energy's Petition for Approval of a Solar Portfolio to Meet Initial Solar Energy Standard (E002/M-14-162), March 24, 2015, eDocket no. 20153-108501-01.

2 Regulatory Framework

Persons seeking to construct and operate a large electric power generating plant in Minnesota must seek permission to do so from the Minnesota Public Utilities Commission (Commission).

2.1 Certificate of Need

No person may construct a large energy facility in Minnesota without a Certificate of Need from the Commission (Minnesota Statute 216B.243). The proposed Project meets the definition of a large energy facility requiring a Certificate of Need under Minnesota Statute 216B.2421, subd. 2. However, under Minn. Statute 216B.243, subd. 9, the proposed Project is exempt from the Certificate of Need requirement because it is a solar electric generating facility that is intended to be used to meet the obligations of Minn. Statute 216B.1691.[2]

2.2 Joint Site and Route Permit

Minnesota Statute 216E.03, subd. 1 prohibits construction of a large electric generating plant without a Site Permit from the Commission. A large electric power generating plant is defined as electric power generating equipment and associated facilities designed for or capable of operation at a capacity of 50,000 kilowatts or more (Minnesota Statute 216E.01, subd. 5). Minnesota Statute 216E.03, subd. 2 prohibits construction of a high-voltage transmission line (HVTL) without a route permit from the Commission. A high voltage transmission line is defined as a conductor of electric energy and associated facilities designed for and capable of operation at a nominal voltage of 100 kilovolts or more and is greater than 1,500 feet in length (Minnesota Statute 216E.01, subd. 4).

In 2014, the Legislature included large electric power generating plants powered by solar energy as eligible for review under the alternative permitting process (Minnesota Statute 216E.04, subd. 2 (8)). Minnesota Statute 216E.04, subd. 2 (3) qualifies high-voltage transmission lines of 115 kV as eligible for review under the alternative permitting process.

In addition, Minn. Rule 7850.1600 allows the proposer of a large electric power generating plant that will also require a high voltage transmission line to apply for both a site permit for the large electric power generating plant and a route permit for the high voltage transmission line in one application and in one process.

Considering all of the above, North Star Solar PV, LLC submitted a combined Application for a Site Permit and a Route Permit[3] for review under the provisions of the Alternative Permitting Process as outlined in Minnesota Statute 216E.04 and Minn. Rule 7850.2800-3900.

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2 *Id.*
3 Joint Site and Route Permit Application (APP), North Star Solar PV, LLC, February 11, 2015, http://mn.gov/commerce/energyfacilities/resource.html?Id=34078; and Addendum to the Application, April 29, 2015, http://mn.gov/commerce/energyfacilities/resource.html?Id=34132

2.3 Environmental Review

The Department of Commerce, through EERA staff, is responsible for administering the environmental review process. Environmental review under the alternative permitting process includes public information/scoping meetings and the preparation of an environmental review document, the Environmental Assessment (Minnesota Rule 7850.3700). The EA is a written document that describes the human and environmental impacts of the Project and methods to mitigate such impacts.

The Deputy Commissioner of the Department determines the scope of the EA. The EA must be completed and made available prior to the public hearing.

2.3.1 Scoping Process

On April 10, 2015, Commission and EERA staff sent notice of the place, date and time of the Public Information and Scoping meeting to local government units and those persons on the Project contact list.[4] Notice of the public meeting was also published in the Chisago County Press newspaper on April 16, 2015.[5]

Commission staff and EERA staff jointly held a public information and scoping meeting (see **Table 2**) in Lent Township on April 30, 2015, proximate to the facility location identified by North Star. The purpose of the meeting was to provide information to the public about the proposed Project, to answer questions, and to allow the public an opportunity to suggest alternatives and impacts (i.e., scope) that should be considered during preparation of the environmental review document. A court reporter was present at the meeting to document oral statements.[6]

Table 2. Public Meeting Summary

Place	Meeting Location	Date and Time	Attendance	Public Comments
Lent Township	Town Hall 33155 Hemingway Avenue	Thursday, April 30, 2015 6:00 - 8:00 p.m.	100	22

[4] Notice of Public Information/Scoping Meeting, April 10, 2015, eDocket no. 20154-109178-01
[5] Affidavit of Publication, April 16, 2015, eDocket no. 20154-109599-02
[6] Oral Comments Received During Scoping Meeting, April 30, 2015, eDocket no. 20155-110394-01

EERA received 18 written comments from the public by the end of the scoping comment period on May 15, 2015, in addition to the 22 comments offered at the public meeting. EERA also received six letters from federal, state and local governments.

Public comments addressed a variety of concerns, including: compliance with local ordinances; appearance and methods to mitigate the visual impact of the facilities; concern over possible health impacts from EMF; impacts of the proposed facilities on property values of adjacent properties; impacts of the facilities on the local economy; potential wildlife dislocation; the overall appearance of the solar installations and the potential for glare; and impacts of noise during construction and potentially during operation of the facilities. Other letters included comments on personal property rights, support for building in this area of lower yield agricultural lands, and general support for solar energy generation.

The Minnesota Department of Transportation (MnDOT) noted that the Project does not abut a state trunk highway. However, MnDOT requested that any site or route construction work or delivery of materials that may affect MnDOT right-of-way (ROW) should be coordinated with the agency.

The U.S. Fish and Wildlife Service (USFWS) provided a list of species that may occur in the Project vicinity. USFWS did not identify records of any federally listed species or proposed critical habitat in the Project area. They did recommend construction restrictions to protect the Northern Long-eared Bat and migratory birds.

The city of North Branch and Chisago County both submitted letters requesting the Commission consider the existing local solar ordinances when issuing a site permit, especially pertaining to setbacks and screening clauses. Lent Township submitted a similar letter but also included a recommendation for an alternative site (see **Section 4**).

Scoping comments are available for viewing on the Department's EERA website; view or download at http://mn.gov/commerce/energyfacilities/Docket.html?Id=34064. Alternately, look up on eDockets at https://www.edockets.state.mn.us/EFiling/search.jsp (enter "15" for year and "33" for number).

These items and issues were incorporated into the EERA staff's recommendation to the Department's Deputy Commissioner on the EA Scoping Decision.

2.3.2 Scoping Decision

On June 19, 2015, after considering what action the Commission should take in regard to the alternatives put forth during the scoping process, the Commission elected to take no action in this matter.

After consideration of the comments, the Deputy Commissioner issued his Scoping Decision on June 24, 2015.[7] A copy of this decision is attached in **Appendix A**. The items and issues brought forth during the scoping process were incorporated into the Scoping Decision.

2.4 Public Hearing

The Commission is required by Minnesota. Rule 7850.3800 subp 1 to hold a public hearing once the EA has been completed. The hearing will be conducted by Administrative Law Judge (ALJ) Barbara Case and is scheduled to be held on October 8, 2015 (see **Table 3**).

Table 3. North Star Solar Project Public Hearing

Place	Meeting Location	Date and Time
Lake Region EMS	40245 Fletcher Ave North Branch	Wednesday, October 7, 2015 6:00 p.m.

The hearing was noticed[8] separately from the EA, and details can be found online at http://mn.gov/commerce/energyfacilities/Docket.html?Id=34064. Interested persons may comment on the EA at the public hearing. Persons may testify at the hearing without being first sworn under oath. ALJ Case will ensure that the record created at the hearing is preserved and will provide the Commission with a report setting forth findings, conclusions and recommendations on the merits of the proposed project applying the siting criteria set forth in statute and rule.[9]

Comments received on the EA become part of the record in the proceeding. EERA staff is not required to revise or supplement the EA document. A final decision on the Site and Route permits will be made by the Commission at an open meeting following the public hearing and filing of the ALJ's report.

2.5 Final Decision

The Commission's obligation is to choose sites that minimize adverse human and environmental impacts while ensuring continuing electric power system reliability and integrity, and also while ensuring that electric energy needs are met and fulfilled in an orderly and timely fashion. Site and Route permits contain conditions specifying siting, construction and operation standards; permit templates prepared for the Project by Commission staff are attached in **Appendices B and C**.

[7] Scoping Decision, June 24, 2015, Department of Commerce, eDocket no. 20156-111832-01
[8] Notice of Public Hearing, Commission, September 16, 2015, eDocket no. 20159-114043-01
[9] Order Directing Use of Summary Proceedings. Commission, July 7, 2014, eDocket no. 20157-112208-01

There are a number of potential impacts associated with power plants or HVTLs that must be taken into account on any large electric power project. Minnesota Rule 7850.4100, A through N, identifies 14 factors that the Commission must consider when designating a site or route for a large electric power facility:

a. *effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation, and public services;*
b. *effects on public health and safety;*
c. *effects on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining;*
d. *effects on archaeological and historic resources;*
e. *effects on the natural environment, including effects on air and water quality resources and flora and fauna;*
f. *effects on rare and unique natural resources;*
g. *application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity;*
h. *use or paralleling of existing rights-of-way, survey lines, natural division lines, and agricultural field boundaries;*
i. *use of existing large electric power generating plant sites;*
j. *use of existing transportation, pipeline, and electrical transmission systems or rights-of-way;*
k. *electrical system reliability;*
l. *costs of constructing, operating, and maintaining the facility which are dependent on design and route;*
m. *adverse human and natural environmental effects which cannot be avoided; and*
n. *irreversible and irretrievable commitments of resources.*

At the time the Commission makes a final decision on the permit application, the Commission shall determine whether the EA and the record created at the public hearing address the issues identified in the scoping decision (Minn. Rule 7850.3900 Subp. 2).

The Commission shall make a final decision on a site permit within 60 days after receipt of the record from the ALJ. A final decision must be made within six months after the Commission's determination that an application is complete. The Commission may extend this time limit for up to three months for just cause or upon agreement of the applicant (Minn. Rule 7850.3900 Subp. 1).

2.6 Other Permits

The Public Utilities Commission Site and Route permits are the only permits required for construction of a large electric power generating plant, but other permits or approvals may be required for certain construction activities such as construction activities within wetlands or new driveways. **Table 4** identifies potential permits that may be required for North Star Solar to complete this Project.

Table 4. Potentially Required Permits

Regulatory Authority	Permit or Approval
Federal Approvals	
U.S. Army Corps of Engineers (USACE)	Wetland Delineation Approvals
	Jurisdictional Determination
	Federal Clean Water Act Section 404 and Section 10 Permit(s)
U.S. Fish and Wildlife Service	Review for Threatened and Endangered Species – informal coordination
Environmental Protection Agency (EPA) Region 5 in coordination with the Minnesota Pollution Control Agency (MPCA)	Spill Prevention Control and Countermeasure (SPCC) Plan
Lead Federal Agency	Federal Section 106 National Historic Preservation Act Review – will occur if Project triggers a federal nexus such as USACE individual permit
U.S. Department of Agriculture	Form AD-1006 Farmland Conversion Impact Rating – will occur if Project triggers a federal nexus such as USACE individual permit
	Conservation/Grassland/Wetland Easement and Reserve Program releases and consents
	Farm Services Agency Mortgage Subordination & Associated Environmental Review
Federal Energy Regulatory Commission	Exempt Wholesale Generator Self Cert.
	Market-Based Rate Authorization
	Waiver of Open Access Transmission Tariff, Open Access Same-Time Information System, and Standards of Conduct requirements applicable to transmission providers with respect to Seller's ownership of generator interconnection facilities

Regulatory Authority	Permit or Approval
Federal Aviation Administration	Form 7460-1 Notice of Proposed Construction or Alteration (Determination of No Hazard)
State of Minnesota Approvals	
Board of Water and Soil Resources	Wetland Conservation Act Approval
Minnesota Pollution Control Agency	Section 401 Water Quality Certification
	National Pollutant Discharge Elimination System Permit (NPDES) – MPCA General Stormwater Permit for Construction Activity
	Very Small Quantity Generator (VSQG) License – Hazardous Waste Collection Program
	Aboveground Storage Tank (AST) Notification Form
Minnesota Department of Health	Environmental Bore Hole (EBH)
	Water Supply Well Notification
	Plumbing Plan Review
Minnesota Department of Natural Resources (MNDNR)	License to Cross Public Land and Water
Minnesota Department of Transportation	Utility Permits on Trunk Highway Right-of-way
	Overweight Permit for State Highways – for transport of transformers, inverters
	Access Driveway Permits for MnDOT Roads
Minnesota Department of Labor and Industry	Building Plan Review and Permits
Minnesota Public Utilities Commission	Site Permit for Power Plant Site
	Exemption from Certificate of Need for Power Plant
Minnesota State Historic Preservation Office (SHPO)	Cultural and Historic Resources Review and Review of State and National Register of Historic Sites and Archeological Survey

Regulatory Authority	Permit or Approval
Local Approvals	
Watershed Districts	Stormwater, drainage, floodplain permits
County	Right-of-way permits, road access permits, driveway permits for access roads and electrical collection system, Wetland Conservation Act Approval, parcel splits, platting
Townships	Right-of-way permits, crossing permits, parcel splits, platting
Municipality	Road access permits, and driveway permits for access roads and electrical collection system, parcel splits, platting

2.7 Issues outside the Scope of the EA

The EA does not consider the following:

- No-build alternative
- Issues related to Project need, size, type or timing
- Any site or route alternatives not specifically identified in the Scoping Decision
- The manner in which landowners are compensated for rights or easements

3 Proposed Project

North Star has secured rights for 1,112 acres of agricultural land north of the Chisago Substation The final Project design (see **Figure 2** below) is expected to occupy approximately 800 acres within the city of North Branch and Sunrise and Lent townships (see **Table 5**). The Project's primary components include PV modules mounted on a linear axis tracking system and solar inverters. The racking system foundations will utilize driven posts that for the most part would not require concrete. Other Project components include electrical cables, conduit, electrical cabinets, switchgears, step-up transformers, SCADA systems and metering equipment. The solar facility would be fenced and seeded in a low growth seed mix to reduce stormwater runoff and erosion.

Table 5. Project Location

	Township	Range	Sections
North Branch	T35N	R21W	25, 36
Sunrise Township	T35N	R20W	30, 31
Lent Township	T34N	R21W	1, 2

North Star expects to interconnect 100 MW of solar generation (accredited capacity of approximately 68 percent) at the 115 kV bus of the Chisago Substation in Lent Township (inside the southernmost portion of the Project boundary). This would require building approximately one-half mile of 115 kV line from the Project substation, across property owned by Xcel Energy to the Chisago Substation.

Since its initial Application, North Star has submitted an addendum to its Application making a minor modification to its Project by adding 10 acres as described and depicted in its filing (see **Figure 2** below).

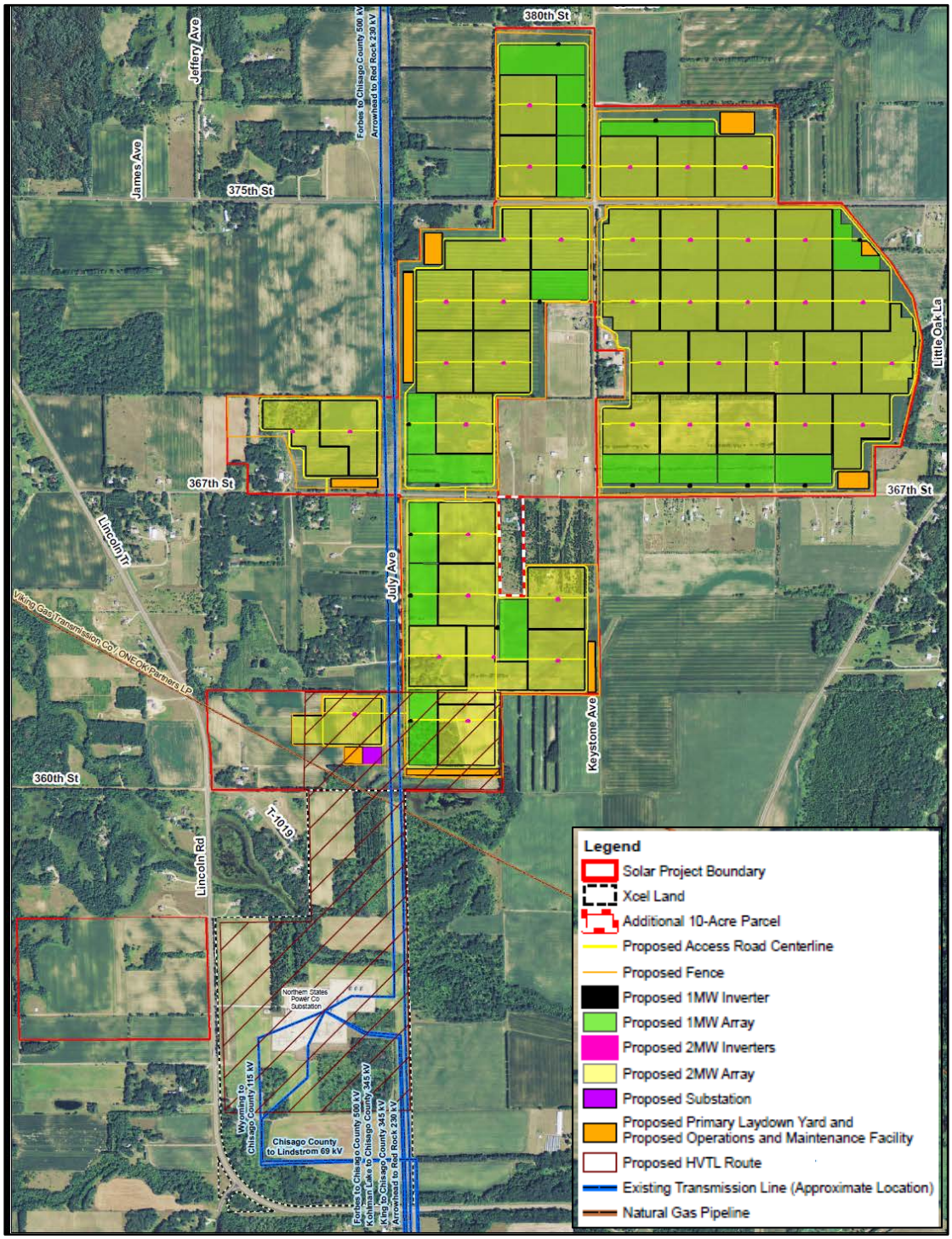
3.1 The Solar Generation Project

The facility will comprise PV modules mounted on linear axis tracking systems and centralized inverters. In addition to the modules grouped into arrays, the facility will also include electrical cables and conduit, electrical cabinets, step-up transformers, SCADA systems and metering equipment, an operations and maintenance (O&M) area, and roads providing access to the equipment. A perimeter fence will surround the Project.

3.1.1 PV Arrays

Each facility will include PV modules approximately 6.5 feet long and 3.25 feet wide mounted on a linear single-axis tracking system. The modules will be grouped into arrays.

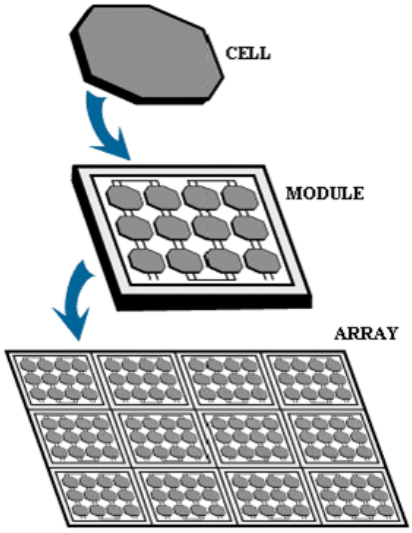
Figure 2. Preliminary Project Design[10]



[10] APP Addendum at Attachment A

While there are different technological variations, the most common PV cells consist of a specially treated conductor made up of two layers with relative positive and negative charges. This conductor is between two contacts that are connected to an external load. Individual PV cells can be combined as a module, or solar panel, to generate greater quantities of electricity. North Star's current plan is to us the "Jinko JKM315P-72," a 72-cell solar module. These modules are 77 x 39 x 1.6 inches, and will likely range from 310 to 315 watts per module.[11] Grouped solar panels are referred to as a solar array. This progression is depicted in **Figure 3**.

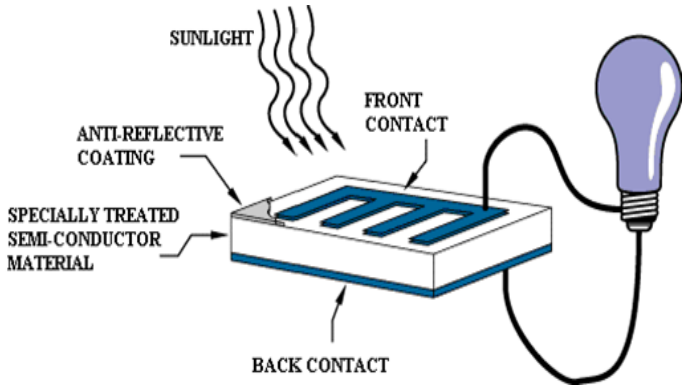
Figure 3. Photovoltaics[12]



PV systems convert both direct and indirect solar energy (direct and scattered sunlight) to electrical energy by capitalizing on nature's inherent desire to keep electrical charges in balance.[13] At the most basic level, electrical current is the flow of electrons through a conductor. When solar radiation strikes a PV cell some of it is absorbed exciting electrons within the cell. Some of these electrons move freely between layers from negative to positive. In the process, electrons from the positive layer are disrupted and "flow" back to the negative layer through the external load creating a continuous flow of electrons, or, a continuous flow of electric current as depicted in **Figure 4**.

[11] North Star Data Submission, EERA Question 01, August 21, 2015 (Appendix D)
[12] National Aeronautics and Space Administration. 2011. *How Do Photovoltaics Work?* http://science.nasa.gov/science-news/science-at-nasa/2002/solarcells/
[13] US Department of Energy, Office of Energy Efficiency and Renewable Energy. 2013. *Photovoltaic Technology Basics*. http://energy.gov/eere/energybasics/articles/photovoltaic-technology-basics; National Aeronautics and Space Administration, 2011

Figure 4. Operation of a PV Cell[14]



PV systems can be configured as a "fixed" or "tracking" system. Permanently mounted in a stationary position, fixed systems are aligned to gather the greatest level of solar radiation over the course of the year. These systems are often subject to site-specific constraints, e.g., roof angle, which limit their overall efficiency.

The Project will use a single axis tracking system to allow the panels to track the sun across the sky. While more expensive than fixed-tilt systems, tracking systems can increase system efficiencies by as much as 33%.[15] There are two general types of tracking systems: single axis and dual axis. Single axis systems track the sun from east to west throughout the day. Dual axis systems track the sun both east to west throughout the day and north to south throughout the year.

The panel blocks will be mounted on metal racks that will be installed on a series of posts driven into the soil. North Star anticipates that most, if not all of the tracking system foundations will be driven directly into the soil. In some cases the results from geotech soil tests may dictate concrete foundations be used. Each panel block contains internal access drives and electrical utilities to support the array. Power production circuits are separated from the tracking circuits, allowing the PV modules to operate during an unscheduled outage of the tracker system.

3.1.2 Roads

Within the facility gravel roads, typically 12 to 20 feet in width, will be constructed to provide access to the facility equipment for maintenance and, when necessary, emergency vehicles. Road configuration is dependent upon final design: a preliminary road configuration is depicted in the preliminary facility layout in yellow in **Figure 2** above.

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[14] National Aeronautics and Space Administration, 2011
[15] Appleyard, D. *Solar Trackers: Facing the Sun*. 2009.
http://www.renewableenergyworld.com/rea/news/article/2009/06/solar-trackers-facing-the-sun

The facility will be accessed from the public road network, through existing drives or possibly through establishment of a new access point. Other than the establishment of new facility access or improvements to existing access points, no upgrades or changes to existing roadway systems are necessary for construction or operation of the Project.[16]

3.1.3 Operations and Maintenance Area

North Star will construct an Operations and Maintenance (O&M) area at the facility, probably near the Project substation. An offsite centralized warehouse may also be used to house strategic spare parts. An O&M area would have a flat gravel or grass area for parking and receiving. A building of approximately 3,000 to 5,000 feet would need to be constructed to house equipment used to operate and maintain the solar facility.

Lights will be installed on temporary 18-foot service poles during the construction phase of the Project. After construction, the temporary service poles will be removed and permanent motion-activated lighting installed near O&M areas, security gates and in perimeter areas. Lighting will be down lit to minimize impacts to adjacent landowners.

3.1.4 Electrical System

PV cells generate direct current (DC) electricity, which must be converted to alternating current (AC) electricity to be utilized on the electrical grid. This is done by an inverter. The electric cabling used to deliver the DC power from the panels to the inverters will typically be located in an underground trench (approximately two to three feet deep and one to two feet wide).

The final number of inverters for each facility is dependent upon the inverter size, inverter and panel availability as well as the final facility design. Each panel block will require one or more inverters, depending on the size of the panel block. Inverters will be installed adjacent to the panel blocks on an inverter skid or on a concrete pad, either of which may be enclosed. After inverters have converted the electricity to AC, transformers step up the electricity from low voltage to medium voltage (34.5 kV). Each inverter pad will contain one or more transformers to which the inverters will feed electricity.

The electricity from the step-up transformers will be collected via underground cables at the Project Substation. The Project Substation will occupy approximately two acres of fenced land, include a parking area and will be accessible using the Project access roads. It will consist of supporting structures for high voltage electrical structures, breakers, transformers, lightning protection, and control equipment according to the specifications of the Interconnection Agreement with MISO and Xcel Energy. The Project Substation will transform the electric voltage from the intermediate level of 34.5kV to the interconnection voltage of 115kV. From there, the electricity will move onto the grid via the North Star HVTL (NS HVTL) at the Point of Interconnect (POI) at the Chisago Substation.

[16] APP at 21

3.2 The HVTL Project

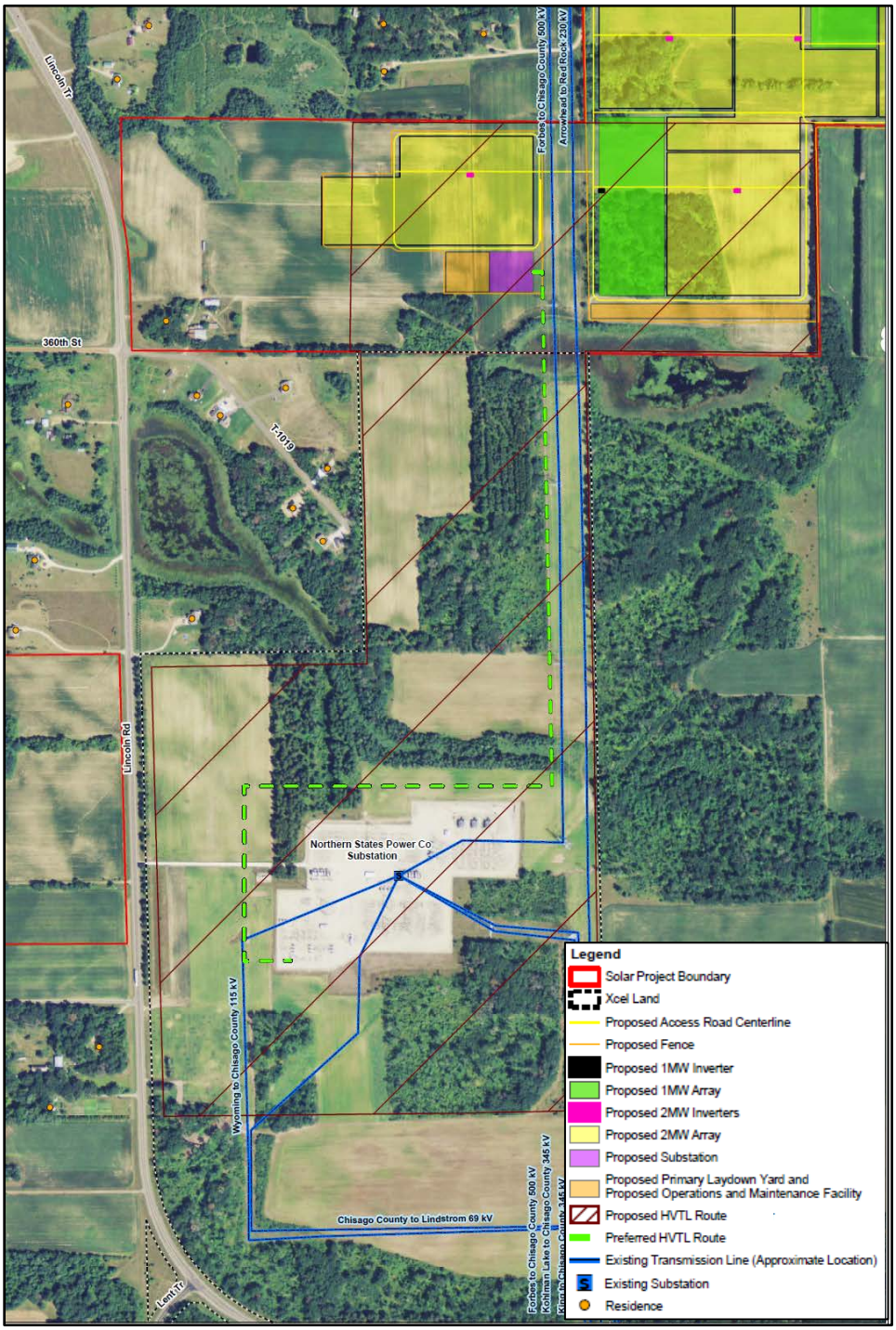
The NS HVTL Project will be constructed within a 75-foot right-of-way (ROW), mostly located parallel to existing transmission lines within Xcel Energy property, from the Project Substation to the Chisago Substation. It will be a single-circuit, 115 kV line built on wood or steel direct-embedded, braced-arm poles approximately 70 feet in height. Typical spans will be 300 to 340 feet.[17] (See anticipated pole design in **Figure 5**). See **Figure 6** for the anticipated alignment.

Figure 5. Anticipated Pole Design

The proposed conductor for the NS HVTL Project is a 795 kcmil Aluminum Conductor Composite Reinforced (ACCR) line. The Applicant states the proposed transmission line will be designed to meet or surpass all relevant local and state codes, North American Electric Reliability Corporation (NERC) standards, and the National Electric Safety Code (NESC). These standards will be met for construction and installation, and all applicable safety procedures will be followed during construction and operation of the transmission line.[18]

[17] *Id.* at 22
[18] *Id.* at 23

Figure 6. Updated NS HVTL Proposed Route[19]



[19] North Star Data Submission, EERA Question 05, August 21, 2015 (Appendix D)

3.3 Project Construction

North Star anticipates that construction will begin in February 2016, with all facilities online by the end of 2016. See **Table 6** below for an estimated construction schedule for the facility.

Table 6. Approximate Construction Timeline for Project[20]

Date	Construction Milestones
January 2016	Commission Site and Route Permit Decisions
02/01/16	Construction begins: • Grading and vegetation clearing where necessary • Preparation of roadways, staging/laydown yards • Installation of job site trailers, temporary restroom facilities • Installation of foundation piles and racking • Access road construction
05/30/16	Foundations for inverters, transformers, substation and O&M building
	Installation of transformers and inverters begin
	Ongoing restoration/revegetation activities as necessary.
06/01/16	HVTL construction begins
06/30/16	HVTL construction complete Project Substation construction begins
08/01/16	Complete interconnection facilities
	Testing of the Solar Project commences
November 2016	Commercial Operation

3.3.1 Site Preparation

North Star details its construction and restoration plan in its Application.[21] Once necessary permits are obtained, North Star will begin preparing the facility location for construction. Once access to the site is established, woody vegetation will be cleared in areas where the PV installations and roads will be constructed. Additional site preparation tasks include establishment or improvement of access to the site, grading in some areas of the site to establish a level area for installation of the PV equipment, and establishment of staging and laydown areas within the Project boundary.

[20] APP at 26
[21] *Id.* starting at 23

In order to provide a level surface for solar arrays, North Star anticipates grading approximately 170 acres.[22] The intent of the grading is to establish a relatively uniform surface to accommodate the single axis tracking systems. The preliminary determination of areas to be graded was determined through assessment of the current grade, the direction of the grade and the desire to maximize useable space for the solar arrays.

The proposed grading process would include both cut and fill activities. Higher areas would be excavated (cut) and the material used to raise the surface (fill) of nearby lower areas. North Star will attempt to design the site so as not to require either the import or export of soils. North Star anticipates spreading any excess soils across the facility. An appropriate volume of topsoil will be stockpiled for replacement during decommissioning of the facility. Such materials will be stockpiled at multiple locations around the site in low berms and stabilized for long-term protection.[23]

Early in the construction process, staging and laydown areas of approximately two to four acres will be established within the facility boundary.[24] The staging areas will be used to receive and store delivery of construction materials and may house a temporary onsite construction office.

3.3.2 Construction of Solar Energy Facility

Following site preparation, solar arrays will be constructed in blocks ranging in size from 1 MW to 2 MW in rated nameplate capacity. Access roads will be constructed between the blocks. The size of the blocks will be dependent upon inverter and racking equipment specifications.

PV panels will be installed on a single-axis tracking system. North Star anticipates that the majority of the tracking system foundations will be a driven pier, although soil conditions at some locations may require that the tracking systems be installed in concrete foundations.

Typical construction equipment such as scrapers, dozers, dump trucks, watering trucks, motor graders, vibratory compactors, and backhoes will be used during construction. Specialty construction equipment that may be used during construction may include:

- Skid steer loader;
- Vibratory pile driver;
- Medium duty crane;
- All-terrain forklift;
- Concrete truck and boom truck;
- High reach bucket truck; and
- Truck-mounted auger or drill rig.

[22] North Star Data Submission, EERA Question 04, August 21, 2015 (Appendix D)
[23] *Id.*
[24] APP at 24

North Star will use Best Management Practices (BMPs) to limit erosion and soil compaction, during construction. Disturbance will occur during the normal course of work, which can take several weeks in any one location. As construction is completed, North Star will restore and revegetate disturbed areas.

3.3.3 Construction of HVTL Facility

Construction of the NS HVTL is anticipated to take approximately four weeks to complete, occurring around May or June of 2016. The Applicant expects to hire a contractor with experience constructing transmission, including using industry best practices of right-of-way clearing, staging, erecting transmission line structures and stringing transmission lines.

Vegetation will be cleared from the approved right-of-way according to NESC standards, minimizing the amount and effect of vegetation clearing activities where possible. The Applicant does not anticipate significant clearing and grading as the preferred alignment generally falls within existing transmission corridors or agricultural fields. Transmission structures will be stored in laydown areas and moved to location using Solar Project access roads and the existing transmission corridor.

Transmission poles will be direct-embedded and back-filled with crushed rock and soil. Spoil from the holes will be removed from the site as necessary or placed according to previous arrangements with the landowner; spoil will not be placed in any wetlands or other native habitats. Concrete pole foundations and guy wires may be used when necessary to address site specific soil conditions and to accommodate turns in the line.[25]

3.3.4 Post-Construction Restoration

As construction is completed, areas disturbed during construction will be restored. Temporary staging and laydown areas will be vacated and any temporary roads will be decommissioned and restored. The site will be graded to its natural contours, access roads will be re-graded, filled and dressed as needed. Any post-construction erosion control methods specific to the site will be implemented consistent with permits and contractor specifications. Soil compacted during construction will be loosened if necessary.

With the exception of access roads, all areas disturbed during construction will be re-vegetated with a weed-free, low-growing seed mix, e.g., clover, short grasses or flowers, low-growing forbs, low-growing wetland seed mixes or some other low-growing perennial cover. North Star anticipates working collaboratively with the Minnesota Department of Natural Resources (MNDNR) to establish and manage vegetation to benefit pollinators and other wildlife.[26] Post-construction clean-up and site restoration activities are anticipated to take approximately two to four weeks to complete.

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[25] *Id.* at 24
[26] *Id.* at 26

3.4 Project Operation and Maintenance

The expected service life of the solar facility is 25 to 30 years.[27] The expected service life of a transmission line would normally be significantly longer than that as a standalone facility. However, the NS HVTL only has use as part of the overall solar generation and associated facilities, so its expected service life is the same.

Solar generating facilities can be remotely operated through a real-time control system (SCADA) for most operations functions. However, North Star anticipates a permanent staff of up to 12 FTE, with at least some staff onsite daily. More staff will be onsite for scheduled maintenance (see **Table 7**). An operations and maintenance (O&M) facility will be constructed onsite for storage and local work space.

North Star will hire trained and qualified personnel for all maintenance activities. Regular maintenance of the Project facilities will include scheduled equipment inspections, road maintenance, vegetation maintenance including mowing the ground cover that is planted under the arrays at each facility, fence and gate inspection, lighting system checks, and PV panel washing as necessary (minimal to no washing is anticipated to be needed at Project facilities). Regular inspection for facility components will include inspection of:

- PV panels: visual examination of the panels and tracking system and surrounding grounds to verify panel and tracking integrity;
- Inverters, transformer and electrical panels: visual inspection of the devices including connection cabinets and the grounding network, check for presence of water and dust;
- Electrical inspection: measurement of insulation level and dispersion, inspection of main switches and safety devices (fuses);
- Cabling and wiring: visual inspection of buried and overhead electrical line and connection box to verify integrity;
- HVTL and Project Substation: regular visual inspection of the transmission system and substation checks and maintenance; and
- General facility inspection: visual inspection for the presence of animals, integrity of the fencing, nests, noise check for abnormal sounds.

North Star will create a maintenance plan for the Project to ensure continued performance of the solar facilities. The plan will include scheduled inspection of the major components and a scheduled maintenance cycle that counters the degradation or loss of efficiency (also referred to as derating/degradation) of the components that is expected over time. Once construction is complete, one or two trucks may be on site periodically, at intervals associated with the maintenance schedule (**Table 7**).

[27] *Id.* at 26

Table 7. Solar Facility Operations and Maintenance[28]

Component and Task	Anticipated Frequency
Photovoltaic Field	
PV modules visual check	Every two months
Wirings and junction boxes visual check	Quarterly
PV strings measurement of the insulation	Quarterly
PV strings and string boxes faults	Weekly
PV panels washing	Only as conditions warrant
Grass cutting (if necessary at site)	Once in Spring, once in Summer
Electric boards	
Case visual check	Twice Yearly
Fuses check	Twice Yearly
Surge arresters check	Twice Yearly
Torque check	Twice Yearly
DC voltage and current check	Twice Yearly
Grounding check	Twice Yearly
Case visual inspection	Every two months
Air intake and filters inspections	Every two months
Inverters	
Conversion stop for lack of voltage	Twice Yearly
AC voltage and current check	Twice Yearly
Conversion efficiency inspection	Twice Yearly
Datalogger memory download	Twice Yearly
Fuses check	Twice Yearly
Grounding Check	Twice Yearly
Torque check	Twice Yearly
Support Structures	
Visual check	Twice Yearly
PV module torque check on random sample	Twice Yearly

[28] *Id.* at 29

3.5 Project Costs

North Star has estimated that the installation of the Solar Project as proposed will cost approximately $180 million, or $1.8 million per MW AC. Once operational, North Star anticipates annual operating costs of approximately $12 million. These estimates include labor, materials, and production taxes.[29]

The construction of the NS HVTL is expected to cost approximately $500,000,[30] presuming the Project Substation costs are subsumed under the Solar Project. Typically, transmission operating utilities assume between $2,000 to $5,000 per mile per year for line maintenance, including vegetation management and regular aerial inspection of the ROW. The North Star transmission connection is less than one mile in length.

3.6 Decommissioning or Repowering

North Star anticipates the useful life of the solar facility will be approximately 25 to 30 years.[31] Determination of a facility's useful life is influenced by energy market conditions, regulations, anticipated equipment lifetime, highest and best use of the underlying property and ongoing operations costs.

At the end of the Project's useful life, North Star will determine whether to decommission the facility consistent with the terms of the Site Permit, or to seek repowering of the facility. A number of criteria play into deciding whether or not to decommission or to extend or repower a facility, including the following:

- Extension of an existing or the execution of a new power purchase agreement. The decision on whether to extend the power purchase agreement considers the local energy demand and the cost of electricity from other generation sources;
- The cost to repower and generate the electricity, including the cost to repair or replace non-power producing equipment such as racking and foundations;
- The cost to decommission;
- The opportunity cost to utilize the land differently (best and highest use of the land);
- Regulations; and
- On-going maintenance and operational costs.

Section 9 of the Site Permit Template (see **Appendix B**) requires that North Star prepare a Decommissioning Plan prior to operation of the Project. The Decommissioning Plan should document North Star's plan for decommissioning of the Project, restoration of the site, estimated cost of decommissioning, and a description of how North Star will ensure that the financial funds necessary to decommission the Project are available.

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[29] *Id.* at 15
[30] *Id.* at 16
[31] *Id.* at 30

North Star estimates it will take approximately six months to complete all decommissioning tasks, assuring that all equipment is either recycled or disposed of properly, and that full restoration is complete. North Star has provided the following breakdown of typical decommissioning tasks:

- Modules are inspected for physical damage, tested for functionality, and removed from racking. Functioning modules are packed and stored for reuse. Non-functioning modules are sent to the manufacturer or a third party for recycling or other appropriate disposal;
- Racking, poles and fencing are dismantled and removed to a metal recycling facility;
- Aboveground wire is sent for proper disposal and recycling. Belowground wire may be abandoned in place;
- Aboveground conduit is disassembled onsite and sent to a recycling facility;
- Junction boxes, combiner boxes, external disconnect boxes, etc., are sent to an electronics recycler;
- Inverters are sent to the manufacturer or an electronics recycler as applicable, and functioning parts will be reused;
- Concrete pads are sent to a concrete recycler; and
- Computers, monitors, hard drives, and other components are sent to an electronics recycler, and functioning parts are reused.

For the NS HVTL installation, conductor is removed first; any anchors or guy wires used are removed. Materials from the anchors or guys more than four feet in the ground can be abandoned in place. Poles are removed, and holes are subsequently back-filled. HVTL conductor, anchors, guy wires, and pole structures are recycled or disposed of as applicable.

After all equipment is removed, the facility is restored. Holes created by poles, concrete pads, and other equipment are filled in with soil. Access roads are removed, with the land restored to preconstruction conditions. Where necessary, topsoil is replaced to restore land for its original (existing) purpose. [32]

North Star's Decommissioning Plan is required to include financial plans for assuring sufficient resources for decommissioning costs.[33] At this point, North Star intends to establish an escrow account, enter into a surety bond or create a reserve fund for decommissioning approximately halfway through the Project life (in order to best predict anticipated decommissioning costs or salvage values). In addition, North Star has included an obligation to decommission the Solar Project and NS HVTL Project components in its applicable landowner easements.[34]

[32] Site Permit Condition 9.2
[33] Site Permit Condition 9.1
[34] APP at 30

4 Alternative Sites or Routes

Alternatives are not required under the alternative permitting process in Minnesota Statutes 216E.04 subd.3. North Star did not consider any alternative sites or routes for the Project.[35]

References were made during the scoping meeting about the possibility of alternatively siting the Project in the Carlos Avery Wildlife Management Area (WMA) and the possibility of using rooftop installations. EERA concluded that these are not feasible alternates. Use of the Carlos Avery WMA is not feasible because of conflicts with Department of Natural Resources intended use policies, including hunting, wildlife habitat protection and availability for public access to the area. Since the facility location proposed by North Star is 800 acres in size, there is simply not enough rooftop space available for a locational match between a utility-scale solar project and the identified interconnection substation.

Lent Township proposed a hybrid project area[36] that excluded sections of the North Star proposal and incorporated the combined development of other solar facilities near the proposed North Star Project. North Star stated that relocating or combining any portion of its proposed Project with these properties could be challenging. In particular, an active competitor would need to release its rights and control of the parcels in question to North Star. Without eminent domain authority, North Star is dependent on voluntary property agreements.

The proposed transmission route is short (approximately 1/2 mile), on one owner's property (Xcel Energy) and unopposed. The entire route length is within the proposed Project boundary. No alternative routes were suggested by the public.

Alternative Sites and Routes Included in the EA

On June 4, 2015, EERA staff provided the Commission with a summary of the EA scoping process.[37] The summary indicated that EERA staff favored including the facility location proposed in the North Star Application and the Lent Proposal alternative site. EERA did not recommend any transmission route alternatives.

On June 19, 2015, the Commission stated it did not consider the Lent Proposal would assist in making the ultimate decision on the permit application (Minn. Rule 7850.3700); especially considering the Applicant's lack of interest in developing in that area and the Commission's own concerns about permitting a site currently controlled by other developers.

Given the lack of interest by the Applicant in expanding its Project boundary to include any of the alternative sites, and given the concerns of the Commission in considering an alternative site for permitting, this Environmental Assessment reviews only the site and route in North Star's Joint Site and Route Permit Application.

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[35] *Id.* at 15

[36] Lent Township Scoping Comment, eDocket no. 20155-110565-05

[37] EERA Comments on the Scoping Process, June 19, 2015, eDocket no. 20156-111167-01

5 Potential Impacts of the Proposed Project

This section provides an overview of the resources and potential impacts and mitigation measures associated with the Proposed Project. Specifically, this section discusses and analyzes:

- The human and environmental resources affected by the project,
- Potential impacts to human and environmental resources, and
- Opportunities to avoid, minimize, or mitigate potential impacts.

5.1 Consideration of Potential Impacts

A potential impact is the anticipated change to an existing condition caused either directly or indirectly by the construction and operation of a proposed project. Potential impacts can be positive or negative, short- or long-term, and, in certain circumstances, can accumulate incrementally. Impacts vary in duration and intensity, by resource, and across locations.

Direct impacts are caused by the proposed action and occur at the same time and place as the action. An indirect impact is caused by the proposed action, but is further removed in distance or occurs later in time. It must be reasonably foreseeable, which means a reasonable person would anticipate or predict the impact. Cumulative impacts are the result of the incremental effects of the project in combination with other past, present, and reasonably foreseeable future projects.

5.1.1 Potential Impacts and Mitigation

Section 5 explains potential impacts from the Proposed Project on various resources. In addition, impacts are put into context using the following concepts:

Duration. Impacts vary over time. Short-term impacts are generally associated with project construction. Long-term impacts are associated with the operational life of the project and usually end with project decommissioning. Permanent impacts extend beyond the decommissioning stage of the project.

Size. Impacts vary by size. Size is a measure of how big something is. To the extent possible, potential impacts are described quantitatively, for example, the number of impacted acres or the percentage of affected individuals in a population.

Intensity. Impacts vary in intensity. Intensity is a measurement of the severity of an impact on a resource condition or function. To the extent possible, potential impacts are described quantitatively, for example, the percentage of affected individuals in a population.

Location. Impacts are location dependent. For example, noise impacts decrease as distance from the source increases, or common resources in one location might be uncommon in another.

Uniqueness. Resources are different. Common resources occur frequently, while uncommon resources are not ordinarily encountered.

In combination with the anticipated on-the-ground effect, context is used to determine an overall resource impact level, and can range from highly beneficial to highly harmful. Impact levels are described using a qualitative scale, which is explained below. These terms are not intended as value judgements, but rather as a means to both ensure a common understanding among readers and, typically, to compare resource impacts between alternatives.

Minimal. Minimal impacts do not considerably alter an existing resource condition or function. Minimal impacts might, for some resources and at some locations, be noticeable to an average observer. These impacts generally affect common resources over the short-term.

Moderate. Moderate impacts alter an existing resource condition or function, and are generally noticeable or predictable to the average observer. Effects might be spread out over a large area making them difficult to observe, but can be estimated by modeling or some other means. Moderate impacts might be long-term or permanent to common resources, but generally short- to long-term to uncommon resources.

Significant. Significant impacts alter an existing resource condition or function to the extent that the resource is severely impaired or cannot function. Significant impacts are likely noticeable or predictable to the average observer. Effects might be spread out over a large area making them difficult to observe, but can be estimated by modeling. Significant impacts can be of any duration, and affect common or uncommon resources.

This section also discusses opportunities to avoid, reduce, or mitigate the level of impact. These actions are collectively referred to as mitigation.

Avoid. Avoiding an impact means it is eliminated altogether by moving or not undertaking parts or all of a project.

Minimize. Minimizing an impact means to limit its intensity by reducing project size or moving the project from a given location.

Mitigate. Impacts that cannot be avoided or further minimized might be mitigated. Mitigating an impact means fixing it by repairing, rehabilitating or restoring the affected environment, or compensating for it by replacing or providing a substitute resource elsewhere.

Some impacts are avoidable or can be minimized; some might be unavoidable but can be mitigated; others might be unavoidable and unable to be mitigated.

5.1.2 Potential Impacts and Regions of Influence

Potential impacts to human and environmental resources are analyzed in this EA within specific spatial bounds or regions of influence (ROI). The ROI for each resource is the geographic area within which a particular impact may exert some influence; it is useful as the basis for assessing the potential impacts to each resource as a result of the Project. Regions of influence vary with the resource being analyzed and the potential impact. The ROI for resources analyzed in this EA are summarized in **Table 8**.

The ROI for most human and environmental resources is the transmission line ROW and the permanent footprint of the Solar Project. Resources within the ROW and footprint could be impacted by the construction and operation of the project. For example, soils could be compacted; trees could be removed. Other resources may be impacted at a greater distance from the project. In this EA, the following ROI will be used for these resources:

- **Right of Way/Project Footprint** (the parcels within the Project Boundary, i.e., surrounding the transmission line/substation and those within the solar project footprint). This EA analyzes the impacts of displacement, agriculture, forestry and mining, soils, and flora using these ROI.

- **Immediate Area** (within 1500 feet of the project boundary). This ROI will be used for analyzing potential aesthetic, noise, property value and electric and magnetic field impacts. No impacts from these elements would be expected beyond this point.

- **Project Area** (one-mile buffer surrounding the project boundary). This ROI will be used for analyzing potential wildlife impacts and impacts to archaeological and historic resources and to rare and unique species. Direct impacts, if they occur are anticipated to diminish relatively quickly such that potential impacts outside of the route width or Project footprint would be minimal to moderate. However, indirect impacts may extend beyond the ROW and the project. For example, indirect impacts to rare and unique species may extend beyond the ROW and Project footprint, particularly for wildlife species. Wildlife may move throughout a project area and may be impacted by limitations on their movement and their ability to access cover, food, and water.

- **Larger Area** (defined generally here as the county within which the Project occurs). Here, Chisago County will be used as the ROI for analyzing potential impacts to cultural values, socioeconomics, public utilities, airports, emergency services, air quality, and tourism and recreation. These are resources for which impacts may extend throughout communities in the project area.

Table 8. Regions of Influence for Human and Environmental Resources

Type of Resource	Specific Resource/Potential Impact to Resource	Region of Influence (ROI)
Human Settlement	Displacement	Right-of-Way or Project Footprint
	Aesthetics, Noise, Property Values, Electronic Interference	Immediate Area
	Zoning and Land Use Compatibility	Project Area
	Socioeconomics, Cultural Values, Public Utilities, Airports, Emergency Services	Larger Area
Public Health and Safety	Electric and Magnetic Fields, Implantable Medical Devices, Stray Voltage, Induced Voltage	Immediate Area
	Air Quality	Project Area
Land-Based Economies	Agriculture, Forestry, Mining	Right-of-Way or Project Footprint
	Tourism and Recreation	Larger Area
Natural Environment	Soils, Flora, Fauna	Right-of-Way or Project Footprint
	Water Resources	Project Area
Archaeological and Historic Resources	---	Project Area
Rare and Unique Species	---	Project Area

5.2 Description of Environmental Setting

The North Star Solar Project and NS HVTL Project combined area is located on approximately 1,400 acres of land within the city of North Branch and Lent and Sunrise Townships in Chisago County, north of the Chisago Substation. This area is in the Wisconsin and Minnesota Thin Loess and Till Southern Part of the Northern Lake States Forest and Forage Region.[38]

[38] "Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, U.S. Department of Agriculture Handbook 296, 2006, http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050898.pdf, at 279-281

This area is typically flat, with cropland and forestland as the major land uses. The Sunrise River parallels the Project about a mile east; an unnamed creek runs within a mile of the western boundary; and an unnamed, intermittent creek runs between the planned Solar Project and the Chisago Substation.

The MNDNR and the U.S. Forest Service have jointly developed an Ecological Classification System (ECS) for ecological mapping and landscape classification in Minnesota.[39] The ECS places the Project within the Minnesota and Northeastern Iowa Morainal Section of the Eastern Broadleaf Forest Province. Pre-settlement vegetation consisted of a mosaic of forest types. However, most areas have been cleared for agricultural use.

EERA staff uses the National Land Cover Database (NLCD) to provide an overview of current vegetative cover by land use in the Project area. The NLCD uses satellite imagery to display land cover across the United States. NLCD uses 16 classes of land cover, as described in **Table 9**, of which 14 are found within the study area (the Project Boundary plus a one-mile buffer).

Land cover within the Project Boundary is currently dominated by cultivated crops (79 percent). In addition, there are dispersed forested areas (7.5 percent), generally in windrows and shelterbelts. The developed space (6 percent) encompasses the Chisago Substation area. The proposed location avoids the limited wetlands in the area (see **Figure 7**).

Table 9. Land Cover Classifications[40]

Classification	Definition
Open Water	All areas of open water, generally with less than 25% cover or vegetation or soil
Developed, Open Space	Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
Developed, Low Intensity	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.

[39] Minnesota Department of Natural Resources, Ecological Classification System: Ecological Land Classification Hierarchy, http://www.dnr.state.mn.us/ecs/index.html
[40] United States Geological Service. *The National Map: Land Cover.* http://nationalmap.gov/landcover.html and National Land Cover Database 2011: Product Legend http://www.mrlc.gov/nlcd11_leg.php

Classification	Definition
Developed, Medium Intensity	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.
Developed, High Intensity	Highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.
Barren Land (Rock/Sand/Clay)	Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
Deciduous Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
Evergreen Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.
Mixed Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.
Shrub/Scrub	Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 perccent of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environments.
Grassland/Herbaceous	Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
Pasture/Hay	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
Cultivated Crops	Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being tilled.

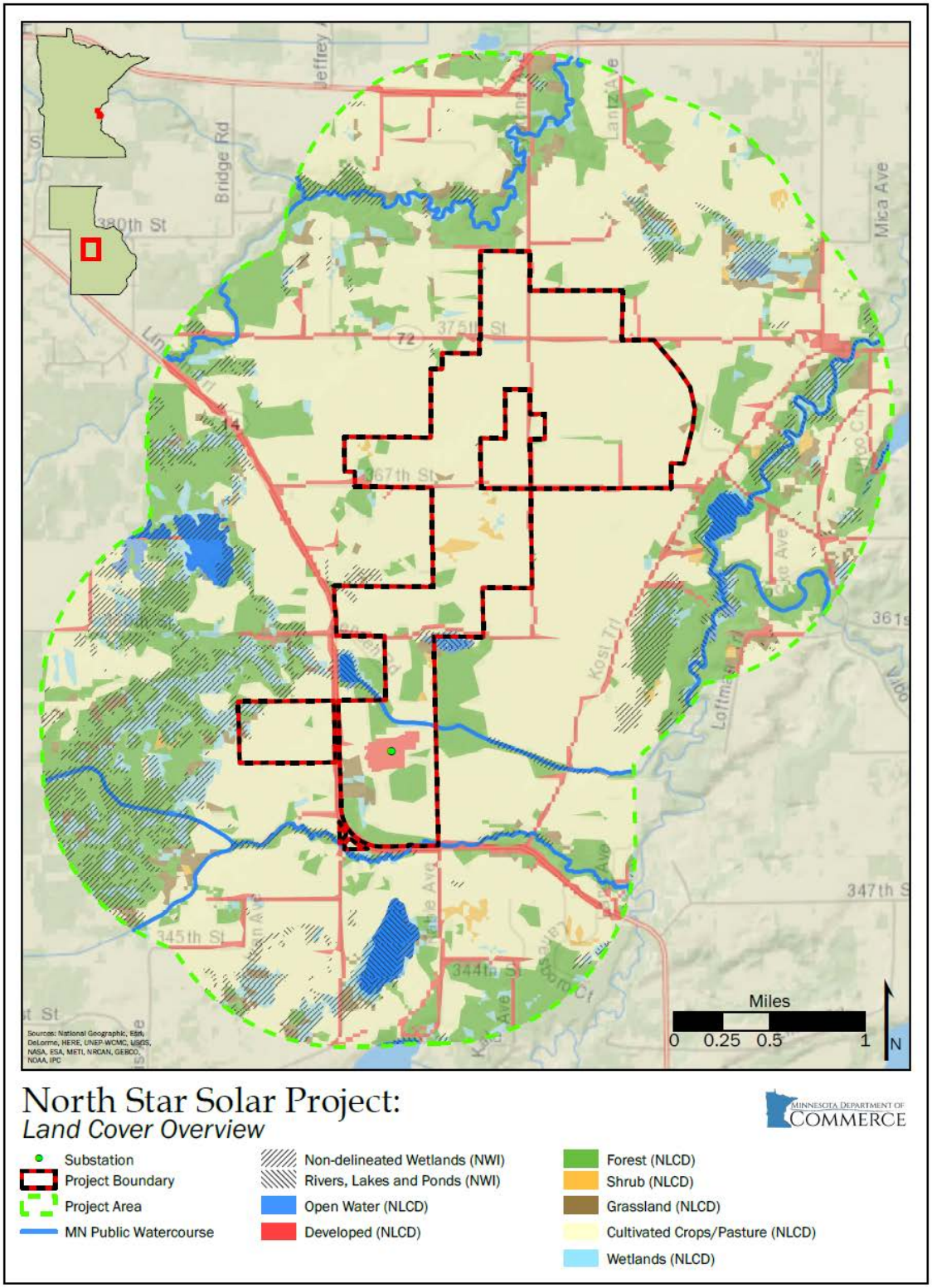
Classification	Definition
Woody Wetlands	Areas where forest or shrub land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Table 10 and **Figure 7** below provide a summary and visual of NLCD land cover within the Project Boundary and within the Project Area.

Table 10. Project NDLC Land Cover

Land Cover Type (NLCD)	Project Boundary		Project Area	
	Acres	Percent	Acres	Percent
Open Water	1.72	0.12	123.66	1.30
Developed, Open Space	56.98	4.06	451.74	4.76
Developed, Low Intensity	24.12	1.72	69.85	0.74
Developed, Medium Intensity	6.65	0.47	11.02	0.12
Developed, High Intensity	—	—	—	—
Barren Land	—	—	—	—
Deciduous Forest	91.09	6.49	2,104.66	22.20
Evergreen Forest	14.05	1.00	80.05	0.84
Mixed Forest	--	--	17.14	0.18
Shrub/Scrub	16.90	1.20	63.80	0.67
Grassland Herbaceous	22.80	1.63	265.06	2.80
Pasture/Hay	43.19	3.08	834.75	8.80
Cultivated Crops	1,108.00	78.97	4,888.32	51.55
Woody Wetlands	2.68	0.19	87.72	0.93
Emergent Herbaceous Wetlands	14.82	1.06	484.18	5.11
Totals	1403	100	9482	100

Figure 7. Project Area NLCD Land Cover



5.3 Effects on Human Settlement

Construction and operation of new generation or transmission facilities have the potential to impact human settlement. These impacts may be short-term, such as an influx of construction jobs, traffic impacts during the construction phase due to increased traffic or oversized loads or construction noise that is noticeable at neighboring residences or recreation facilities. Once constructed, there may also be long-term impacts such as changes in land use, displacement of homes or businesses or an increase in the local tax base.

5.3.1 Socioeconomic

The proposed facility is located in a rural area of Chisago County, immediately north of the Twin Cities area. **Table 11** provides an overview of the population characteristics in the communities where the facility is proposed. The Project is located away from the population concentration centers of the local governments. The entire Project is in agricultural or rural residential-zoned areas.

Table 11. Socio-Economic Matrix of Proposed Project Area

Location	Population 2010[41]	Population 2014[42]	Percent Change 2000-2014	Population per sq. mi. 2010[43]	Minority* Population (Percent)[44]	Median Household Income (Dollars)[45]	Poverty Level (Percent)[46]
Minnesota	5,303,925	5,453,218	2.8	66.6	17.4	59,836	11.5
Chisago County	53,887	54,134	0.5	129.9	5.5	67,157	7.5
North Branch	10,125	10,286	1.6	284.4	7.1	62,874	8.4
Lent Twn.	3,091	3,072	-0.6	95.4	5.1	80,104	6.1
Sunrise Twn.	1,994	1,985	-0.5	44.3	2.6	75,855	4.4

* Minority population includes all persons excluding non-Hispanic white.

The Proposed Project is not located in an area of disproportionately high minority populations or low-income populations.

[41] 2010 U.S. Census
[42] Minnesota State Demographer Population Estimates, July 2015
[43] 2010 U.S. Census (Density calculated using land area.)
[44] U.S. Census Bureau 2009-2013 American Community Survey 5-Year Estimates
[45] *Id.*
[46] *Id.*

Potential Impacts

Socioeconomic impacts resulting from the project will be primarily positive with an influx of wages and expenditures made at local businesses during the construction of the project, increased tax revenue and increased opportunities for business development.

There will be a short-term influx of contractor employees during construction of the various aspects of the project. North Star anticipates that approximately 250-300 jobs will be directly created during the construction phase of the Project.[47] The communities near the project are expected to experience short-term positive economic impacts during the construction phase of the Project through the use of the hotels, restaurants and other consumer goods and services by the various workers, as well as purchase of some materials such as fuel, concrete and gravel from local vendors.

Once the Project becomes operational, North Star anticipates up to 12 permanent employees will be required to operate and maintain the facilities.[48]

North Star will pay property taxes on the facility to local governments in accordance with state and county law. Property taxes are calculated on the land underlying the facility; the value of the equipment at the facility is not included in the calculation. In lieu of the personal property tax on the equipment, Minnesota has adopted a production tax of $1.20 per MWh. Production taxes are calculated based on energy production, and are paid to the local governments where the facility is located; 80 percent to the county and 20 percent to the city or township[49]. Based on North Star's estimated annual electricity production of approximately 200,000 MWh, the production tax would produce approximately $240,000 annually for local governments.

The majority of the Project Area is currently used for agricultural purposes. The North Star Solar Project will result in up to 800 acres being removed from agricultural production for at least the anticipated 25 year minimum useful life of the Project. Impacts to agriculture are discussed further in Section 5.3.1, but the change in land use would result in a negligible loss of overall crop production in the county (about 0.7 percent of the 113,744 acres of farm land[50] in Chisago County). North Star will compensate landowners for the land used for the facility, either through lease payments or purchase of the land.

If a PV facility is abandoned or is not decommissioned properly at the end of its useful life, the responsibility for proper disposal of the project components and restoration could fall on the landowner.

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[47] APP at 43
[48] *Id.*
[49] Minnesota Statutes 272.0295
[50] 2012 Census of Agriculture, USDA National Agricultural Statistics Service

Mitigative Measures

Socioeconomic impacts resulting from construction of the Project would be primarily positive with an influx of wages and expenditures made at local businesses during the construction.

North Star will compensate landowners for loss of use of the development area through lease payments or purchase of the land.

Section 9 of the *Site Permit Template* (**Appendix B**) addresses decommissioning and site restoration. Section 9.1 of the *Site Permit Template* would require North Star to file a *Decommissioning Plan* with the Commission prior to operation. Section 9.2 of the *Site Permit Template* would establish North Star as the responsible party for carrying out decommissioning tasks and sets out minimum standards for restoration. Section 9.3 of the *Site Permit Template* addresses abandoned solar installations.

5.3.2 Land Use and Zoning

Zoning is a regulatory tool used by local governments (counties, cities and some townships) to geographically restrict or promote certain types of land uses. Minnesota statutes provide local governments with zoning authority to promote the public health and general welfare.

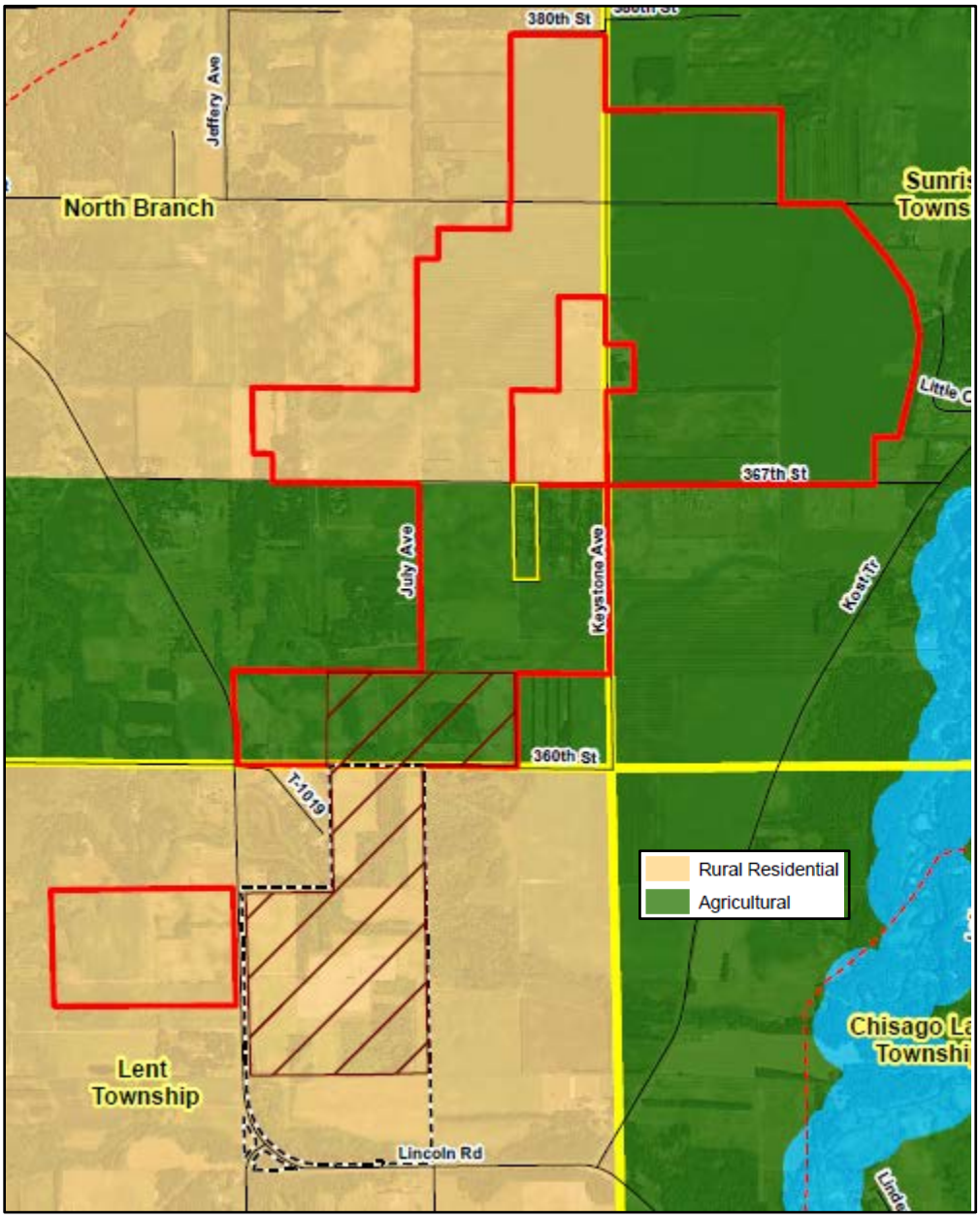
The North Star Project is subject to permitting under Minnesota's Power Plant Siting Act. With respect to the role of state permitting of large energy facilities, Minnesota Statute 216E.10, subdivision 1 states:

> *To assure the paramount and controlling effect of the provisions herein over other state agencies, regional, county, and local governments, and special purpose government districts, the issuance of a site permit or route permit and subsequent purchase and use of such site or route locations for large electric power generating plant and high-voltage transmission line purposes shall be the sole site or route approval required to be obtained by the utility. Such permit shall supersede and preempt all zoning, building, or land use rules, regulations, or ordinances promulgated by regional, county, local and special purpose government.*

Although North Star is not required to seek permits or variances from local government to comply with local zoning, impacts to local zoning are clearly an impact to current and planned human settlement, and the Commission considers impacts to human settlement as a factor in its siting decision.

The facility is located in an area zoned by the local governments as agricultural or rural residential (see **Figure 8** below). Rural residential zones are typically transitional areas between agricultural and urban areas. The North Star Solar Project is a compatible use within those zones.

Figure 8. Project Area Zoning[51]



Chisago County, North Branch and Lent Township address utility-scale solar facilities in their zoning ordinances, specifying zoning districts where they are compatible or incompatible and in many cases identifying performance standards such as setbacks and screening. The excluded areas, such as shoreland protection areas, do not occur in this case.

[51] APP at Appendix C-3

Potential Impacts

The development of the facility would change the land use of the developed area from a generally agricultural use to an industrial use for at least 25 years. After its useful life, the development area could be restored for use as agricultural or other planned land uses. No other development plans have come to light for the immediate area for which the Project would serve as an impediment. Rather, the facility may serve a useful role in ensuring a productive use of the land until the location is ripe for other uses, or a return to its original use.

Mitigative Measures

There are no shoreland protection areas that require setbacks in the Project Area, so no mitigation or special appliance of local ordinance would be required.

Landscaping plans, described in Section 5.2.7, can be used to minimize visual impacts to adjacent land uses.

5.3.3 Property Values

Property values are influenced by a complex interaction of factors specific to individual parcels. These factors can include, but are not limited to, condition, improvements, acreage, or neighborhood characteristics, as well as proximity to schools, parks, and other amenities. In addition, local and national market conditions often influence property values. The presence of a utility-scale PV facility would become one of many interacting factors that could affect a property's value.

Electrical generating facilities have the potential to impact property values. Often, negative effects from these facilities are the result of impacts that extend beyond the immediate footprint. Examples include noise, emissions and visual impacts. Unlike fossil-fueled electric generating facilities however, a PV facility would have no emissions and essentially no noise impacts to adjacent land uses during operation of the facility. The installation of PV facilities would create a visual impact, but lacking the height of smokestacks or wind turbines, the visual impact at ground level, or within a neighboring building, would be more limited.

A review of the literature found no research specifically aimed at quantifying impacts to property values based solely on proximity to utility-scale PV facilities. As the recently permitted Aurora Distributed Solar Project involves the first utility-scale PV facilities across Minnesota, comparable sales data do not exist. As the industry continues to develop comparable data should become available.

For these reasons, the impact to the value of one particular property based solely on its proximity to a utility-scale PV facility is difficult to determine. Widespread negative impacts to property values are not anticipated. In unique situations it is possible that individual property values might be negatively impacted.

Mitigative Measures

Landscaping plans, described in Section 5.2.7, can be used to minimize visual impacts to adjacent land uses. In addition, North Star has noted to EERA that they have made purchase offers to homeowners within the Project Boundary who might experience a visual impact.

5.3.4 Public Services and Transportation

Public services in the form of fire, law enforcement and emergency services are provided by Chisago County and local government units where the proposed facilities are located.[52]

Telephone and electric services are delivered by electric utilities, and distribution lines are typically located along public roads. A major transmission corridor runs north and south through the western portion of the Project Boundary.

Water and sewer services in the area are generally provided by private wells and septic. The Minnesota Department of Health (MDH) County Well Index identifies three wells within the development footprint, including two irrigation wells.[53]

Potential Impacts

Construction activities may inadvertently disrupt utilities. Underground utilities are particularly vulnerable to disruption, as construction personnel may not be aware of their existence.

North Star does not anticipate that facilities will be served by city water or sewer. They may install a well and septic system at an O&M facility to provide sanitary services and water for maintenance. North Star would need to obtain appropriate state and local permits for wells or septic systems installed as part of the facility.

Impacts to local electrical service are not expected, as the Project will interconnect with Xcel Energy's transmission system at the Chisago Substation, but not its distribution system.

The facility is not crossed by a railroad, so there will be no impact to rail traffic. Potential impacts to air traffic are discussed in Section 5.2.8. None of the solar facility will be constructed over the Viking Pipeline.

The existing public road system that services and provides access to the proposed facilities is generally located along section lines and is managed by local government units. The facility will be accessed from the public road network. North Star will generally be able to use existing road access points, while in some cases it may require establishment of a new access point from the existing roadway network.

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[52] APP at 45
[53] *Id.*

Other than the establishment of facility access, no upgrades or changes to existing roadway systems are necessary for construction or operation of the Project.[54] North Star will use existing roadways to deliver construction materials and personnel to facility construction sites, which may add approximately 40 vehicle trips per day during construction.[55] No impacts to roads would be expected during the operation of the facility, as minimal traffic would occur during regular maintenance.

There are two FAA recognized airports located within three miles west and southwest of the Project Boundary. North Star screened whether or not FAA Notice form 7460-1 needed to be filed. North Star notes that the Project does not exceed notice criteria.[56] Additionally, transmission structures are expected to be only about 70 feet tall.

EERA conducted a preliminary glare analysis using the Sandia National Laboratories' Solar Glare Hazard Analysis Tool[57] (see **Appendix E**). The results indicate the Project would produce a "low potential for temporary after-image" at the two airports at only a limited number of times during the year. There was no indication the Project would cause any higher potentiality or any potential for physical/visual damage.

Mitigative Measures

As part of the facility design process, North Star would need to identify the locations of underground utilities and avoid impacts to those utilities in final facility design. Prior to construction, utility locations would be marked on site plans and on the ground to avoid impacts from construction activities.

North Star would need to follow MDH procedures to shut down private wells located within the development area.

New drives or access roads would require approval by appropriate local governments.

No mitigation is necessary for local airports, including for potential solar glare.

5.3.5 Displacement

Because of the land requirements, solar facilities are generally sited away from homes or businesses. North Star does not anticipate removing any of the three homes in the Project Boundary in the course of constructing and operating the solar facility. Therefore no potential impacts are noted, and no mitigative measures are required.

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[54] *Id.* at 46
[55] *Id.*
[56] *Id.*at Appendix A-3
[57] "Solar Glare and Flux Mapping Tools," https://share.sandia.gov/phlux/

5.3.6 Noise

Noise, typically defined as a loud or unpleasant sound, is measured in units of decibels (dB) on a logarithmic scale. The A weighted decibel (dBA) scale corresponds to the sensitivity range for human hearing. For example, a noise level change of 3 dBA is barely perceptible to average human hearing while a 5 dBA change in noise level is noticeable. For the Project, noise would primarily be experienced during the construction phase of the Project and to a lesser extent during the operations phase from the inverters and transformers.

Recognizing that some level of noise is the necessary result of human activity, and that sensitivity to noise can reasonably differ depending upon the activity and site, the Minnesota Pollution Control Agency (MPCA) has established noise limits. Land use activities associated with residential, commercial and industrial land are grouped together into Noise Area Classifications (NAC). Residences, which are typically considered sensitive to noise, are classified as NAC 1. Each NAC is assigned both daytime (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.) noise limits for land use activities within the NAC. **Table 12** shows the MPCA daytime and nighttime limits in dBA for each NAC. The limits are expressed as a range of permissible dBA within a one-hour period; L_{50} is the dBA that may be exceeded 50 percent of the time within an hour, while L_{10} is the dBA that may be exceeded 10 percent of the time within one hour.

Residences would be the typical noise sensitive receptors in the Project Area. Current average noise levels in a similarly rural area would typically be in the 30 to 40 dBA range, well within acceptable limits for residential land use activities. Ambient noise in rural areas is commonly made up of farm equipment, wind, rustling vegetation and infrequent vehicle pass-bys. Higher ambient noise levels, typically 50 to 60 dBA, would be expected near roadways, urban areas and commercial and industrial properties surrounding the Project vicinity.

Table 12. MPCA Daytime and Nighttime Noise Limits

Noise Area Classification	Daytime		Nighttime	
	L_{50}	L_{10}	L_{50}	L_{10}
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Potential Impacts

Noise concerns for the Project are related primarily to the construction phase as the result of heavy equipment operation and increased vehicle traffic associated with the transport of construction materials and personnel to and from the work area. North Star anticipates that construction activities will only occur during daylight hours.

During operation of the Project, the primary source of noise will be from the inverters, and to a lesser extent from the transformers and rotation of tracking systems, located at each facility. All electrical equipment will be designed to National Electrical Manufacturer Association (NEMA) Standards. The anticipated inverter model under consideration produces 65 dBA[58] at the source. Preliminary facility design indicates that the closest home would be approximately 250 feet from any solar array. Because the inverters would be located within the solar arrays, noise impacts beyond the MPCA limits are not expected at residences during operation of the facility.

Noise from the electric collection system is not expected to be perceptible.

Because the facilities will not be generating electricity at night, the tracking systems would not be rotating and noise from inverters would be at less than peak levels.

While most maintenance activities would be performed during the day, it may be preferable to perform some maintenance activities after the sun is down in order to limit impacts to energy production.

Mitigative Measures

Section 4.2.5 of the Site Permit Template would require North Star to limit construction and routing maintenance activities to daytime working hours as defined in Minnesota Rule 7030.0200.

Maintenance activities that may potentially create excessive noise would necessarily be performed during the day in order to minimize noise impacts to nearby residents.

No mitigation measures are proposed for the operational phase of the project, as operational noise levels are not predicted to exceed the state noise limits.

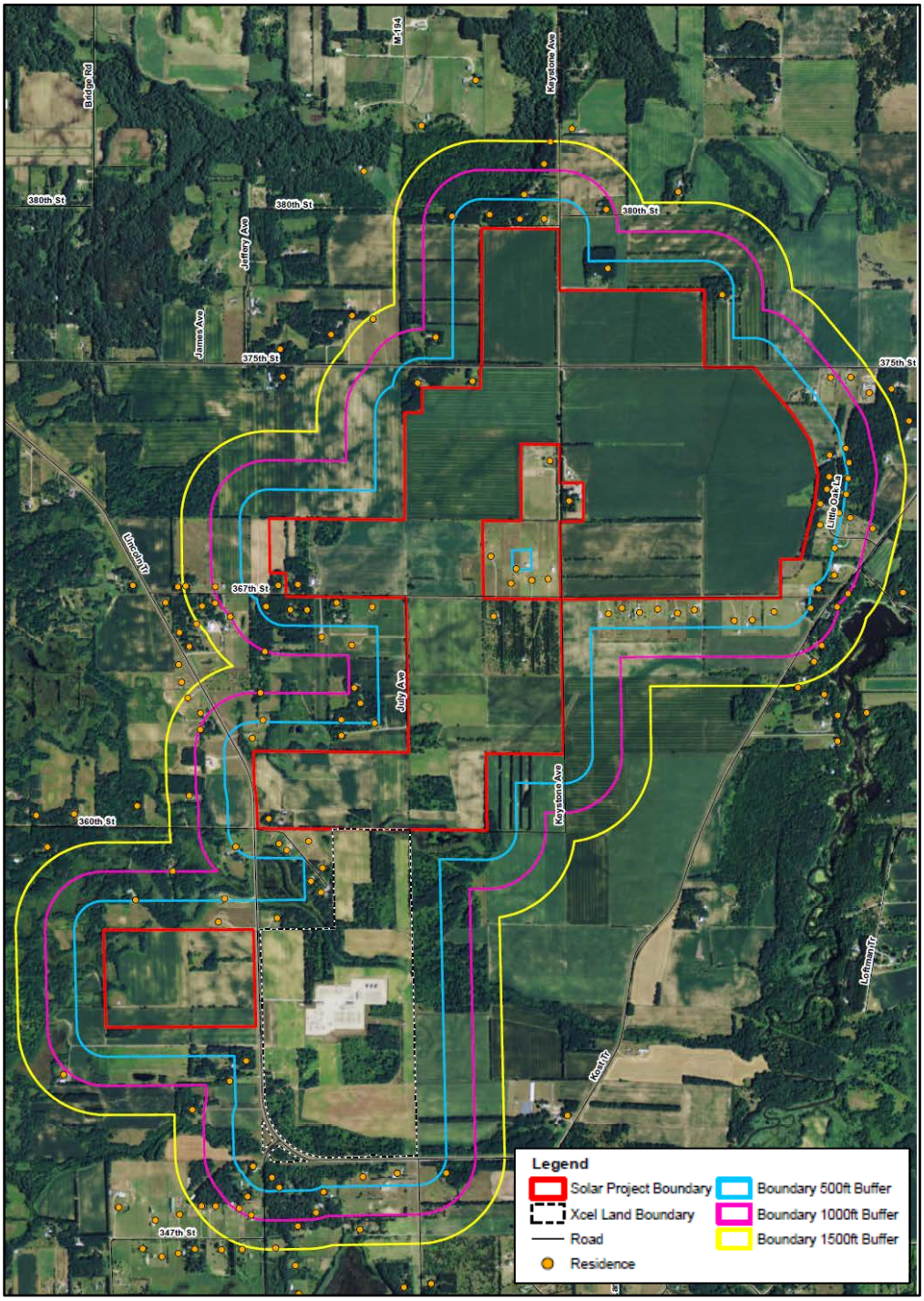
5.3.7 Aesthetics

Aesthetics refer to the natural and built landscape that contribute to the public's experience and appreciation of their environment. Features, such as wetlands, surface waters, landforms, forests and vegetation patterns are among the natural landscape features that define an area's visual character. Buildings, roads, bridges and other structures represent the built environment imposed upon the natural landscape.

The scenic value or visual importance of an area is a subjective matter and depends upon the perception and philosophical or psychological response of the viewer. The level of impact to visual resources is also subjective and generally depends on the sensitivity and exposure of a particular viewer. The perceived impact can vary greatly from one individual to the next.

[58] APP at 40

Figure 9. Houses within 500, 1000 and 1500 Feet of Project Boundary[59]



[59] Original Map generated by Westwood; homes located using aerial photography.

Potential Impacts

Installation of the proposed solar facilities will result in visible landscape changes as land that is now primarily covered in row crops or pastureland is converted to a solar facility. Based on preliminary facility design, up to 800 acres will be converted from its current use, primarily cropland or pasture, for at least 25 years, the minimum estimated useful life of a PV facility. The primary components of a PV solar facility that alter the landscape are solar arrays and the perimeter fencing. Samples of existing solar facilities near Oronoco Minnesota and Lambton County, Ontario are shown in **Figure 10** and **Figure 11**.

Because of their relatively low profile, the facilities will not be visible from great distance. The aesthetic impacts will be experienced primarily by nearby residents and people using the roads adjacent facilities. There are 114 houses in the immediate area; 55 within 500 feet of the Project Boundary. (There are 34 within 500-1,000 feet and 25 within 1,000 to 1,500 feet; see **Figure 9**).

Figure 10. 517 kV Solar Facility - Oronoco, MN[60]

When the PV panels are at a zero degree angle (sun is directly overhead) panels will be approximately four to six feet off of the ground. When panels are at their maximum tilt of 45 degrees (tilted east in the morning and west in the afternoon as the panels follow the sun) the tops of the panels will be approximately eight to ten feet off the ground.

Unlike concentrating solar, which uses mirrors to concentrate the solar energy to create heat energy used to create electricity, PV panels are constructed of dark, light-absorbing material and covered with an anti-reflective coating in order to limit reflection. Because of the materials used, glare and reflection are expected to be minimal (see **Appendix E** for glare analysis).

[60] Aurora Distributed Solar

Figure 11. 80-Acre Solar Farm - Lambton County, Ontario[61]

A limited amount of tree-clearing is anticipated in parts of the solar facility. The collector lines that connect the solar facility to the Project Substation are anticipated to be underground. Overhead transmission lines approximately 70 feet tall will run from the Project Substation for less than one mile south to the Chisago Substation. This 115 kV line will be smaller than other transmission lines (a 230 kV and a 500 kV line) sharing the same corridor. The line will, again, require limited tree-clearing.

Typical solar facilities are enclosed by an 8-foot security fence (a seven-foot chain link fence topped by another foot of barbed wire).

Lights will be installed on temporary service poles to provide lighting during the construction phase of the Project. After construction, the temporary service poles will be removed and permanent motion-activated lighting will be installed near O&M areas, security gates and in perimeter areas. Lighting will be down lit to minimize impacts to adjacent land uses. North Star anticipates that most maintenance activities will be performed during the day, although it may be preferable to perform some maintenance activities that require activation of facility lighting after the sun is down in order to limit impacts to energy production.

Mitigative Measures

The primary strategy for minimizing aesthetic impacts is choosing a site where solar facilities are in keeping with the existing landscape, separated as far as possible from existing homes or shielded from view by terrain or existing vegetation.

[61] Aurora Distributed Solar

Landscaping plans can be developed to identify site-specific landscaping techniques including vegetation screening, berms or fencing to minimize visual impacts to adjacent land uses.

As an alternative to chain link fencing (e.g., a seven-foot fence with an additional extension angled outward at 45 degrees), North Star is evaluating the suitability of an eight foot wood pole and woven wire fence.[62] This fence design is frequently referred to as a "deer fence" or an "agricultural fence." This wood pole and woven wire fence design potentially offers superior aesthetics to the standard chain link fence. North Star also asserts it meets the requirements for security and safety in the National Electrical Code 110.31 (D).

Screening the solar facility from residences is the most effective means to affect aesthetics. Chisago County, North Branch and Lent Township have each included a section on solar energy systems in their zoning ordinances, and each addresses the importance of screening. Lent Township (and North Branch in an amended version of its ordinance) included the following specifics for its permits:

1. Two rows staggered of conifer trees which must be a minimum of eight (8) feet in height at the time of installation, and reach a minimum maturity height of twelve (12) feet will be required to screen the use from public right-of-way and immediately adjacent residences or

2. Alternative buffer and screening using a combination of trees, shrubs, fences and/or berms that completely screen the use from public right-of-way and immediately adjacent residences. [63]

The Commission can consider local ordinances in its decision or impose reasonable conditions of its own in the Site Permit.

North Star is developing a landscaping plan applicable to each residence that is immediately adjacent the project, accounting for the existing visual corridor between a residence and the proposed project, such as existing vegetation, topography and distance. North Star plans a tailored approach that will comprise a combination of evergreen trees and ornamental flowering trees and shrubs. Screening made up of these different species is intended to provide year-round visual screening and also serve as wildlife habitat.[64]

5.3.8 Public Health and Safety Including EMF

Safety issues at PV facilities are largely associated with construction. Safety concerns associated with the operation of a PV facility are limited.

[62] North Star Data Submission, EERA Question 02, August 21, 2015 (Appendix D)
[63] Ordinance No. 2015-1, Section 4.18 (Solar Energy Systems), Lent Township
[64] North Star Data Submission, EERA Question 03, August 21, 2015 (Appendix D)

Potential Impacts

The manufacturing process for PV panels does involve the use of hazardous chemicals, and proper disposal of the PV panels at the end of the Project is necessary to prevent leaching of the materials, in particular lead used in the soldering of individual cells onto a module.[65]

Unauthorized access to PV facilities, both during construction and operation phases, could result in safety issues. As with any large construction project, there is a potential for construction accidents including falls, vehicle accidents, electrical accidents, and power tool accidents. Unlike wind turbine installations, construction activity occurs close to ground level and special emergency procedures for rescue in tall and confined spaces are not necessary.

Compared to other solar technologies such as Concentrating Solar Power, PV installations, especially ones using anti-reflective surfaces such as proposed by North Star, are unlikely to create hazards to aircraft. North Star conducted the FAA Notice Criteria screening tool for the two FAA-registered airports within three nautical miles of the facility and determined no further aeronautical study or FAA filing is needed.[66]

Electric and Magnetic Fields

Voltage transmitted through any conductor of electricity produces both an electric field and a magnetic field in the area surrounding the wire. For example, the electric field associated with electric transmission lines extends from the energized conductors to other nearby objects. The magnetic field associated with electric transmission lines surrounds the conductor. Together, these fields are generally referred to as electromagnetic fields, or EMF. These effects decrease rapidly as the distance from the conductor increases.

The North Star Project will require construction of a short 115 kV transmission line. The Project will also have buried 34.5 kV collections lines transmitting from the individual inverters and transformers to the Project Substation. This collection system is well removed from the public, with the closet residence to an inverter at approximately 400 feet distant.[67] The transmission line is also set back from residences, with the closest residence approximately 1,100 feet away.[68]

Electric Fields

Voltage on any conductor produces an electric field in the area surrounding the wire. The electric field associated with a transmission line extends from the energized conductors to other nearby objects such as the ground, towers, vegetation, buildings and vehicles. The electric field from a transmission line gets weaker as one moves away from the transmission line. Nearby trees and building material also greatly reduce the strength of transmission line electric fields.

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[65] Oregon Department of Transportation, *Health and Safety Concerns of Photovoltaic Panels*, http://www.oregon.gov/ODOT/HWY/OIPP/docs/life-cyclehealthandsafetyconcerns.pdf
[66] APP at Appendix A-3
[67] *Id.* at 32
[68] *Id.* at 33

The intensity of electric fields is associated with the voltage of the transmission line and is measured in kilovolts per meter (kV/M). Transmission line electric fields near the ground are designated by the difference in voltage between two points (usually 1 meter). There is no federal standard for transmission line electric fields. The Commission, however, has historically imposed a maximum electric field limit of 8 kV/m measured at one meter above the ground. The standard was designed to prevent serious hazards from shocks when touching large objects parked under AC transmission lines of 500 kV or greater.

North Star has modeled the electric field at and near the transmission line based on the maximum operating voltage (nominal voltage plus 5 percent) as noted in **Table 13** below.

Table 13. Calculated Electric Fields (kV/m) at One Meter above Ground[69]

Electric Field Strength										
Structure Type	Maximum Operating Voltage (kV)	Distance to Centerline								
		-300'	-200'	-100'	-50'	0'	50'	100'	200'	300'
Braced Post Steel or Wood Pole; Single-Circuit 115kV	121	0.006	0.013	0.056	0.200	0.739	0.188	0.058	0.015	0.007

Magnetic Fields

Current passing through any conductor, including a wire, produces a magnetic field in the area around the conductor. The magnetic field is expressed in units of magnetic flux density, expressed as milligauss (μG), and is dependent upon the current flowing through the conductor. The peak magnetic field values for the NS HVTL were calculated at one meter above the ground at a point directly under the transmission line, where the conductor is closest to the ground. The same relative point was used to calculate the field going out from the alignment.

Buildings and other materials do not block magnetic fields in the same way that they block electric fields. However, the magnetic field associated with a transmission line still decreases rapidly with increasing distance from the conductor.

North Star has modeled the magnetic field at and near the transmission line based on the maximum operating voltage (nominal voltage plus 5 percent) as noted in **Table 14** below. Actual current flow on the line will vary, so magnetic fields will generally be less than peak levels during most hours of the year.

[69] *Id.* at 33

Table 14. Calculated Magnetic Flux Density (Milligauss) at One Meter above Ground[70]

Magnetic Flux Density										
Structure Type	Maximum Current (amps)	Distance to Centerline								
		-300'	-200'	-100'	-50'	0'	50'	100'	200'	300'
Braced Post Steel or Wood Pole; Single-Circuit 115kV	502	0.56	1.24	4.48	13.20	42.47	14.71	4.80	1.29	0.58

Mitigative Measures
Site permits typically require compliance with FAA determinations.

Construction will comply with local, state, and federal regulations regarding installation of the facilities and standard construction practices. Established industry safety procedures will be followed during and after construction of the Project.

All facilities will be fenced to prevent unauthorized access to the facility.

Section 8.9 of the Site Permit Template requires North Star to prepare *an Emergency Response Plan* prior to Project construction. The *Emergency Response Plan* will identify procedures to be followed in the event of an emergency during construction. Contact information for emergency officials and the location of hospitals should be included in the *Emergency Response Plan.*

There should be little or no change from the existing, ambient EMF outside the solar facility. There are no homes within the requested route, all within Xcel Energy property, or within 1,000 feet of the proposed alignment. Therefore, again, there would be no change from the existing EMF levels for any residence. In addition, based upon current scientific evidence, no adverse impacts from electric or magnetic fields associated with the Project solar or transmission projects are anticipated.

Since no EMF impacts are anticipated, this EA does not contain an exhaustive discussion of current literature and findings. For the reader who has more interest in EMF, Stray Voltage and other related issues and potential impacts, further information is available in other EERA environmental documents. The author refers the reader as an example to the Environmental Assessment for the Elko New Market Cleary Lake Area 115 kV Transmission Upgrade.[71]

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[70] *Id.* at 34
[71] Environmental Assessment, EERA, February 21, 2014, eDocket no. 20142-96692-01 at Section 5.7

5.3.9 Recreation

Outdoor recreational opportunities in the area include hiking, biking, camping, hunting, fishing, wildlife viewing, cross-country skiing and snowmobiling. **Figure 12** displays the location of several areas of recreational use within and around the Project Area, None of these fall within the Project Boundary.

The only recreational use area that transacts the Project is the North Branch Sno Drifters Trail, a snowmobile trail that follows public right-of-way along 367th Street across a 1.25 mile portion of the Project. The Project itself is set back away from the public right-of-way, so the solar facility would not interfere with free movement along or require any relocation of the trail.

There are no federal, county or state parks within or adjacent the proposed facilities. There are three county parks within one to two miles of the planned facilities. One park, the Kost Dam County Park is within one-half mile to the east along the Sunrise River.

The Minnesota DNR has established Wildlife Management Areas (WMAs) to provide wildlife habitat, improve wildlife production, and provide public opportunities for hunting and trapping. WMAs are open to the public for hunting, fishing, trapping and wildlife viewing but are closed to all-terrain vehicles and horses because of potential detrimental effects on wildlife habitat. There are no Project facilities within any WMA. The North Star Solar Project is within one mile of both the Carlos Avery and Jane Johnson WMAs.

Scientific and Natural Areas (SNAs) are designated to protect rare and endangered species habitat, unique plant communities, and significant geologic features that possess exceptional scientific or educational values. There are no SNAs within one mile of the Project facilities.

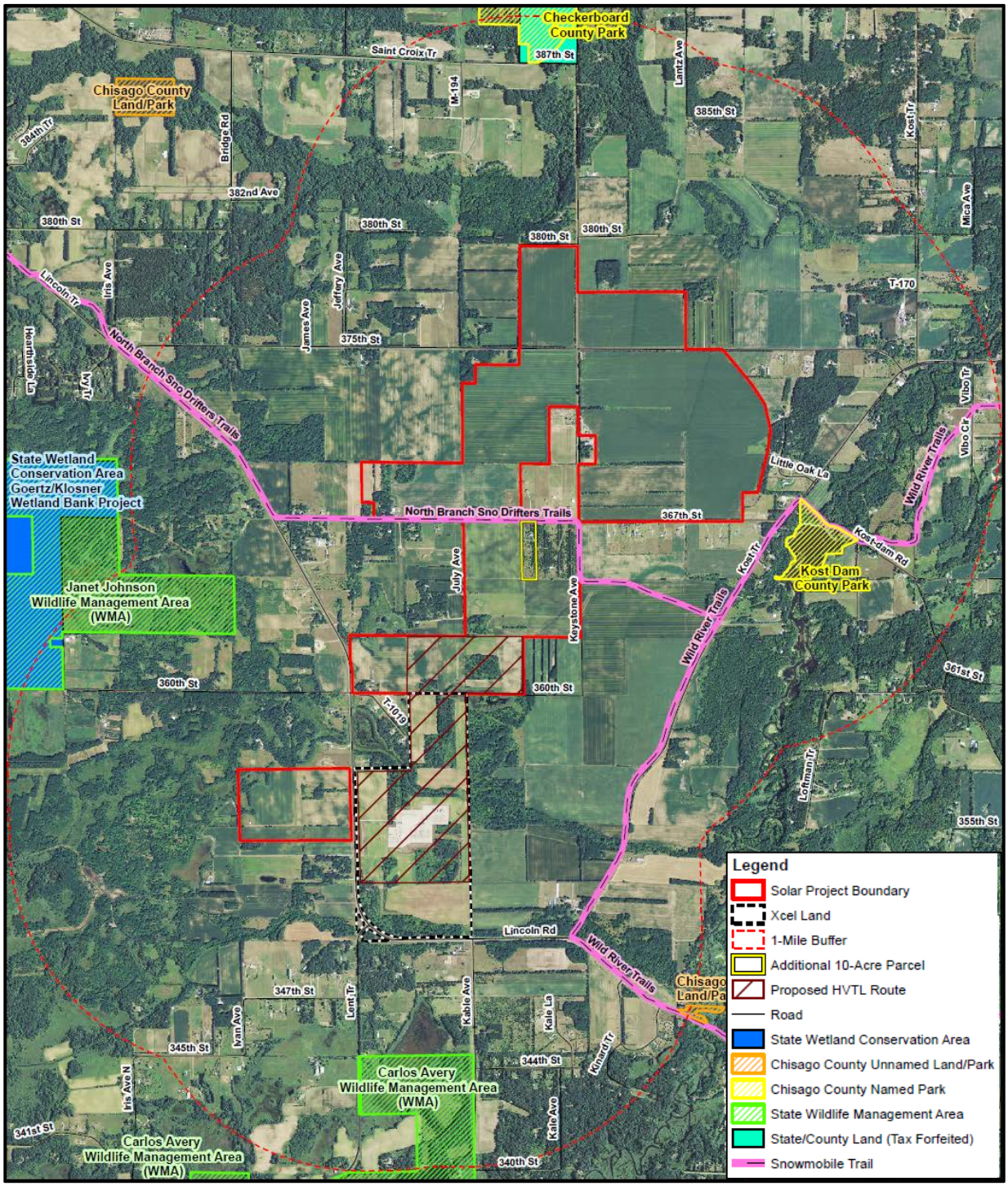
Waterfowl Production Areas (WPAs) provide habitat for a vast variety of plants and wildlife. WPAs provide opportunities for hunting, wildlife watching and photography. There are no WPAs located within one mile of the proposed facilities. A State Wetland Conservation Area is approximately one mile west of the Project Boundary.

There are no National Parks or National Wildlife Refuges identified within one mile of the Project facilities.

Potential Impacts

The proposed Project facilities will be located on private lands, so no public recreational lands will be directly impacted by construction or operation of the proposed PV or HVTL facilities. Visual impacts may affect individuals utilizing public or private lands within or near the proposed Project. Temporary noise impacts could be experienced by individuals using the recreational resources in the area during construction of the facilities.

Figure 12. Public Parks and Recreation Areas near the North Star Project[72]



[72] APP at Appendix C-2

Mitigative Measures

The proposed facilities will not have a direct impact on any public lands. No interference with the local snowmobile trail is anticipated. Except for specific visual screening for any perceived aesthetic impact to recreation, no other mitigative measures should be required.

5.4 Land-based Economies

Installation of a solar PV facility will result in a change of land use. The current land use would be displaced with the PV panels and the roads, fencing, inverters, electrical collection system and other infrastructure necessary to support the operation of the PV facility.

To the extent that the PV facility displaces other economic uses of the land, such as farming, mining or forestry, the facility will impact land-based economies at the site. Impacts on land-based economies on neighboring parcels are not anticipated.

5.4.1 Agriculture

Rural areas, with their relatively large parcels of relatively flat open land, tend to be attractive locations for developers seeking to site ground-mounted PV projects requiring 7 to 10 acres per MW.

Although much of the land in the Project Area has historically been used for agricultural purposes, there are differences in the quality and suitability of land for purposes of agricultural production. The United States Department of Agriculture (USDA) defines prime farmland as follows:

> *Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water). It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding. Examples of soils that qualify as prime farmland are Palouse silt loam, 0 to 7 percent slopes; Brookston silty clay loam, drained; and Tama silty clay loam, 0 to 5 percent slopes.*[73]

[73] U.S. Department of Agriculture, Natural Resources Conservation Service. *National soil survey handbook, title 430-VI*. Available online.. Sec. 657.5 Identification of important farmlands. http://www.soils.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054226#ex1

Although "prime farmland" characteristics are the same nationwide, the USDA also realizes that certain areas that do not meet the specific characteristics determined by soil classification data, are nevertheless important at a statewide level.

Additional farmland of statewide importance is land, in addition to prime and unique farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oil seed crops. Criteria for defining and delineating this land are to be determined by the appropriate State agency or agencies. Generally, additional farmlands of statewide importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce as high a yield as prime farmlands if conditions are favorable. In some States, additional farmlands of statewide importance may include tracts of land that have been designated for agriculture by State law.[74]

The rules governing the siting of power plants provide for up to 0.5 acres of prime farmland to be used per MW in most areas unless there is no feasible alternative (Minnesota Rule 7550.4400). In this case, the 100 MW Project could use up to 50 acres of prime farmland. However, prime farmland is nonexistent within the Project Boundary. Also, the great majority of farmland of statewide importance in the area falls outside the Project Boundary.

Farmland that would be prime if drained is a minuscule percentage of all farmland in the area. In fact, drain tiling is generally not employed in the Project Area. North Star verified with participating landowners that no drain tile systems were in use within the Project Boundary.[75]

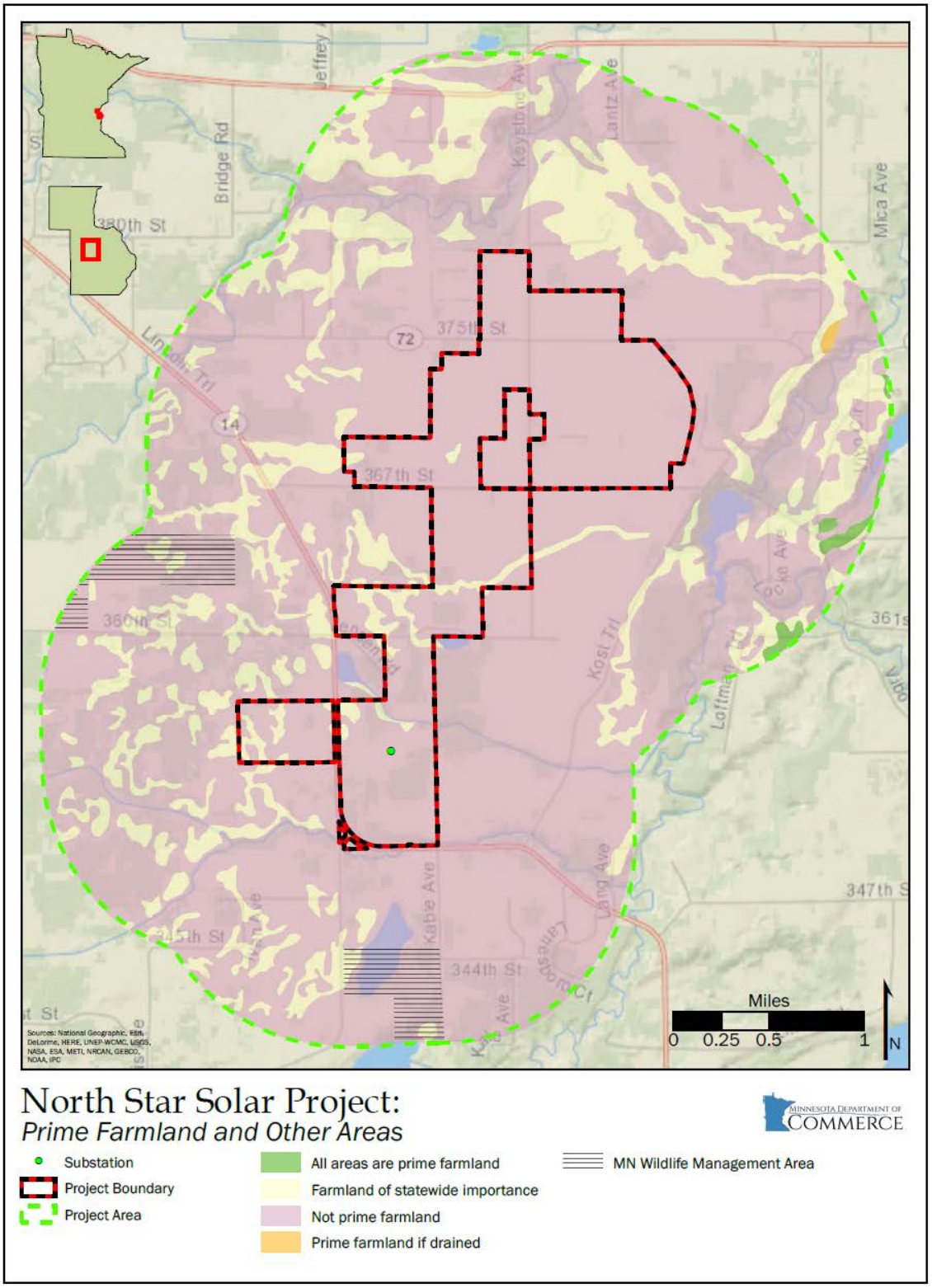
Table 15 and **Figure 13** summarize the quality of farmland as detailed in the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO).[76]

Table 15. Farmland Types in the Project Area

Farmland Types (SSURGO)	Project Boundary		Project Area	
	Acres	Percent	Acres	Percent
Prime	0.00	0.00	29.39	0.31
Prime, if Drained	–	–	5.90	0.06
Statewide Importance	80.83	5.76	1,577.31	16.62
All Other	1,322.17	94.24	7,877.51	83.01
Totals	1403	100	9490	100

[74] *Id.*
[75] APP at 49
[76] http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053627

Figure 13. Farmland Types (SSURGO) in the Project Area



Potential Impacts

The **Table 15** total acreage within the Project Boundary (1403) represents the land in the Solar Project and the Transmission Project. The transmission should repurpose only a nominal amount of land for the areas immediately surrounding the pole structures. The solar facility could remove up to 800 acres from agricultural production. At the end of the facility's useful life, a minimum of 25 years, North Star could decommission the facility and restore the land to agricultural use.

Construction of the facilities has the potential to damage agricultural soils through compaction or erosion if best management practices (BMP) are not implemented to minimize damage.

No areas of prime farmland would be removed from agricultural production for any part of the Project. Regardless, the prime farmland exclusion in Minnesota Rule 7850.4400, Subpart 4 does not apply to this Project because it is within "home rule charter or statutory cities; areas located within two miles of home rule charter or statutory cities of the first, second, and third class; or areas designated for orderly annexation."

Mitigative Measures

As part of the voluntary agreement between North Star and landowners, North Star will compensate the owners of the parcels directly affected by Project facilities through the negotiated purchase or lease of the land.

Section 4.2.7 of the Site Permit Template requires reasonable measures to minimize erosion during construction. Other permits have also included requirements to implement measures to protect and segregate topsoil and measures to minimize soil compaction.

According to the Applicant, "topsoil excavated during grading will be stockpiled and re-spread prior to the start of panel installation in the general array areas that are subject to cut [grading]. This will enhance the presence of topsoil for establishing vegetation during operations and for future agricultural use. Areas of fill will be initially filled with sub-soil and topped with a layer of topsoil as available. An appropriate volume of topsoil will be stocked piled [sic] for placement within the civil infrastructure footprint during decommissioning of the facility. Such materials will be stockpiled at multiple locations around the site in low berms and stabilized for long-term protection. The grading associated with the project will result in a more level site that will not impair future agricultural production. The permanent vegetative cover established during operations will enhance the organic composition of the soil and will very likely enhance the future use of the area for agriculture."[77]

[77] North Star Data Submission, EERA Question 04, August 21, 2015 (Appendix D)

5.4.2 Forestry

Although there are forested areas within the facility location, these areas are associated with shelterbelts, homesteads and waterways and are not managed for economic purposes. No economically significant forestry resources will be affected by the Project.

Mitigative Measures

No impacts to forestry resources are anticipated and therefore no mitigative measures are proposed.

5.4.3 Tourism

Tourism in the area of the proposed facility location is largely associated with the recreational activities discussed in Section 5.3.9. Impacts to tourism would be expected if the proposed facilities affected the overall experience of visitors to tourism sites, either through aesthetic impacts, noise or degradation of the natural resources such as air or water quality. No impacts to tourism are anticipated from the Project.

Mitigative Measures

No impacts to tourism are anticipated and therefore no mitigative measures are proposed.

5.4.4 Mining

Although there are four inactive gravel pits in the general vicinity of the proposed facilities, there are no active gravel pits or other mineral extraction sites located within or directly adjacent the development area.

Potential Impacts

Construction or operation of the proposed facilities would not impact any mining or mineral extraction activities. If sites are activated around the Project Boundary, that activity could have an effect on solar operations and efficiency due to fugitive dust. Local permitting agencies may consider dust control measures for those operations.

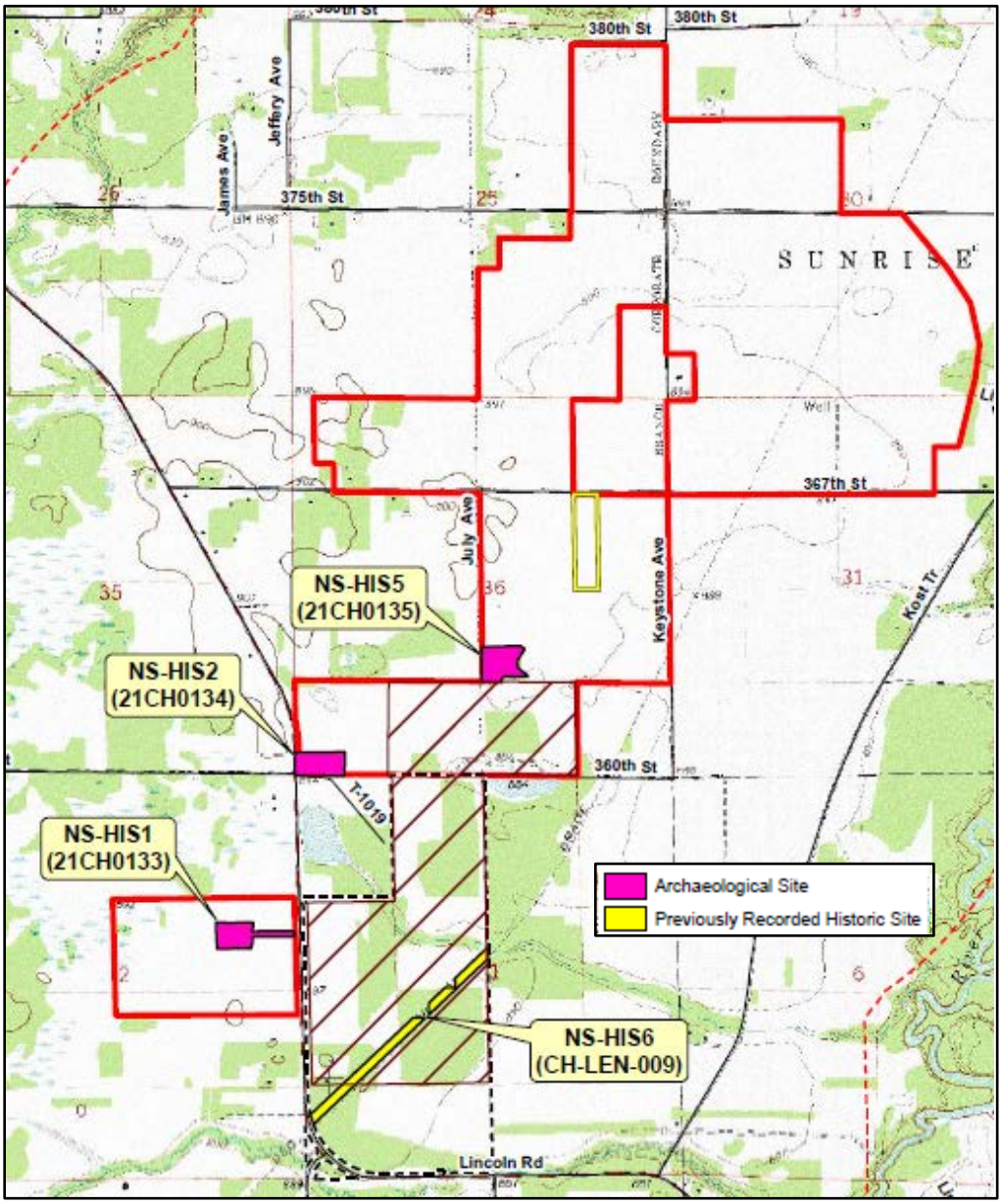
Mitigative Measures

As no impacts to mining or mineral extraction are anticipated, no mitigative measures are proposed.

5.5 Archaeological and Historic Resources

North Star requested a records search of Minnesota State Historic Preservation Office (SHPO) records for the Project Area in September 2014. North Star also performed a Phase I archaeological survey within the Project Boundary in October 2014.

Figure 14. Cultural Resources within the Project Boundary[78]



The background review revealed an historic railroad bed (SHPO no. CH-LEN-009) located on Xcel Energy property in the HVTL Project Corridor, which had previously been recommended as not eligible for the National Register of Historic Places (NRHP). This site is not expected to be impacted by construction of the transmission line.

[78] APP at Appendix C-4

The Phase I survey identified three historic farmsteads (see **Figure 14** above) within the Solar Project boundary. These sites were designated SHPO nos. 21-CH-0133, 21-CH-0134 and 21-CH-0135. Of the three, only the last would be impacted by construction of the solar facility under the proposed layout.

Potential Impacts

Archaeological and historic resources and artifacts can be impacted by the construction of a PV facility as soil is disturbed. If a site would be impacted, the first test of the significance of any resources would be to determine the site's potential eligibility for enrollment in the NRHP. In the case of 21-CH-135, North Star commissioned a preliminary archaeological evaluation of the site by Westwood Professional Services and 10,000 Lakes Archaeology, Inc.

The study determined, "The Holtman site (21-CH-0135) is recommended not eligible to the NRHP due to a lack of archaeological integrity, and an inability to answer significant historic research questions. No additional field investigation on this site is recommended. Design plans for the parcel may proceed."[79]

As with any construction project, there remains a potential for impacts to unidentified archaeological properties in previously undisturbed portions of the facilities.

Mitigative Measures

Avoidance of archaeological and historic architectural properties is the preferred mitigative policy for construction of infrastructure projects. If avoidance is not possible, North Star has noted that appropriate mitigative measures will be developed in consultation with Minnesota SHPO, the State Archaeologist, and consulting American Indian communities.[80]

Section 4.2.16 of the Site Permit Template requires North Star to coordinate with SHPO in the event that new unrecorded sites are discovered during construction. The procedures outlined in permit condition could be formalized in an *Unanticipated Discoveries Plan* to outline the process for resolution should any previously unknown archaeological resource or human remains be encountered.

5.6 Natural Environment

The consideration of the impacts of an electric generation project on the natural environment, including air quality, water resources and flora and fauna is required as part of the environmental review. The range of potential impacts for a PV facility depends upon the characteristics of the facility site, facility design, construction techniques and the ongoing maintenance activities during the facility's operation.

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[79] "Preliminary Archaeological Evaluation, 21-CH-135, The Holtman Site" Westwood, August 19, 2015, eDocket nos. 20159-113765-02 and 20159-113765-03
[80] APP at 53

5.6.1 Air Quality

Air quality in Minnesota is generally good, and the trend has been improving for most pollutants. The enactment of the Clean Air Act in 1970 dramatically reduced air emissions from large facilities.[81]

Temporary short-term air quality impacts would occur during the construction phase of the Project. Once operational, the Project would not generate criteria pollutants or carbon dioxide.

Potential Impacts

During construction of the Project, temporary short-term air emissions are expected as a result of vehicle exhaust from the construction equipment and from vehicles traveling to and from facility locations. The magnitude of the construction emissions is influenced heavily by weather conditions and the specific construction activity occurring. Exhaust emissions from primarily diesel equipment would vary according to the phase of construction but would be minimal and temporary.

In addition to emissions from construction equipment, short-term air quality impacts from fugitive dust may result from travel on unpaved roads, grading at some sites and limited amounts of excavation for foundations for inverter boxes, O&M buildings and potentially solar array piers at some locations. Fugitive dust is considered particulate matter under air quality regulations. The concentrations of fugitive dust that is fine particulate matter (P.M. less than 2.5 microns or PM2.5) is generally small, or approximately 3 percent to 10 percent of total particulate matter (USEPA's AP-42, Sections 13.2 and 11.9). Since fine particulate matter has the potential to travel further into the lungs, it is of greater concern than larger particle size ranges.

Mitigative Measures

Dust from construction traffic can be controlled using standard construction practices such as watering of exposed surfaces, covering of disturbed areas, and reduced speed limits on site. Emissions from construction vehicles can be minimized by keeping construction equipment in good working order.

5.6.2 Soils and Groundwater

Soils within the Solar Project and the NS HVTL Project areas are typically fine and loamy fine sands[82] on generally level topography. There are no at risk land features such as sinkholes, shallow limestone formations, unconfined or shallow aquifers, and no karst conditions in the Project Boundary.[83]

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[81] MPCA, *Air Quality in Minnesota: Emerging Trends.* 2009. http://www.pca.state.mn.us/index.php/view-document.html?gid=5658
[82] See the NRCS soils map at APP at Appendix C-5
[83] APP at 54-55

Potential Impacts

Construction of the facilities will disturb up to 800 acres. As with any ground disturbance, construction of the Project has the potential for soil compaction, erosion and sedimentation as a result of construction activities.

North Star anticipates that infrastructure, including the direct-embedded piers supporting the PV tracking installations, foundations for inverters and the Operations and Maintenance facility, and embedded transmission poles will be installed at a depth above the average depth to groundwater of 15-40 feet.[84]

Mitigative Measures

The use of BMPs (including, but not limited to containment of excavated material, protection of exposed soil, stabilization of restored material, and treating stockpiles to control fugitive dust) would protect topsoil and minimize the potential for soil erosion

Section 4.2.7 of the Site Permit Template would require North Star to develop a Soil Erosion and Sediment Control Plan. The plan may be the same as the Storm Water Pollution Protection Plan (SWPPP) submitted to the MPCA as part of the National Pollutant Discharge Elimination System (NPDES) permit application. As part of the SWPPP, North Star will be required to prepare a Spill Prevention, Control and Countermeasure (SPCC) Plan to minimize the potential for spills of hazardous materials and their transport to groundwater resources.

As part of the SWPPP preparation for the facility, North Star will identify BMPs to minimize the potential for soil erosion. Once the construction is complete, no mitigations should be necessary as permanent vegetation will be established over the Solar Project area, excluding access roads.

North Star has already conducted a Phase I Environmental Site Assessment in order to identify any existing hazardous material contamination. No Recognized Environmental Conditions (REC) were found,[85] meaning no design for avoidance of contaminated areas is necessary.

5.6.3 Surface Water

Public waters are wetlands, water basins and watercourses of significant recreational or natural resource value in Minnesota, as defined in Minnesota Statute 103G.005; MNDNR has regulatory jurisdiction over these waters. The MNDNR Public Waters Inventory (PWI) identifies lakes, wetlands, and watercourses over which the MNDNR has regulatory jurisdiction. Minnesota law (Minnesota Statute 84.415 administered through Minnesota Rule 6135) requires that a license be obtained from the MNDNR Division of Lands & Minerals for the passage of any utility over, under or across any state land or public waters.

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[84] *Id.* at 55
[85] *Id.* at 56

There are two (unnamed) MNDNR Public Watercourses within the Project Boundary, both in the HVTL Project area; one intermittent stream and one perennial stream.[86] The closest surface water resource near the Project is the Sunrise River which runs within a mile to the north and east of the Projects. There are also five MNDNR PWI wetlands located to the west, south, and east of the Project Boundary.

Potential Impacts

During construction, there is the possibility of sediment reaching nearby surface waters and wetlands as the ground is disturbed by excavation, grading and construction traffic. In the case of this Project, the potential for impacts to surface waters is limited, as the facility location generally avoids surface water features. The noted streams can be spanned for construction of the HVTL if necessary. Maintenance and operation activities for the PV facilities are not expected to have an adverse impact on surface water quality.

Mitigative Measures

The use of BMPs (including, but not limited to containment of excavated material, protection of exposed soil, stabilization of restored material, and treating stockpiles to control fugitive dust) would protect topsoil and minimize the potential for soil erosion.

Again, Section 4.2.7 of the Site Permit Template would require North Star to develop a SWPPP, including an SPCC Plan to minimize the potential for spills of hazardous materials and their transport to streams and other water bodies. North Star would identify BMPs to minimize the potential for soil erosion and sedimentation.

Many local governments have designated shoreland protection areas that require setbacks from the ordinary high water level of surface waters in order to limit impacts to surface waters. The North Star site, however, would not require construction within any Shoreland Overlay Districts and would not conflict with any local shoreland ordinances.

5.6.4 Wetlands and Floodplains

Wetlands are important resources for flood abatement, wildlife habitat and water quality. Minnesota uses two systems to classify wetlands:

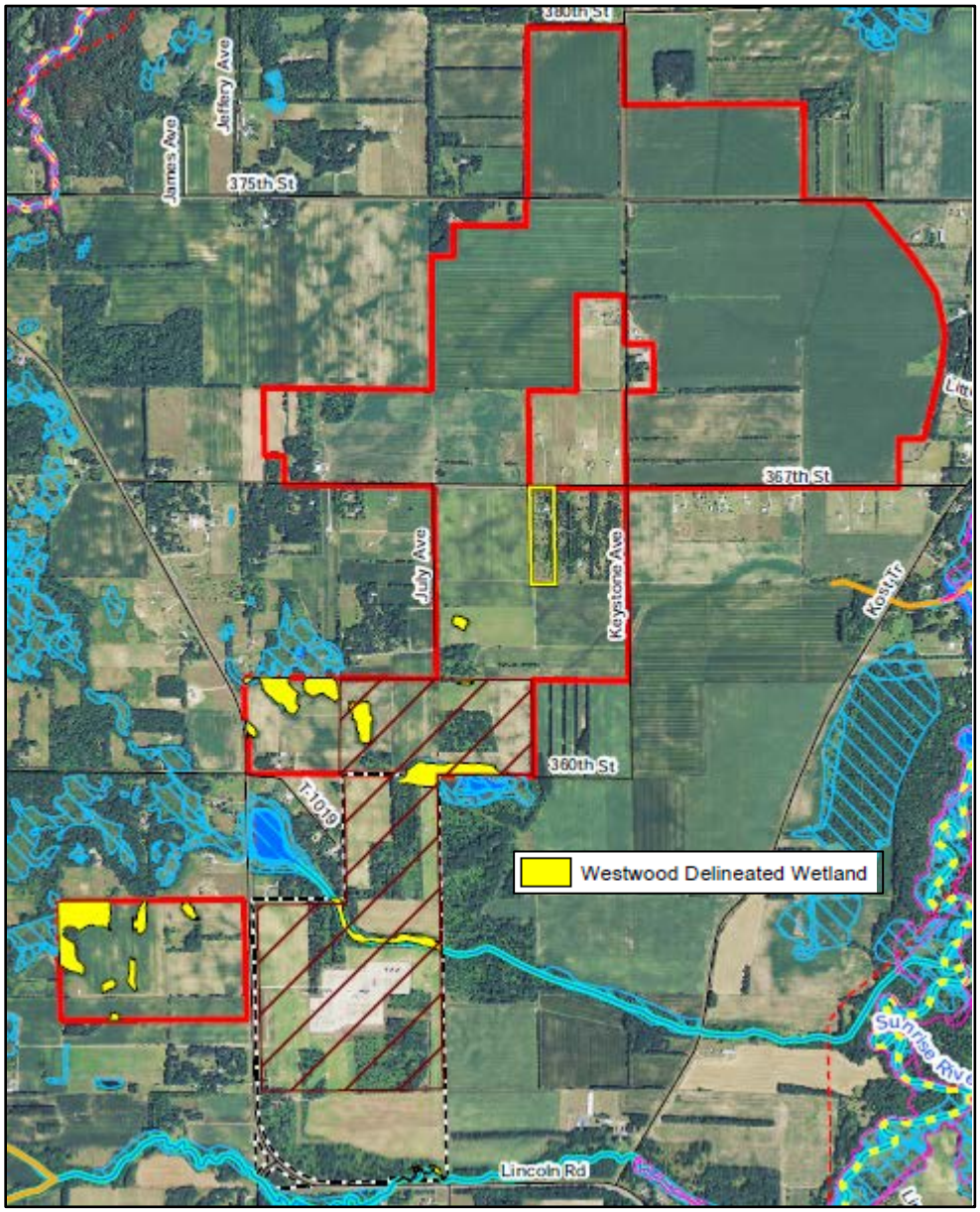
- The Circular 39 system: This system was developed by the U.S. Fish and Wildlife Service in 1956 and updated in 1971. Under the Circular 39 system, wetlands are divided into eight types based on the depth of water and the characteristics of vegetation.

- The Cowardin system: In 1979 the USFWS developed a more precise tiered system for classifying wetlands. Under the Cowardin system, each tier describes the characteristics of a wetland more specifically than the previous tier.

[86] *Id.* (Also see APP at Appendix C-6)

Westwood conducted wetland delineations in the Project Area in the fall of 2014. The delineations classify wetlands based on both classifications.[87] Westwood delineated 15 areas (see **Figure 15**), the majority of which were Circular 39 Type 2 fresh wet meadows.[88]

Figure 15. Wetlands Delineated within the Project Boundary[89]



[87] *Id.* at 57-58
[88] See "Wetlands in Minnesota," BWSR, www.bwsr.state.mn.us/wetlands/publications/wetland.pdf
[89] APP at Appendix C-6

Potential Impacts

The USFWS began producing maps of wetlands based on aerial photographs and Natural Resources Conservation Service soil surveys starting in the 1970s; these wetlands are known as the National Wetland Inventory (NWI). It is important to note that NWI wetlands are based on aerial imagery and are not field verified. The U.S. Army Corps of Engineers (USACE) verified the Westwood field verification as accurate.[90]

In Minnesota, wetlands are also protected under the Wetland Conservation Act (WCA), which is administered by the Board of Water and Soil Resources (BWSR) and the identified Local Government Unit (Chisago County). The only impact to wetlands would be posts along an approximately 560-foot segment of the perimeter fencing (total impact of 56 square feet). Chisago County issued a Notice of Decision on August 12, 2015, that no replacement plan is required for the construction in the wetland;[91] a decision of *de minimus* impact.

USACE determined the construction qualified as a "non-reporting" activity and that no application was required to the Corps for the Project under the Clean Water Act (CWA).[92]

Floodplains are low-lying areas that are subject to periodic inundation due to heavy rains or snowmelt. Floodplain areas are generally found adjacent to lakes, rivers and stream. In their natural state, floodplains provide for temporary water storage during flooding events. The only Federal Emergency Management Agency (FEMA) floodplains in the Project Area are associated with the Sunrise River. There are no floodplains within the Project Boundary.

Mitigative Measures

Construction and maintenance of a solar facility has the potential to result in long-term and temporary loss of wetlands or wetland function. The preferred method for minimizing impacts to wetlands is to avoid disturbance of the wetland through project design. North Star's proposed site plan generally avoids wetlands. Temporary construction impacts can be minimized by using BMP's that include construction mats and directional bores under wetlands for installation of electrical collection lines.

Section 4.2.9 of the Site Permit Template requires that solar panels and associated facilities not be placed in public waters wetlands, as defined in Minnesota Statutes section 103G.005, subdivision 15(a). Under this definition, public water wetlands are all Types 3, 4 and 5 wetlands of 10 or more acres in unincorporated areas or 2.5 acres in incorporated areas.[93] All the wetlands identified in the delineation are smaller than the statutory standard for meeting a public waters wetland.

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[90] USACE Letter, June 9, 2015, eDocket no. 20156-111329-01
[91] WCA Notice of Decision, Chisago County, August 12, 2015, eDocket no. 20158-113316-02
[92] USACE Letter, July 21, 2015, eDocket no. 20158-113155-02
[93] Minnesota Statute 103G.005, https://www.revisor.mn.gov/statutes/?id=103G.005

5.6.5 Vegetation

Consistent with the current agricultural use of the facility location, native plant communities are generally absent, and the overwhelming majority of vegetative cover, row crops, pasture and maintained grass areas, has been established and maintained by humans. Non-native invasive species cover is also quite limited due to the intensive weed management associated with agriculture. Section 5.2 provides additional information about local land cover.

North Star has not identified any Reinvest in Minnesota (RIM), and the only Conservation Easements in the Project Area expired in 1997.[94]

Potential Impacts

Construction and operation of the Project would change the vegetative cover of up to 800 acres for at least the 25 year expected lifespan of the Project. Areas developed for the Project, mostly now cultivated or in pastureland, would be re-seeded with a low growing, low maintenance seed mix suited to the sandy soils of this region.[95]

Construction activities may introduce invasive species. The Minnesota Noxious Weed Law defines a noxious weed as an annual, biennial or perennial plant that the Commissioner of Agriculture designates to be injurious to the public health, the environment, public roads, crops, livestock or other property.[96] The Minnesota Department of Agriculture's (MDA) Noxious & Invasive Weed Program assists local governments and landowners with resources for managing noxious and invasive weeds throughout Minnesota.

A limited number of trees will be removed from the development area for construction. In some areas, North Star may seek agreements with neighboring landowners to conduct limited tree trimming on adjacent parcels if shading of the PV arrays becomes a concern. In general, most tree clearing will be associated with the HVTL line, especially along a 2,500 foot stretch that would require widening the existing transmission corridor (see **Figure 6**). That could potentially clear 2-4 acres of trees.

Mitigative Measures

Section 4.2.11 of the Site Permit Template requires North Star to clear the site only to the extent necessary to assure suitable access for construction, safe operation and maintenance of the project. The condition also requires North Star to work with MNDNR to establish and manage vegetation that will benefit pollinators and other wildlife, to the extent that the vegetation will not interfere with the operation of the facility. Sections 4.2.13 and 4.2.14 include restrictions to manage for noxious weeds and invasive species.

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[94] APP at 62 and Appendix C-8
[95] *Id.* at 62
[96] Minnesota Statute 18.75 – 18.91, https://www.revisor.mn.gov/statutes/?id=18

A vegetation management plan can be developed to formalize measures to minimize the disturbance and removal of vegetation for the Project, prevent the introduction of noxious weeds and invasive species and re-vegetate disturbed areas consistent with the safe and reliable operation of the Project. A recent communication from MNDNR to EERA[97] included the recommendation to establish prairie species on prior farmed land to:

- improve water quality by reducing soil erosion;
- increase soil water retention;
- improve soil composition and structure with the extensive root system;
- reduce applications of fertilizer and herbicides; and
- provide habitat for pollinators and other wildlife.

5.6.6 Wildlife

As discussed in the above section, vegetative cover at the proposed facility locations is dominated by cultivated agricultural field and to a lesser extent by pasturelands. The predominance of non-native cover types are typically used by common wildlife species that are accustomed to agricultural habitats. Examples of such species would include deer, squirrel, raccoons, mice, voles, common perching birds, red-tail hawks, reptiles and amphibians. It is anticipated that these species' use of the proposed facility locations is largely limited to occasional foraging in the fields and shelter within wooded areas that may surround the fields. The only surface water is the perennial stream in the southern (transmission route) portion of the Project Boundary. This could contain certain warm-water fish species such as mud minnows and brook stickleback.

Potential Impacts

Wildlife that resides within the construction zone will likely be temporarily displaced to adjacent habitats during the construction process. The wildlife species near the facilities do not generally require specialized habitats and are able to find generally suitable habitat nearby. Comparable habitat is near the facility locations, and it is likely that these animals would only be displaced a short distance.

Once restoration of the facilities is established after construction, the current non-native habitats that are used by habitat generalists will be replaced by a modified habitat that may be attractive to some species and less attractive to species that use the open farm and pasturelands.

During Project operation, access to facilities will be limited by a perimeter fence. Although a variety of birds, small mammals, reptiles and amphibians are likely to still be able to gain access to facilities to use the habitats under and around the solar arrays, access will be limited for larger wildlife. Fencing around facilities may also disturb wildlife movement corridors.

[97] Email, MNDNR, June 16, 2015

Plastic erosion control netting is frequently used for erosion control during construction and landscape projects and can negatively impact terrestrial and aquatic wildlife populations as well as snag in maintenance machinery, resulting in costly repairs and delays. Wildlife entanglement in and death from plastic netting and other man-made plastic materials has been documented in birds, fish, mammals and reptiles.[98]

A National Fish and Wildlife Forensics Laboratory report[99] has identified some avian risks associated with PV facilities. Some birds in the study suffered impact trauma, and related predation. Preliminary findings, based on limited data, suspect the danger is the possible appearance of the facility as a large body of water. Migrating birds may attempt to land, consequently incurring the trauma. However, the design of the North Star Project should help minimize this potential danger. The single-axis tracking system will occupy only about 33 percent of the overall foot print,[100] so the arrays will not appear as an unbroken expanse (like water). It will also continually alter its appearance while tracking the sun during the day.

Mitigative Measures

The short transmission line is along a corridor of an existing, larger transmission lines. The visibility of the lines, and the lack of adjacent waterfowl habitat, should help to minimize impacts to birds. Consultation with MNDNR and USFWS would help North Star determine if and where they should install bird diverters on the conductors. The design of the single-axis array system should help limit avian injury or death associated with the Solar Project.

Siting of facilities in locations that avoid or minimize impacts to known wildlife movement corridors can minimize impacts to wildlife. The Site Permit could require that Biological and Natural Resource Inventories include identification of any known wildlife movement corridors. The MNDNR recommends that the southern project border fence along the highway be set back sufficiently to encourage wildlife (primarily deer) to follow the fence line around the Project well away from the highway, instead of pushing them back into traffic.[101]

Avoiding the use of photodegradable erosion-control materials where possible and using biodegradable materials (typically made from natural fibers) instead, preferably those that will biodegrade under a variety of conditions, can minimize the impact to wildlife. The Site Permit could include the use of these materials as a standard condition or as a special condition.

Checking open trenches and removing trapped turtles before filling trenches can minimize impacts to turtles.

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[98] MNDNR. *Wildlife Friendly Erosion Control Fact Sheet.* 2013, http://files.dnr.state.mn.us/eco/nongame/wildlife-friendly-erosion-control.pdf

[99] USFWS Forensics Lab, *Avian Mortality at Solar Energy Facilities in Southern California: A Preliminary Analysis*, 2014, http://www.ourenergypolicy.org/wp-content/uploads/2014/04/avian-mortality.pdf

[100] APP at 65

[101] Email, MNDNR, June 16, 2015

5.7 Rare and Unique Natural Resources

Construction and maintenance of solar facilities might destroy individual plants and animals or might alter their habitat so that it becomes unsuitable for them. For example, trees used by rare birds for nesting might be cut down, soil disturbance from construction activities may destroy rare plant species or communities, or soil erosion may degrade rivers and wetlands that provide required habitat.

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

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

Some areas of the state have not been surveyed extensively or recently, so the NHIS database cannot be relied upon as a sole information source for rare species. Nevertheless, the NHIS database provides a starting point for anticipating potential impacts to rare and unique natural species and communities.

Potential Impacts

The MNDNR NHIS database was queried by Westwood to obtain the locations of rare and unique natural species. A list of threatened and endangered species within one mile of the Project Boundary can be found in the Application.[102] Within the Project Boundary, the search turned up two records for Blanding's turtles (*Emydoidea blandingii)* and one historic (1892) record for Tooth-cup **(***Rotala rotundifolia)*.[103] Both are threatened species. No endangered species records were found inside the Project Boundary or the within the Project Area.

Although no instances of the northern long-eared bat (*Myotis septentrionalis*) NLEB were identified at the Project site, the species is known to occur in suitable forested habitats throughout Minnesota. The USFWS issued a final decision and interim rule[104] as of May 4, 2015, designating the NLEB as threatened under the Endangered Species Act. Any tree removal at this location will likely be required to be conducted outside the summer roost period for the species. The northern long-eared bat would not be anticipated to be present in the action area between the months of October 1st and March 30th.

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[102] APP at 68
[103] *Id.* at Appendix A
[104] Interim Rule 4(d), http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinalListing02April2015.pdf

Mitigative Measures

The mitigative measures described for Vegetation and Wildlife in Sections 5.6.5 and 5.6.6 are also applicable to minimizing impacts to sensitive species. Avoidance of identified areas of biological significance and rare species is the most effective mitigation strategy to limit direct impacts to the sensitive natural resources.

The Site Permit should require field surveys of sensitive biological areas. Information from field surveys would be used to identify areas to be avoided in final site design. Areas to be avoided are typically marked in site plans in order to minimize the potential for inadvertent incursions into these areas during the construction phase.

North Star has committed to using wildlife-friendly erosion mesh for facilities in the vicinity of protected reptile species such as the Blanding's turtle. North Star should provide training to construction workers so they can identify and avoid impacts to Blanding's turtles for work within the specie's habitat.

Most of the tree-clearing for the Project occurs for HVTL construction. The Project would likely require designation under Interim Rule 4(d) as "Limited Expansion of Existing Rights-of-Way and Transmission Corridors" in order to qualify for incidental take. To avoid taking, tree removal should avoid the active season (April 1-September 30). To determine the conditions and timing of tree-clearing under the rule, North Star will need to consult with the USFWS.

6 Application of Siting and Routing Factors

The Power Plant Siting Act requires the Commission to locate large electric power facilities in an orderly manner compatible with environmental preservation and the efficient use of resources and in a way that minimizes adverse human and environmental impact while insuring electric power reliability.[105] Minnesota Statute Section 216E.03, subdivision 7(b) identifies considerations that the Commission must take into account when making its final determination on siting of large electric power facilities. Minnesota Rule 7850.4100, lists 14 factors to guide Commission site and route designations, including the evaluation and minimization of adverse environmental impacts, impacts to public health and welfare, and adverse economic impacts. These factors are outlined in Section 2.5 of this document.

6.1 Relative Merits

Generally, an Environmental Assessment will review the Factors to help establish the relative merits of a proposed project against any alternative routes or sites that have been reviewed in the EA. Since only the Proposed Solar Site and Proposed HVTL are being considered in the current review, the concept of relative merits is not applicable.

6.2 Review of the Siting and Routing Factors

This review looked not only at the Factors, but also the Elements that make up those Factors (see subsections below). For the most part, adherence to best practices during construction and operation and the general permit conditions in the Site and Route Permit Templates provided by Commission Staff in this record (**Appendices B** and **C**) is anticipated to result in minimal to moderate impacts from the facilities. In some instances, however, the addition of special permit conditions could help to minimize impacts.

6.2.1 Factor: Effects on Human Settlement

Potential impacts and mitigative measures related to human settlement are discussed in Section 5.3.

Elements: Noise, cultural values, public services, recreation

Impacts related to noise, cultural values, public services and recreation are anticipated to be minimal with the use of standard construction techniques and the general conditions in the Site Permit Template. The only impact to recreation would be an alteration of the view along the North Branch Sno Drifters snowmobile trail that runs along the Project for approximately 1.25 miles along 267th Street. That change in view should be no more than a minimal impact to no impact, depending on the aesthetic of the trail rider.

[105] Minnesota Statute 216E.02, https://www.revisor.mn.gov/statutes/?id=216E.02

Element: Displacement

Construction of the North Star Solar Project would not result in the removal of any homes at the site, so there would be no displacement. North Star does not have the authority to exercise Eminent Domain for the Project; therefore, the removal of a home would necessarily be through a voluntary agreement between North Star and the affected landowner.

Element: Aesthetics

Impacts are anticipated to be minimal with the use of standard construction techniques and the general conditions identified in the Site Permit Template

Aesthetic impacts at solar facility are anticipated to be minimal to moderate, but may be mitigated to a degree with special permit conditions. Given the proximity of the facility to existing homes in the immediate area, development of a landscaping plan that identifies site-specific landscaping techniques (including, but not limited to, vegetation screening, berms and fencing) could be used to minimize visual impacts to adjacent homes.

Aesthetics impacts from the HVTL should be minimal, as the line would be a similar use to the existing use of the area as a transmission corridor and substation.

Element: Consistency with Local Land Use and Planning

Chisago County, North Branch and Lent Township all have ordinances that include siting solar facilities. In each case, the North Star Solar Project qualifies as a compatible use given local zoning and land use. The local ordinances preclude construction of solar facilities within designated shoreland protection areas, however, none exist within the Project Boundary.

Details on screening a solar project are part of each local ordinance. North Star is currently developing a residence-specific landscaping and screening plan.

6.2.2 Factor: Effects on Public Health and Safety

Construction presents the only potential impacts to public health and safety. These are anticipated to be minimal with use of standard construction techniques and the general conditions identified in the Site Permit Template. Operation of the facility is not anticipated to be a public health or safety concern, especially considering the secured access.

6.2.3 Factor: Effects on Land-Based Economies

Elements: Forestry, Tourism and Mining

Impacts to forestry, tourism and mining are generally avoided; therefore any potential impacts are anticipated to be minimal with the use of standard construction techniques and the general conditions in the Site Permit Template.

Element: Agriculture

Impacts to agriculture are anticipated to be minimal with use of standard construction techniques and the general conditions identified in the Site Permit Template, especially concerning management of topsoils.

Minnesota Rule 7550.4400, Subp. 4 allows for the use of up to 0.5 acres of prime farmland per MW in most areas unless there is no feasible alternative. The 0.5 acre per MW limit does not apply to the North Star Project because it is within two miles of a first, second or third class city, North Branch. Regardless, no prime farmland exists in the Project Boundary.

If a proper vegetation management plan is implemented, the Project could serve an anti-erosion and conservation service that should preserve the land to be returned to its original agricultural use in the future.

6.2.4 Factor: Effects on Archaeological and Historic Resources

Impacts are anticipated to be minimal with use of standard construction techniques and the general conditions identified in the Site Permit Template. The one archaeological site identified within the Project Boundary that would be impacted by construction was subsequently determined to be not eligible for the NRHP. Any possible impact to two additional sites identified should be mitigated through avoidance or development of a special mitigation plan in consultation with SHPO, if they are determined eligible for the NRHP.

The procedures outlined in Section 4.2.16 of the Site Permit Template provide an outline of the process for resolution should any previously unknown archaeological resource or human remains be encountered.

6.2.5 Factor: Effects on Natural Environment

Element: Air

Impacts to air quality are anticipated to be minimal with the use of standard construction techniques and the general conditions in the Site Permit Template.

Element: Surface Water

Impacts to surface waters are anticipated to be minimal with the use of standard construction techniques and the general conditions identified in the Site Permit Template, and the nominal open water space in the Project Boundary. There are no Shoreland Overlay Districts.

Element: Wetlands

Impacts to wetlands are expected to be minimal with the use of standard construction techniques and the general conditions in the Site Permit Template.

Direct impacts to water resources from the HVTL can be avoided by placement of the pole structures outside of any wetland or the perennial stream and spanning the distance for crossings over wetlands and streams.

Element: Soils and Groundwater

Impacts to soils and groundwater are anticipated to be minimal with the use of standard construction techniques and the general conditions in the Site Permit Template.

Element: Vegetation

Impacts to vegetation are anticipated to be moderate with the use of standard construction techniques and the general conditions in the Site Permit Template.

In addition to the general conditions in the Site Permit Template, a vegetation management plan, such as required in Commission permits for High Voltage Transmission Lines, should be developed. The plan should formalize measures to 1) minimize the disturbance and removal of vegetation for the Project; 2) prevent the introduction of any noxious weeds or invasive species; 3) maintain the ground cover to minimize erosion and stormwater runoff; and 4) re-vegetate disturbed areas consistent with the safe and reliable operation of the Project.

Element: Wildlife

Impacts to wildlife are anticipated to be minimal to moderate with the use of standard construction techniques and the general conditions in the Site Permit Template.

In addition to the general conditions in the Site Permit Template provided by Commission staff in this record, the site permit should require that the design of the facilities preserves or replaces identified natural wildlife, wetland, woodland or other corridors:

6.2.6 Factor: Effects on Rare and Unique Natural Resources

The North Star Project does not appear poised to impact any rare and unique natural resources. Recommendations for Blanding's turtles and northern long-eared bats can be included in the Site Permit. Otherwise, impacts should be minimal with standard construction techniques and the general conditions in the Site Permit Template.

6.2.7 Factor: Project Design

Element: Design Options to Maximize Energy Efficiencies

North Star's Proposed Project is a single-axis tracker and module layout designed to maximize exposure to the sun and use of the available land. The locations of the inverters and the layout of the electrical collection system have been designed to avoid energy losses.

Element: Design Options to Accommodate Potential Expansion

There is insufficient information in the record to fully assess the Project's ability to expand its generating capacity. North Star has designed the proposed facility in accordance with agreements with landowners, environmental and siting constraints specific to the Project Area, and its POI agreement at the Chisago Substation. North Star's ability to expand its facility depends upon a number of criteria, including:

- availability of additional land from willing landowners;
- suitability of additional land to support a PV facility; and
- capacity at the substation to deliver the power into the grid.

If North Star could meet those criteria, and had interest in expanding the Project, they would need to seek a modification to the Site Permit from the Commission or, more likely, file a new Site Permit Application.

Element: Design Options to Mitigate Adverse Environmental Effects

A description of mitigative measures that could be used to avoid and minimize impacts is thoroughly addressed in the descriptions of impacts in Section 5. To the extent that special conditions may be appropriate for particular Elements, those mitigative measures are identified in the individual subsections.

6.2.8 Factor: Use of Existing Large Electric Power Generating Plant Sites

The North Star Solar Project does not make use of existing Large Electric Power Generating Plant sites. A solar facility's unique siting requirements, particularly the relatively large land requirements, preference for a site without large structures that may limit solar access, and the need for willing landowners, make using existing power plant sites more challenging.

6.2.9 Factor: Use of existing transmission systems or rights-of-way;

The North Star HVTL Project follows an existing transmission corridor for much of it's length. This routing choice will minimize the impact of vegetative clearing, depending on the degree to which the Project ROW shares the existing rights-of-way.

6.2.10 Factor: Electrical System Reliability

Electrical system reliability was addressed in a separate docket (eDocket 14-162). The North Star 100 MW Solar Project was determined by the Commission to be an appropriate segment of Xcel Energy's solar portfolio. Reliability was also a focus of the Project's MISO interconnection agreement.

6.2.11 Factor: Design-Dependent Costs

This 100 MW Project is the largest solar proposal to date in Minnesota. The centralization of that energy production in one location creates efficiencies for construction, infrastructure, transmission and interconnection costs.

6.2.12 Factor: Irreversible and Irretrievable Commitments of Resources

A commitment of resources is irreversible when its primary or secondary impacts limit the future option for a resource. An irretrievable commitment refers to the use or consumption of resources that is neither renewable nor recoverable for later use by future generations. The commitment of resources refers primarily to the use of nonrenewable resources such as fossil fuels, water, and other materials (aggregate minerals, steel/metals, etc.).

Construction activities would require the use of fossil fuels for electricity and for the operation of vehicles and equipment. Use of raw building materials for construction would be an irretrievable commitment of resources from which these materials are produced, excluding those materials that may be recycled at the end of the Project life cycle. The use of water for dust abatement during construction activities would be irreversible. Commitment of labor and fiscal resources to develop and build the project is considered irretrievable.

6.2.13 Factor: Unavoidable Impacts

Where feasible, the EA suggests mitigation measures to be incorporated into the planning, design, and construction of the Proposed Project to substantially eliminate the adverse impacts. In other areas of consideration, adverse impacts can be reduced but not eliminated and are therefore determined to be unavoidable. Most unavoidable adverse impacts would occur during the construction phase of the proposed project and would be temporary. A review of impacts and possible mitigation measures is located in Chapter 5 of this document.

Unavoidable adverse effects related to the Proposed Project construction would last only as long as the construction period, and would include the following:

- Soil compaction, erosion, and vegetation degradation;
- Disturbance to and displacement of some species of wildlife;
- Disturbance to nearby residents;
- Traffic delays in some areas; and
- Minor air quality impacts due to fugitive dust.

Unavoidable adverse effects related to The Proposed Project that would last at least as long as the life of the Project would include the following:

- The addition to the visual landscape of PV modules and security fencing; and
- Changes in land use and development patterns surrounding the Facility.

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